SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 124 (WHOLE VOLUME)

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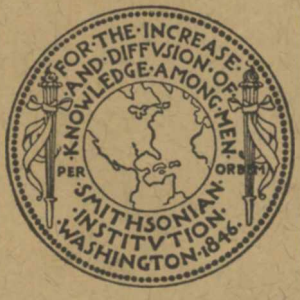
THE MATERIAL CULTURE OF PUEBLO BONITO

(With 101 Plates)

By NEIL M. JUDD
Associate in Anthropology, U. S. National Museum

WITH APPENDIX
CANID REMAINS FROM PUEBLO BONITO AND PUEBLO DEL ARROYO

By GLOVER M. ALLEN



(Publication 4172)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
DECEMBER 29, 1954



PLATE 1.—Pueblo Bonito from the Air

(Photograph by Col. Charles A. Lindbergh, 1929; reproduced through courtesy of Dr. A. V. Kidder and the Laboratory of Anthropology, Santa Fe, N. Mex. For explanation, see footnote, page 1.)

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The Lord Baltimore Press
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PREFACE

The story of the vanished Indian culture of Pueblo Bonito in Chaco Canyon, New Mexico, set forth in fascinating detail in this volume, is the outgrowth of a program of archeological research initiated by the National Geographic Society in 1920. In that year, at the request of the Society's Research Committee, Neil M. Judd, then curator of archeology at the U. S. National Museum, conducted a preliminary survey of the vast abandoned "apartment house" of Pueblo Bonito. Following this survey, and upon Mr. Judd's recommendation, the Society embarked upon an extensive program of excavations from 1921 through 1927 which produced the material for this report.

Mr. Judd's painstaking investigations have made it possible to reconstruct to a remarkable degree the everyday life and culture of the people who lived in Pueblo Bonito approximately 1,000 years ago. These prehistoric Indians inhabited the site at least as early as A.D. 919, and attained their "Golden Age" after A.D. 1000, about the time of the Norman conquest of Britain and the First Crusade. They continued to occupy the Pueblo for at least another century; then some 300 years before the coming of Columbus they disappeared without trace.

Our detailed knowledge of the actual dates when Pueblo Bonito was occupied was furnished by two other expeditions of the National Geographic Society, in 1928 and 1929, led by Dr. Andrew Ellicott Douglass, director of Steward Observatory at the University of Arizona. Dr. Douglass was engaged at that time in the study of climatic cycles as revealed in the varying thickness of the annual growth rings of trees, and the possible relation of such cycles to the 11-year sunspot cycle.

Dr. Douglass made careful measurements of the growth rings in logs used as supporting beams in the Pueblo Bonito structures, and then was able to fit them into an unbroken sequence of tree rings extending back into the past from the present day. Thus he was able to establish the dates when many of the Pueblo Bonito beams had been cut from living forests.

His monograph, "Dating Pueblo Bonito and Other Ruins of the Southwest," appeared in 1935 as the first of several papers presenting the scientific results of the Pueblo Bonito expeditions.

The researches of Mr. Judd and Dr. Douglass have clearly shown the closely knit interrelationship of primitive man and his environ-

ment. Their findings leave little doubt that the gradual destruction of the forests that once flourished in and about Chaco Canyon caused increasing erosion and steadily decreasing water supply. This in turn made it more and more difficult for the inhabitants of Pueblo Bonito to raise sufficient food, and undoubtedly led to the eventual abandonment of the site.

The results of the expeditions have been described in several splendidly illustrated articles in the Society's official journal, the National Geographic Magazine, notably "Pueblo Bonito, the Ancient," July 1923, and "Everyday Life in Pueblo Bonito," September 1925, both by Mr. Judd, and "Secret of the Southwest Solved by Talkative Tree Rings," December 1929, by Dr. Douglass.

Mr. Judd spent many years of research and study in the preparation of this report of his scientific discoveries. More recently, as associate in anthropology of the Smithsonian Institution, he has devoted full time to the completion of the work.

After his completed manuscript was submitted to the National Geographic Society, its Board of Trustees, acting upon the recommendation of the Research Committee, placed the material at the disposal of the Smithsonian Institution and provided for its publication.

A third report, "The Geology of Chaco Canyon, New Mexico, in Relation to the Life and Remains of the Prehistoric Peoples Who Inhabited Pueblo Bonito," by the late Dr. Kirk Bryan, was made available to the Smithsonian Institution at the same time and has since been published.

The National Geographic Society is happy to recognize with gratitude and admiration Mr. Judd's devoted and untiring labor in producing an outstanding contribution to American archeology and to our knowledge of the way of life of the prehistoric Indians of the Southwest.

It seems appropriate here to recognize also the deep and wholehearted interest of the Society's Research Committee in the scientific results of the Pueblo Bonito Expeditions and, more particularly, to acknowledge the guidance of the Committee's chairman, Dr. Lyman J. Briggs, Director Emeritus of the National Bureau of Standards, and of its vice chairman, Dr. Alexander Wetmore, formerly Secretary and now research associate of the Smithsonian Institution.

GILBERT GROSVENOR
President, National Geographic Society

Washington, D. C.
April 30, 1954

CONTENTS

		Page
	Preface	iii
	Foreword	vii
I.	Introduction and conclusions	1
II.	Subsistence and living conditions	39
III.	Dress and adornment	69
IV.	Household tools and utensils	117
V.	Pottery	174
VI.	Implements of the field and chase	239
VII.	Objects of religious implication	261
VIII.	Intramural burials	325
IX.	Navaho notes from Chaco Canyon	343
	Bibliography	355
	Appendix A: Size and provenience of objects illustrated	365
	Appendix B: Canid remains from Pueblo Bonito and Pueblo del Arroyo, by Glover M. Allen	385
	Index	391

FOREWORD

At its meeting of April 1, 1920, the Research Committee of the National Geographic Society accepted the proposal of one of its members, Dr. Sylvanus G. Morley, for an archeological reconnaissance of the Chaco Canyon district, northwestern New Mexico. In response to a request from the Society, the Smithsonian Institution lent my services for a period of three months to direct that survey, the sole purpose of which was to ascertain whether detailed examination of a major Chaco Canyon ruin was advisable at that time and, if so, which ruin might reasonably be expected to contribute most to then existing knowledge of Pueblo civilization at its height. Tentative conclusions reached on a preliminary trip through the Canyon were reviewed a few weeks later when I had the privilege of the advice and companionship of three long-time friends, Drs. Morley, A. V. Kidder, and Earl H. Morris.

On November 17 I submitted a report recommending comprehensive study of the two neighboring ruins, Pueblo Bonito and Pueblo del Arroyo. Indorsed by an advisory committee consisting of Dr. J. W. Fewkes, then Chief of the Bureau of American Ethnology; Dr. W. H. Holmes, then Head Curator of the Department of Anthropology, U. S. National Museum; and Dr. Morley, Associate in American Archeology, Carnegie Institution of Washington, this report was accepted by the National Geographic Society's Committee on Research, and, after further consideration, plans were drawn for an initial 5-year program of investigation that included inquiries into such pertinent matters as the physiography of Chaco Canyon, the relationship between its major and minor ruins, and the agricultural practices probably followed by its ancient inhabitants. Mine was the honor of having been invited to organize and direct the project, and for this purpose the United States National Museum granted me leave of absence for four months each year.

The first season's party pitched its tents on the adobe flat before the famous ruin early in May 1921, improvised for its kitchen stove an altogether inadequate shelter from spring sandstorms, dug a well in the nearby arroyo, and went to work. We returned to the same camp annually thereafter until conclusion of local field studies in the autumn of 1927. Elsewhere, for two additional seasons, search continued for prehistoric timbers that were to aid in determining the age of Pueblo Bonito. Each summer's explorations were conducted under

authority of a permit from the Department of the Interior, and the cultural material collected was, in accord with its previously announced intention, donated by the National Geographic Society to the American public, as represented by the United States National Museum.

The National Geographic Society published, in its National Geographic Magazine, four illustrated articles on these explorations, as follows:

A New National Geographic Society Expedition, June 1921, pp. 637-644.
The Pueblo Bonito Expedition of the National Geographic Society, March 1922, pp. 323-332.
Pueblo Bonito, the Ancient, July 1923, pp. 99-108.
Everyday Life in Pueblo Bonito, September 1925, pp. 227-262.

The Beam Expeditions of 1923, 1928, and 1929 were an outgrowth of our desire to ascertain the period during which Pueblo Bonito was inhabited. As set forth in my foreword to his 1935 paper, "Dating Pueblo Bonito and Other Ruins of the Southwest," Dr. A. E. Douglass, director of Steward Observatory at the University of Arizona, while seeking evidence of sunspot influence on climate, had discovered a correlation between the annual rings of pines in widely separated localities—a correlation that permitted the superposition of one tree's life record upon the end of another, and so on until a very respectable number of years was brought into a single sequence. The archeological possibilities of this discovery were recognized in 1914 by Dr. Clark Wissler, late curator of anthropology at the American Museum of Natural History, New York City, who aided and encouraged further research by every means at his command. In 1922 Dr. Wissler and the American Museum graciously relinquished their interest in the project to the Society. The fascinating story of the search thereafter for older, and still older, timbers in ruined Spanish churches, Indian villages occupied since the Conquest, and prehistoric cliff dwellings was first told by Dr. Douglass in the National Geographic Magazine for December 1929.

In that article and in a second one published in 1935, Dr. Douglass has recognized our obligation to many members and friends of the Society whose individual helpfulness contributed to the success of the three beam expeditions. It is now my privilege to acknowledge our indebtedness to those who participated more directly in the explorations at Pueblo Bonito.

First of all, I wish to express my personal gratitude to Dr. Gilbert Grosvenor, President, and other officers of the National Geographic Society and to members of its 1921 Committee on Research—Dr.

Frederick V. Coville, chairman, Drs. Gilbert Grosvenor, John Oliver La Gorce, C. Hart Merriam, Sylvanus G. Morley, Carl L. Scofield, Charles Sheldon, Hugh M. Smith, and Philip Sidney Smith—who fully appreciated the complexity of our problems and sought in every way to lessen them.

Since my associates in the field were selected mostly from among college students then preparing for a career in archeology, it is pleasing to recall, as I write these lines, the number now firmly established on university faculties and in research institutions, and to believe their experiences at Pueblo Bonito proved helpful, as was intended. These colleagues, to whom I am more deeply obligated than this impersonal reference indicates, are as follows:

	1921	1922	1923	1924	1925	1926	1927
Karl Ruppert	x	x	x	x	x	x	
O. C. Havens	x		x	x	x		
A. H. Linsley (cook)	x						
H. B. Collins, Jr.		x	x	x			
George B. Martin		x	x				
Robert McFarlane (cook)		x					
Cecil Ban (cook)			x				
Frans Blom				x			
L. C. Hammond				x	x	x	x
J. B. McNaughton (cook)				x			
Frank H. H. Roberts, Jr.					x	x	
Monroe Amsden					x		
George M. McLellan (cook)					x	x	x
Henry B. Roberts						x	x
Dolores Calahan (secretary)							x

Our topographic survey of Chaco Canyon, a prerequisite to the investigations contemplated, was completed in 1922 by the late Capt. R. P. Anderson. Dr. Kirk Bryan, late Professor of Physiography at Harvard University, was engaged during the summers of 1924 and 1925 with studies pertaining to the geophysical history of Chaco Canyon. The final ground plan and several cross sections of Pueblo Bonito were prepared in 1925 and 1926 by Oscar B. Walsh, C. E., of the U. S. General Land Office. Based on this plan and our excavation data, Prof. Kenneth Conant, of the School of Architecture at Harvard University, in 1926 executed four drawings that picture Pueblo Bonito as it probably appeared in its heyday. They will be reproduced in a subsequent publication on this subject.

To the late Dr. Clark Wissler, of the American Museum of Natural History, I am personally indebted in many ways and especially for his courtesy in sending me, in mid-May 1921, partial page proof of Pepper's "Pueblo Bonito." This volume, which consists primarily

of the author's notes covering field work of the Hyde Exploration Expeditions of 1897-1900, went to press in the fall of 1920, and Dr. Wissler kindly provided a prepublication copy, albeit in page proof. In the quarter century that had lapsed between the first Hyde expedition and inauguration of the Society's project, the true significance of Pueblo Bonito had become apparent. It was no longer merely the largest and best-known ruin in Chaco Canyon but the very symbol of Pueblo civilization in full flower. To know more of this civilization it was necessary to know more of Pueblo Bonito. To avoid duplication of effort it was desirable to learn as early as possible in the course of our explorations what rooms had been excavated and subsequently refilled by the Hyde expeditions.

Prof. Richard E. Dodge, of Connecticut Agricultural College, who in 1900 and 1901 conducted the physiographic studies quoted by Pepper, generously placed at our disposal his original Chaco Canyon notebooks. With these in hand it was possible, in 1923 and again in 1925, to identify several of the sites where Professor Dodge made his observations and thus note to what extent erosion had progressed in the interval.

The better to gage changes within Pueblo Bonito itself, the Bureau of American Ethnology furnished copies of photographs made by Victor Mindeleff in the winter of 1887-88, and B. T. B. Hyde kindly permitted me to have prints made from many of Pepper's unpublished negatives. What a tragedy that W. H. Jackson, experimenting with a substitute for the old wet-plate process, should have lost the entire photographic record of his otherwise productive trip to Chaco Canyon in 1877!

Beginning in 1921, annual symposia were held at Pueblo Bonito for several seasons. To these gatherings came students of archeology and ethnology, agronomy and botany, geology and physiography. The discussions prompted by this association of kindred spirits proved mutually instructive and, I trust, adequate recompense for the inconveniences of an archeological camp.

Our crew of Zuñi and Navaho workmen varied in number from month to month and from year to year in accordance with each season's excavation program. The monthly average for the summer of 1921 was 14; for 1924, 28; for 1927, 8. Contrary to the predictions of one alarmist, we experienced no trouble from the simultaneous employment of representatives of these two tribes, hereditary enemies for over 400 years. So far as I could observe, the Zuñi were always welcome guests at Navaho homes throughout the valley, and several Navaho were invariably present on Sunday nights when the Zuñi

danced and sang in the light of a weekly bonfire before our tents. Once, to be sure, we were somewhat concerned when passersby brought word that a workman I had discharged the week before had returned to Zuñi with a Navaho scalp and demanded that it be received with the full ceremony of former days. But it was later proved that the scalp had been taken from the body of a woman buried sometime previously, a fact that convincingly identified our "warrior" as a crackpot.

As every archeologist knows, winnowing the data one assembles in the field and grinding the brighter kernels into a satisfactory report constitute a more arduous task than the mere pick-and-shovel work of excavation. It was my original desire to present the results of our investigations at one time, and in their proper order, but the combination each year of four months in the field and eight months of unremitting museum routine proved a windmill against which my good intentions were repeatedly shattered. Even after conclusion of our explorations, time for uninterrupted writing seemed always just beyond reach. Hence, it was decided in 1934 to abandon the earlier plan and publish our observations in a series of papers not necessarily in their logical sequence. Dr. Douglass's "Dating Pueblo Bonito and Other Ruins of the Southwest," issued in 1935, was the first of these; Dr. Kirk Bryan's on the geology was the second; the present report is the third. Subsequent numbers will consider the exceptional pottery of Pueblo Bonito, skeletal remains, the architectural development and decline of Pueblo Bonito, excavations at Pueblo del Arroyo, and other phases.

Except for a small selection on view in Explorer's Hall, at the Washington home of the National Geographic Society, our entire Pueblo Bonito collection is in custody of the United States National Museum where it is available, together with our notes and ground plans, for examination by qualified students. Stone artifacts and potsherds studied in the field were left at the ruin, reburied as protection against the ubiquitous curio collector.

Identification of materials cited herein has been made, for the most part, by my coworkers at the National Museum: Bird bones, by A. Wetmore; mammalian bones, by G. S. Miller, Remington Kellogg, David H. Johnson, and H. H. Shamel; minerals, by W. F. Foshag and E. P. Henderson; botanical specimens, by C. V. Morton, of the National Herbarium, and the late Dr. F. V. Coville.

Plates illustrating artifacts are by B. Anthony Stewart, staff photographer of the National Geographic Magazine; text figures are by William Baake, except as otherwise noted. Authors and articles re-

ferred to in the text are given in the bibliography and there are doubtless many others I should have consulted. These references offer a variety of spellings for the several Chaco ruins, but in this series we shall follow Simpson and Jackson, whose official reports, published in 1850 and 1878, respectively, first brought these ruins to public notice and whose orthography has been generally accepted by the Bureau of American Ethnology, the United States Geographic Board, and other authorities.

Mrs. Leta B. Loos, my secretary during the 25 years this volume has been in preparation, typed all the original manuscript with the exception of chapter I, which fell to Miss Lucy H. Rowland. For brief periods during summer vacations, Susan Perkins Setzler, Betty Jane Meggers, Robert N. Ladd, and Richard B. Woodbury have helped with reference work, sorting and analysis of specimens, checking tabulated data, and other tasks. Mrs. James W. Goodwin, who shared some of our experiences in the field, has contributed helpful advice and editorial criticism. And, lastly but foremost, my wife, Anne MacKay Judd, by her tact and gentle persuasion, is responsible for keeping this volume in process throughout the years. I have unquestionably been derelict in allowing my daily vocation to interfere so persistently with this writing. And yet it is probably a fact that only those few of my archeological coworkers who desired earlier to learn the results of our observations have really been inconvenienced by my tardiness.

NEIL M. JUDD

U. S. National Museum,
Washington, D. C.
October 1950

THE MATERIAL CULTURE OF PUEBLO BONITO

By NEIL M. JUDD
Associate in Anthropology
U. S. National Museum

(With 101 Plates)

I. INTRODUCTION AND CONCLUSIONS

Pueblo Bonito is a ruined communal dwelling, the home of perhaps 1,000 Indians at the close of the eleventh century, A.D.*

The ruin stands toward the lower end of Chaco Canyon, a 15-mile section of Chaco River, in San Juan County, northwestern New Mexico. The river rises on the Continental Divide 30-odd miles to the east, flows westwardly past Pueblo Bonito and some 40 miles beyond, then turns abruptly north to join the Rio San Juan just above Shiprock.

In or bordering Chaco Canyon, within 6 miles of Pueblo Bonito, are 12 other ruins of like age and culture and dozens of lesser ones, older or later. Kinbiniyol lies 10 or 12 miles to the southwest, in a valley of the same name; Pueblo Pintado forms a prominent landmark 20 miles to the east and Kin Yai, or Pueblo Viejo, is to be found near Crownpoint, 30 miles south. Together, these one-time habitations, large and small, comprise Chaco Canyon National Monument, created by presidential proclamation on March 11, 1907, and now administered by the National Park Service, Department of the Interior. (See map, fig. 1.)

Chaco River has cut its canyon through massive beds of Upper Cretaceous sandstone. The more conspicuous of these, with lesser

* See plate 1, "Pueblo Bonito from the Air." Richard Wetherill's dam is shown in front of and to the right of the ruin; his combined residence and store, at the left corner. At the right margin, the road crosses the 1928 bridge, curves past the site of the National Geographic Society's camp and two abandoned corrals, to end at the black-roofed building that was the Hyde Expedition's boardinghouse. Dimly seen below the latter, the old freight road descends to cross the arroyo, passes a small ruin on the shadowed arroyo edge, and turns southward.

strata between, are collectively known to geologists as "Cliff House" sandstone. They are of marine origin and vary in color from pale yellow to brown. Beneath the Cliff House is the Menefee formation, composed of diversified sandstones and a series of carbonaceous shales, gray to black. Subbituminous coal outcrops at intervals along the junction of the Menefee and the Cliff House.

Chaco Canyon varies in width from half to three-quarters of a mile, or a little more. Its floor is uniformly level from side to side and lies, out in front of Pueblo Bonito, at an elevation of 6,250 feet (6,250 was the reading at an assumed benchmark where Sections 11, 12, 13, and 14 meet, just south of Pueblo del Arroyo). Immediately behind Pueblo Bonito the Cliff House sandstones rise sheer 135 feet and then continue, steplike, to Pueblo Alto at an elevation of 6,560. Northward from Pueblo Alto the Chaco Plateau dips gently to 5,500 feet at the San Juan River, 45 miles away; toward the south it rises almost imperceptibly for 30 miles to 6,800 feet near Crownpoint (Gregory, 1916; Reeside, 1924).

At 6,500 feet above sea level, New Mexico temperatures may differ considerably from day to night and from summer to winter. Precipitation likewise is variable and unpredictable. Native vegetation mirrors climate, and the rigorous climate of Chaco Plateau is reflected in its plant life. Yellow pines grow at the higher elevations where rainfall is greatest; junipers and pinyons, a little lower; lower still, a scattering of sagebrush and greasewood. Perennial grasses thrive where floodwaters are allowed to stand. Less conspicuous plants are present also, though sometimes sparse.

ANCIENT FORESTS

Dr. A. E. Douglass (1935) has recounted our search for traces of the forests that furnished timbers for construction of Pueblo Bonito. Fifteen or sixteen miles east of the ruin a couple of dozen pine trees, living and dead, comprised the largest surviving remnant of those forests. Four dead pines, one of them still standing (pl. 2, left), were seen at the head of Wirito's Rincon, 2 miles or more southeast of Bonito. A lone survivor, on the south mesa and within sight of our camp, was cut for firewood during the winter of 1926-27.

Thousands of logs went into the roofs and ceilings of Pueblo Bonito. Fragments unearthed during the course of our excavations were invariably straight-grained, clean, and smooth. They had been felled and peeled while green; they showed no scars of transporta-

tion. Clearly they were cut within easy carrying distance. The character of their annual rings shows that most of them grew under exceptionally favorable conditions. Thanks to a technique developed by Dr. Douglass, the age of pine and fir beams can ordinarily be determined from their growth rings, but fully 10 percent of the samples we collected are useless for that purpose because their rings are too uniform in thickness. Such regularity indicates an abundant, constant water supply. Obviously Chaco Canyon had more rainfall when those beams were living trees.

Old Navahos told us of pines and pine stumps formerly standing in Mockingbird Canyon and elsewhere. We found some but not all. At the south end of the West Court we unexpectedly discovered the remains of a large pine that had stood there, alive and green, when Pueblo Bonito was inhabited. Its decayed trunk lay on the last utilized pavement, and its great, snaglike roots preclude the possibility of its ever having been moved (pl. 2, right). Unfortunately the outer part had rotted away, and so we could not learn the year the tree died. Its last readable ring gave A.D. 1017, but there was an unknown number missing after that. Altogether, our observations indicate the former existence of a pine forest in close proximity to Pueblo Bonito, principally on the south mesa but with fringes reaching down into the rincons and even out upon the valley floor.

Man and nature joined in the dissipation of the Chaco forests. Man felled the trees; without trees to check runoff following passing storms, the shallow soil was gradually washed from the underlying sandstone. Floodwaters drained even more quickly from bare rock and poured down into the valley. In a surprisingly short time the alluvial fill of the canyon was being trenched by an animated gully. Year after year that gully grew in width and depth as it cut its way upstream. In consequence, the water table was soon lowered beyond reach of grass, trees, and shrubs. As the ground cover withered and died the rapidity of runoff was accelerated. When floodwaters could no longer be controlled, fields they had previously watered were useless. Without bountiful crops, communal life on the scale practiced at Pueblo Bonito became impossible. Family groups withdrew to seek their fortune elsewhere; eventually none was left.

The channel that may well have been a determining factor in compelling abandonment of Pueblo Bonito has its present-day counterpart. We watched this latter as it annually carved a deeper course and reached out hungrily on either side. Every passing flood took its toll. In a single season, that of 1923, storm waters debouching from Wirito's Rincon, a mile and a half upcanyon, left a wide fan of sand

and gravel that completely blocked our road to Crownpoint and Thoreau. Successive floods uprooted the windmill on an arroyo bar west of Una Vida and gnawed at the talus under the nearby cliff.

There was an arroyo of sorts here in 1849. It was probably intermittent and, for the most part, inconspicuous. We draw this inference from the journal of Lt. James H. Simpson, a member of the military expedition under Lt. Col. John M. Washington that passed through upper Chaco Canyon that year. After breaking camp on the morning of August 28 the main body of troops left the canyon at Fajada Butte while Simpson and nine companions went on to see reported ruins. His journal makes no reference whatever to a gully, but when the little party stopped briefly at the ruin next below Pueblo Bonito his Mexican guide had a name on tongue's tip: "Pueblo of the Arroyo" (Simpson, 1850, p. 81).

During a day crowded with the excitement of inspecting what few white men had previously seen and none had described, six major Chaco Canyon ruins and sundry smaller ones, it is conceivable that Simpson overlooked so commonplace a subject as an arroyo. On the other hand, he mentions none between August 25, when the troops were on the east crest of the Continental Divide, and September 1, when they began their ascent of the Tunicha Mountains.

Where Colonel Washington's command camped for the night of August 27, 1849, less than 2 miles west of Pueblo Wejegi, Simpson (ibid., p. 78) reported that "the Rio Chaco . . . has a width of eight feet, and a depth of one and a half. Its waters . . . are of a rich clay color." Twenty-four hours later and about 23 miles farther west, he added: "The water of the Rio Chaco has been gradually increasing in volume in proportion as we descended" (ibid., p. 86). He had passed the Escavada and several lesser tributaries. Twenty-three miles of running water can only mean that rains had crossed the upper Chaco drainage a few days earlier and, as may happen, had somehow missed the expedition. Late August is within the normal rainy season.

In 1877, 28 years after Simpson, W. H. Jackson, famed photographer of the Hayden Surveys, found Chaco Canyon gutted from end to end by a channel 10 feet deep or more. It was 10 or 12 feet deep at Pueblo Pintado; 16 at Pueblo del Arroyo (Jackson, 1878, pp. 433, 443).

Our oldest Navaho neighbors (pl. 3) professed to remember when there was little or no gully in Chaco Canyon; when water could be had anywhere with a little digging; when a ribbon of cottonwoods and willows marked the middle of the valley, and grass grew thick and tall.

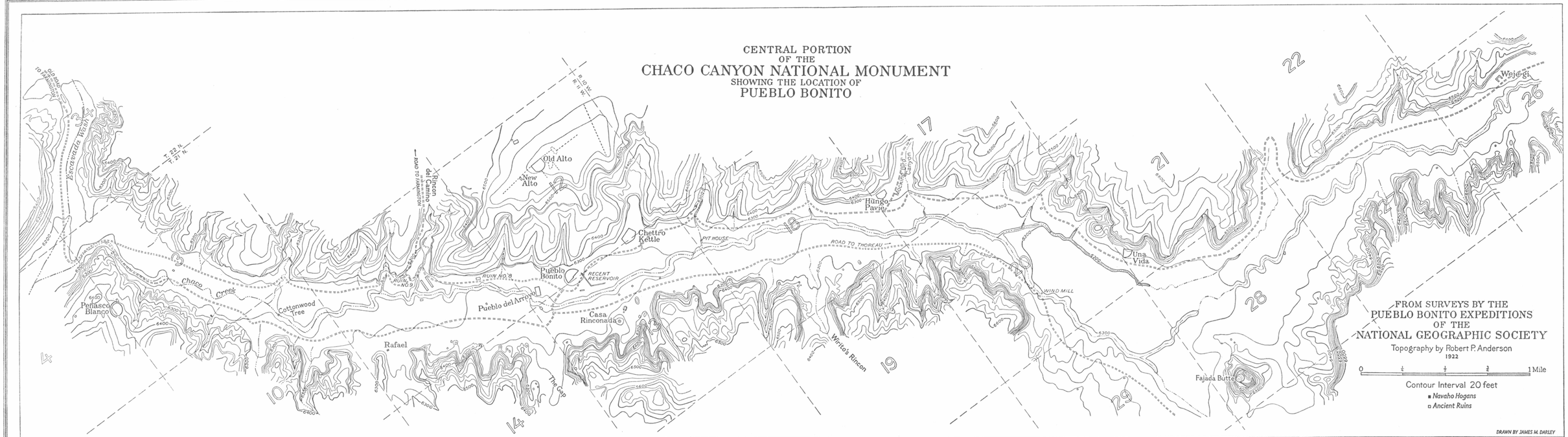


FIG. 1.—The central portion of Chaco Canyon, New Mexico, scene of the National Geographic Society's archeological investigations.

Hosteen Beyal stated emphatically that there was no arroyo above the mouth of Escavada Wash when he was a boy. On the contrary, the canyon was then carpeted with high grass among which shallow pools of rainwater stood throughout the year. He recalls neither cottonwoods nor willows opposite Pueblo Bonito but says both were numerous downcanyon, nearer Peñasco Blanco, and still more plentiful beyond.

By his son's estimate, Hosteen Beyal was born about 1832 and first saw Chaco Canyon 10 years later. Thus his boyhood recollections were of a time shortly antedating Simpson's recorded observations of 1849. Where Simpson found an arroyo just prominent enough to suggest a name for the ruin nearest Pueblo Bonito, Jackson, 28 years later, encountered one 16 feet deep and 40 to 60 feet wide.

Intrenchment of the Chaco was therefore already accomplished when cattle were locally introduced on a large scale, in 1878 or 1879. The livestock industry may be blameworthy elsewhere but not here. Jackson, reporting his 1877 observations, mentions neither cattle nor cattlemen. Yet within 2 years thereafter, two large companies, the "LC's" and the Carlisles, had moved in and usurped nearly all the range between the present Crownpoint area and the San Juan. It was probably the former, owned by a Dr. Lacy, that in 1879 built the stone houses under the cliff north of Peñasco Blanco for ranch headquarters (information from John Wetherill, 1936). I have not learned when or why they abandoned the Chaco country, but both companies had moved into southeastern Utah before 1896. And Old Wello had promptly appropriated to himself the vacated "LC" buildings and continued to occupy them until his death, in 1926.

The existing Chaco arroyo is at least the third of its kind, according to Bryan (1941). His physiographic studies in our behalf (Bryan, 1954) show that here, as in several other localities examined, floodwaters have alternately deposited vast quantities of alluvium and later bisected those deposits with gullies similar to recent arroyos. Presumably another cycle of alluviation will follow the current period of erosion. These phenomena are most readily explained, in Bryan's opinion, by the theory of climatic change, a theory first proposed by Huntington (1914).

The theory of a changing climate assumes that floodwaters are largely regulated by vegetation. A conspicuous change in temperature or rainfall is not essential, merely a slight shift from the dry toward the less dry. We have ample proof of such shifts. Although our Navaho informants, relying upon memories of their boyhood, insisted that he exaggerated, Simpson pictured a rather sparse ground cover

when he rode through Chaco Canyon in 1849, at the inception of the present arroyo system. On the other hand, the rushes with which Bonitian wives wove their sleeping mats and the pine logs that roofed their dwellings alike evidence moister conditions when Pueblo Bonito was inhabited, 800 years before. Here and elsewhere throughout the plateau country growth rings in timbers from prehistoric ruins provide a visible record of recurrent periods of deficient rainfall in times past. The Great Drought of 1276-99 merely climaxed a long succession of lesser droughts (Douglass, 1935, p. 49). Since the protection normally provided by living plants is lessened by any reduction in their density, erosion naturally follows periods of diminished rainfall. Thus the theory of climatic change seems to offer the most plausible explanation for the alternating periods of erosion and sedimentation Bryan sees in the alluvial fill of Chaco Canyon.

DISCOVERY AND EXPLORATION

Simpson was first to publish a personal impression of the principal Chaco ruins; Jackson was first to give detailed descriptions. Simpson names six of the eight ruins he and his nine companions visited between sunrise and sunset on August 28, 1849. Accompanied by old Hosta, ex-governor of Jemez pueblo and one of Simpson's guides, Hosta's grandson, and an interpreter, Jackson, in May 1877, spent "four or five days" in the canyon during which he examined and plotted 11 ruins and reported upon other features. I find no fact to support statements that Ainza in 1735, Gregg in 1840 or thereabout, and Domenech a decade later were ever in Chaco Canyon. And I see absolutely nothing on the oft-cited 1776 map of Don Bernardo Miera y Pacheco (Library of Congress, Lowery 593) to indicate that he had ever been there either. Traders, colonial agents, and militiamen unquestionably penetrated this "Provincia de Nabajoo" repeatedly prior to 1840, and the tales they carried to the market place in Santa Fe probably supplied the generalized information that led Gregg (1845, p. 285) and Loew (1875, p. 176) to describe Pueblo Pintado as Pueblo Bonito. Brand (1937) has best summarized the known history of the Chaco country, although he errs in some particulars.

Morgan (1881) quotes directly from Simpson and Jackson and reproduces the latter's map and ground plans. Mindeleff (1891) photographed the central Chaco ruins but had surprisingly little to say of them in connection with his study of Pueblo architecture. After Mindeleff came a succession of writers, vacationists, and others drawn

by the mystery and romance with which they, themselves, veiled the dead towns.

The Hyde Expeditions.—In 1896 Richard Wetherill, a leader in the discovery and exploitation of cliff dwellings and earlier remains, transferred his field of operations from Colorado and Utah to Chaco Canyon and began digging in Pueblo Bonito. His initial success, plus the remarkable condition of the ruin, prompted the idea of a more formal program. He communicated his thoughts to B. Talbot B. Hyde and Frederick E. Hyde, Jr., of New York, to whom he had previously sold a Utah collection. Having donated this latter to the American Museum of Natural History, the Hyde brothers quite understandably went to the Museum seeking advice on Wetherill's proposal. Prof. F. W. Putnam, then curator of the department of anthropology, not only approved the plan but undertook to guide its scientific phase from New York while his newly appointed assistant, George H. Pepper, directed field operations. The Hyde brothers took over Wetherill's 1896 finds and financed the program during the four following years, 1897 through 1900. Field work was not resumed in 1901 "by reason of Government interference" (Holsinger, Ms., p. 73).

With "about 100 Navajos" employed, provision for their subsistence had to be made. This necessity suggested a trading post at Pueblo Bonito, for there was none within 30 miles at the time. Accordingly, in 1898 a company was formed, under the name of the Hyde Exploring (or Exploration) Expedition, with Richard Wetherill field manager and Frederick E. Hyde, Jr., general supervisor. Company headquarters were established at Pueblo Bonito; in 1901 a local post office was authorized under the name "Putnam."

A residence for Wetherill was built a few feet from the southwest corner of Bonito, paralleling its west wall. Rooms 122-124 were cleared and revamped for occupancy. The store, a large room, adjoined the residence on the west. Back of the store, extending toward the cliff, was a long, narrow building, the stable. At the northeast corner of Pueblo del Arroyo a bunkhouse was built for employees; at the southeast corner, a boardinghouse with a few rooms for transients later became known as "the hotel." There were lesser structures here and there and a horse pasture south of the arroyo, at the foot of The Gap. All these improvements had been made on the unappropriated public domain.

On May 14, 1900, Wetherill filed a homestead entry upon the NW ¼ sec. 30, T. 21 N., R. 11 W., an area that included Kinklizhin ruin and the adjacent prehistoric farmlands. Six months later, alleging

a surveyor's error, he asked permission to change the entry to the south quarter of section 12, embracing not only the buildings he had erected but also the ruins of del Arroyo, Bonito, and Chettro Kettle. To inquire into this request and at the same time to investigate alleged acts of trespass, Special Agent S. J. Holsinger of the General Land Office was directed to visit Chaco Canyon. His report to the Commissioner, under date of December 5, 1901, contains much information and much misinformation. Wetherill and Frederick E. Hyde, Jr., gave their testimony under oath, but it is obvious that they indulged freely, at other times, in that favorite western sport, spoofing the stranger. Like those before him, Holsinger was swayed to superlatives by the size and condition of Pueblo Bonito. He accepted enthusiastically Wetherill's idea of preserving the Chaco ruins in the public interest, and it was his argument, in large part, that brought about creation of Chaco Canyon National Monument in 1907.

Following Holsinger's investigation, but before his report was submitted, the Hyde Exploring Expedition transferred its headquarters from Pueblo Bonito to Thoreau, on the Santa Fe Railroad, and its archeological collections were presented to the American Museum of Natural History, in New York. A handsome gift half a century ago, those collections remain today not only convincing proof of the generosity of the Hyde brothers but also of the cultural heights attained by the builders of Pueblo Bonito.

Some of his more spectacular finds were described in four short papers by Mr. Pepper (1899, 1905b, 1906, 1909). The final report he had hoped to prepare was never written, but in its stead publication of his rough field notes was authorized in the autumn of 1920. These notes, of but limited usefulness to one not intimately acquainted with Pueblo Bonito, are often confused and incomplete, as are my own. Pepper and I were close friends for 10 years prior to his death in 1924, and Pueblo Bonito was a frequent subject of conversation. Since we both earned our daily living in museums, no one knows better than I his disappointment when museum chores year after year delayed the volume that should have been an appropriate end to the principal undertaking of his scientific career.

The National Geographic Society Expeditions.—In beginning researches at Pueblo Bonito 20 years after the Hyde Expeditions, the National Geographic Society had but a single purpose: to contribute, if possible, additional information regarding Pueblo civilization at its height. This cultural apex, many agreed, was best exemplified by the major Chaco Canyon ruins, and of these Pueblo Bonito had been recognized by our 1920 reconnaissance as the one site at which all

phases of the distinctive Chaco culture should be most fully illustrated. Pueblo del Arroyo was added because its proximity permitted examination coincident with the Pueblo Bonito investigation and because masonry walls exposed by the arroyo on the west side of the ruin were thought to underlie the latter.

The Society's program of investigation, as approved by its Committee on Research, included everything identifiable with the life of these two prehistoric communities. Their domestic water supply, their sources of food and fuel, their entire subsistence problem—all lay within the scope of our inquiry.

In the early summer of 1921 we set up our tents directly south of Pueblo Bonito, on the edge of a long, cellarlike excavation that had been the Hyde Expedition's storeroom for wool and Navaho blankets. Where we dug our well, on a sand bar at one side of the main watercourse and a couple of feet higher, the arroyo measured 32 feet deep and 180 feet wide. Elsewhere, depth and width were greater. Water for camp purposes was pumped into a tank elevated above the tents; gravity carried it down into the kitchen, at the east end of the old cellar, and to a mud box near the ruin. (A crew of three, sometimes two crews, made wall repairs as our excavations progressed.)

It is generally recognized throughout the Southwest that drinkable water is to be had only by digging in, or adjacent to, the actual stream course of an arroyo. The Hyde Expedition was an early experimenter in Chaco Canyon. "A six-inch well, 350 feet deep, was drilled near the south-west corner of Bonito ruins with the hope of securing artesian water. No flow, however . . . and only brackish water, unfit for use, encountered." (Holsinger, Ms., p. 10.)

In April 1901, at the time of Holsinger's visit, the well supplying Hyde Expedition personnel and livestock was situated "just south and almost under the walls of Pueblo Arroyo" and was 20 feet deep. It was short-lived, however, presumably ruined at the same time floodwaters destroyed the wagon road across the arroyo at that point, since a new well had been dug and a new crossing prepared a hundred yards upstream prior to Wetherill's death in 1910. During the following decade floods continued their annual channeling, for when I first crossed here, in June 1920, the well platform stood 4 feet above the bottom of the arroyo and a crumpled steel windmill tower lay half buried in the sand. A year later both wreckage and well disappeared.

WATER RESOURCES AND AGRICULTURE

Potable water is a major want in Chaco Canyon today, but was it always so? In 1877 Jackson camped three days at a muddy pool 250

yards west of Pueblo del Arroyo. Not until the very morning of his departure did he find the ancient stairway up the cliff back of Pueblo Bonito and the deep, half-filled water pockets beyond. Richard Wetherill drew upon these latter, letting a daily ration down over the cliff by rope and bucket, until a well had been dug in the Chaco wash; he also built an earth dam to increase the storage capacity of the pockets and later replaced it with one of concrete (verbal statement of John Wetherill, 1921). Nine hundred years before, women and girls from Pueblo Bonito climbed the old stairway to that same source of cool, clear water and back again, each with an olla balanced upon her head.

Deep as they are, the water-worn cavities on the cliff overlooking Pueblo Bonito were reservoirs of limited capacity. They can scarcely have met the yearlong needs of the village. But, visited upon occasion, they offered opportunity for feminine gossip and a change from, presumably, the more frequented waterholes down on the canyon floor. If we can accept Hosteen Beyal's recollections of 1840 or thereabout, when the water table was only 2 or 3 feet below the surface and a succession of shallow, willow-bordered pools marked the middle of the valley, another such series must have been present when like conditions prevailed back in the days of Pueblo Bonito. These pools naturally vanished as floodwaters cut away the intervening sod and thus initiated an arroyo system. Being shallow-rooted, willows were doomed to disappear as the water table fell beyond reach of their roots.

According to Jackson, willows and cottonwoods were still fairly numerous in 1877. Most of them, however, had disappeared before 1920, the year of our reconnaissance. At that time we noted several cottonwood trees on the south side of the canyon, east of Wejegi, and others here and there. A lone example was growing near the windmill in the arroyo west of Una Vida, and two more, similarly situated, stood a quarter-mile below Pueblo del Arroyo. These latter clearly had slumped from surface level with caving of the arroyo bank. One of them, transported a mile farther downstream, still flourished in 1924. Clustered willows sprouted on gully sandbars each spring, but their numbers decreased from year to year as the channel grew wider and deeper.

To test the quality of Chaco Canyon water and to measure the effect of floodwaters upon that quality, we submitted several samples to the U. S. Department of Agriculture for analysis in 1923 and again in 1925. I desire at this time to acknowledge our indebtedness to C. S. Scofield, then senior agriculturist, in charge, Office of West-

ern Irrigation Agriculture, and to J. F. Breazeale, also of that office, for the following report:

Quality of water samples from Chaco Canyon, N. Mex., expressed in parts per million

Sample No.	Ca	Mg	HCO_3	Cl	SO_4	NO_3	Total salts
1	30	tr.	240	72	108	tr.	432
2	36	5	264	42	236	tr.	640
3	33	tr.	336	42	169	2	616
4	36	0	312	42	172	2	568
5	30	0	240	tr.	164	2	496
6	138	6	216	0	725	5	1,304
7	105	2	192	0	436	0	848

Description of samples

No. 1, First floodwaters of 1923, collected July 9.
No. 2, N.G.S. well, collected July 10, 1923.
No. 3, N.G.S. well, June 24, 1925, before cleaning.
No. 4, N.G.S. well, June 26, 1925, after cleaning.
No. 5, Floodwater, June 24, 1925.
No. 6, Rafael well, July 16, 1925.
No. 7, Surface water, Kinbiniyol alluviation plain near Navaho cornfield, July 15, 1925.

Character of salts expressed as reacting values or milligram equivalents

Sample No.	Ca	Mg	HCO_3	Cl	SO_4	Total acids	Na *
1	1.5	tr.	3.9	2.0	2.2	8.1	82
2	1.8	0.4	4.3	1.2	4.9	10.4	83
3	1.6	0	5.5	1.2	3.5	10.2	84
4	1.8	0	5.1	1.2	3.6	9.9	82
5	1.5	0	4.0	tr.	3.4	7.4	80
6	6.9	0.5	3.5	0	15.1	18.6	60
7	5.2	0.2	3.1	0	9.1	12.2	56

* In reviewing my interpretation of his data 25 years after they were submitted, Mr. Scofield generously added the *sodium percentage value*, this being a later, and now more widely used, criterion for evaluating irrigation waters. He points out that when its sodium percentage ranges below 65, water usually penetrates the soil readily, but when the percentage exceeds 65, as in the Chaco, impairment of permeability is inevitable and the rapidity of its onset and its intensity, once started, both increase with increase in the sodium percentages.

In his letter of August 24, 1925, transmitting the foregoing results, Mr. Scofield says:

From these results it is evident that the water obtained from your well is substantially of the same quality as the floodwater of the Wash. But the water from the Rafael well is different. Not only is it more concentrated, but it contains a high proportion of calcium. Is it possible that the water in the Rafael well is influenced by drainage from the rincon south of his cornfield, which drains an area in which the soil is derived chiefly from sandstone rather than from Lewis shale?

I am particularly interested in the quality of the water from the Kinbiniyol. This differs from the water of the Chaco, not so much in total salt as in quantity of calcium. It is a hard water and should not cause soil trouble when used for irrigation.

Mr. Scofield adds that there was no appreciable change in the quality of the water between 1923 and 1925. This was true also, as one might expect, in samples taken both years from the Expedition well and from the reconditioned Wetherill well, a hundred yards downstream.

The last sentence quoted from Mr. Scofield's letter echoes a thought he had previously expressed, namely, that Chaco Canyon water might prove unsuitable for irrigation. This possibility prompted an analysis of soils from fields presumably cultivated by the Bonitians. The results are reported in our next chapter. It may be noted in passing, however, that a calcium deficiency and an excess of sodium salts in the soil samples analyzed have left them impervious to water and therefore incapable of producing crops. Poor soil thus becomes a second probable cause for abandonment of Pueblo Bonito. Together, poor soil and the twelfth-century arroyo would have frustrated every Bonitian effort toward large-scale agriculture in Chaco Canyon.

There are no springs in the canyon now, but seeps here and there, chiefly at the heads of rincons, may have been more productive in times past. Rushes still grow below these seepage zones, but they are noticeably smaller and less sturdy than those used in ceiling construction and in floor mats at Pueblo Bonito. This fact suggests a more generous rainfall when the pueblo was inhabited. On the basis of our incomplete observations we estimated at 10 inches the current annual precipitation, but geologists studying the local situation reason that even one additional inch per year would cause existing seeps to flow again.

The most active seep seen by members of our party was in a shallow sandstone cave in upper Rincon del Camino, about a mile and a half northwest of Pueblo Bonito. It had been developed and carefully protected for domestic use by Dan Cly, one of our Navaho workmen, who resided nearby. As is evident from the following analysis, the water is exceptionally pure:

Ca	Mg	HCO_3	Cl	SO_4	NO_3	Total salts
30	0	120	0	48	0	152

Floodwaters following midsummer rains make a noisy approach, at once fascinating and frightening. Time after time we watched unbelieving as they methodically undercut the arroyo banks and

carried them away, yard by cubic yard (pl. 4, upper). During our seven summers in Chaco Canyon, every storm that passed meant an interruption to our work while we repaired approaches to the road crossing.

Despite all the destruction they have caused, these recurrent floods performed one worthy service: they laid bare a partial profile of Chaco Canyon history. Across from Pueblo del Arroyo a low mound in midvalley marks a small Pueblo III ruin. One corner had already been exposed when W. H. Jackson in 1877 observed that the foundations lay "five or six feet below the general level." The arroyo, then 16 feet deep, was 12 feet deeper in 1920, when, to judge from what remained, fully half the little ruin had been undermined and washed away.

Both above and below the surface on which that house was erected, silt deposited by gently flowing waters formed uniform layers extending right and left toward the canyon walls (pl. 4, lower). Obviously, when those silt layers were laid down a lush ground cover was present to hinder and delay runoff. Our test pits at a number of places showed like stratification, although nearer the cliff the overburden was sometimes only 2 feet thick.

The prehistoric arroyo.—Bryan (1925, 1926) described the origin and development of the present-day arroyo and compared it with one that existed in Pueblo Bonito times. This latter, which we plotted for more than a quarter mile, apparently did not exceed 12 or 13 feet in depth. Nevertheless, it could have brought about what the present arroyo is even now accomplishing, namely, transformation of Chaco Canyon from a suitable place of residence into a waste incapable of supporting more than a few scattered families.

An interval of approximately 800 years separates this modern gully and its predecessor. After the older one had run its course it was gradually filled with alluvium and then buried under an additional 5 or 6 feet, as we have seen. Thus the old channel was completely hidden until exposed by its present-day parallel. What other secrets lie concealed by those 5 feet of silt is one of the tantalizing mysteries connected with Pueblo Bonito.

W. H. Jackson first called attention to this buried channel. A cross section of it near Pueblo del Arroyo showed, 14 feet below the surface, an irregular stratum of potsherds, flint chips, and bone fragments—household and workshop waste from the trash piles of Pueblo Bonito. Here, too, apparently brought in by floodwaters the previous summer, was a human skull from an unmarked upcanyon grave. A

lesser stratum of sherds on the south bank led up to the small arroyo-side ruin above mentioned (Jackson, 1878, pp. 443-444).

The prehistoric arroyo presumably reached its climax about the middle of the twelfth century. We draw this inference because Late Bonitian potsherds were found on the bottom of it and because new house construction at Pueblo Bonito seems to have come to an end by that time. Of 52 datable timbers recovered during our excavations only 4 were felled after A.D. 1100, and the latest of these was cut in 1130 (Douglass, 1935, p. 51). Since the present 30-foot channel has already been a century in the making, we may, employing the same time gage, assume its predecessor had a beginning somewhere around 1075. Bryan (1941, p. 231) dates the period of refill and alluviation between 1250 and 1400. By 1500 or 1600 ecological equilibrium had been reestablished and Chaco Canyon was once again a fit place in which to live.

The Navaho were quick to discover this fact, for the upper Chaco, with the mesa country northward along the Continental Divide to the Gobernador, was their tribal birthplace and nursery. It was here they gathered the numerical strength for recurrent depredations that all but wiped out the Jemez towns by 1622 (Hodge, *in* Ayer, 1916, p. 243). With Navaho acquiescence Pueblo refugees from the aftermath of their 1680 revolt against Spanish dominance found brief asylum in this same region (Kidder, 1920).

ABORIGINAL OCCUPANCY OF CHACO CANYON

Evidences of Navaho occupation abound throughout the Chaco country, but one cannot always fix their age. The site of a hogan, for example, may be 50 years old or twice that. Neglected drainage ditches look timeless. Here and there along the canyon rim are "watchtowers" of sandstone blocks loosely piled 2 or 3 feet high. I believe these structures to be of Navaho origin, despite the possible presence of Pueblo potsherds, because they are more or less circular and invariably have a sill-less opening to the eastward. They could be relics of the eighteenth and nineteenth centuries when guards were posted to warn of approaching troops, sent to retaliate for Navaho raids on Spanish and Pueblo settlements to the east and south.[1]

Notwithstanding its present-day barrenness and desolation, Chaco Canyon formerly possessed some now-missing quality that attracted Indian settlers. The ruins of one-time habitations, some older than

[1] For a later study than ours, see "Archaeological Remains, Supposedly Navaho, from Chaco Canyon, New Mexico," by Roy L. Malcolm, Amer. Antiq., vol. 5, No. 1, pp. 4-20, July 1939.

others, are to be seen on every hand. A Late Basket Maker village 9 miles east of Pueblo Bonito was tested in connection with our studies in 1926 and excavated the following year for the Bureau of American Ethnology by Roberts (1929). During our 1920 reconnaissance, to keep three Zuñi occupied while I visited Pueblo Pintado and the upper Chaco, a P. I pit house on the south side of the canyon, opposite Pueblo Bonito, was partly excavated. Two years later we cleared what remained of another, in midvalley and a mile to the east. From this second dwelling, its roof level buried under six feet of alluvium, we removed two charred logs subsequently dated A.D. 777±10 (Judd, 1924; Douglass, 1935).

Scores of small Pueblo II and III structures are to be found along the south side of the valley and in the open country beyond. In contrast, most of the great P. III towns are situated close under the canyon's north wall. Here, too, a few natural cavities had been converted into granaries or one-family shelters; terraced houses were piled against the cliff behind Pueblo Bonito and Chettro Kettle. Up-canyon, on jutting crags beyond Wejegi, are the ruins of at least two houses built between 1680 and 1700 by refugee families from Rio Grande pueblos. In few places can the pageant of Pueblo history be seen so clearly as in Chaco Canyon!

In this and following reports on our investigations I shall continue to designate culture sequences by the terminology of the Pecos Classification (Kidder, 1927), with occasional resort to Roberts's 1936 proposals by way of variation, despite the fact that increase of knowledge since these studies were begun has shown that material and physical differences between the so-called Basket Makers and the Pueblos are less real than was formerly supposed.

Like the Basket Makers, the Early Pueblos (P. I) dwelt in pits before they learned to build houses that could stand alone. Walls made of posts and mud eventually were replaced by those of masonry; detached, one-family dwellings were brought into juxtaposition, their storage bins at the rear; one-clan structures developed into vast, terraced buildings housing several hundred persons. Pueblo Bonito and others of its kind illustrate this latter stage, the third (P. III) and highest advance of Pueblo civilization. It was followed by a period of retrogression, commonly designated Pueblo IV, and then by the further disruption of the Spanish Conquest (P. V). Some 30-odd Pueblo villages in New Mexico and Arizona still cling, more or less tenaciously, to the traditional way of life and the old religion. At least two of them, Acoma and old Oraibi, still occupy the very sites they occupied in 1540.

When our Pueblo Bonito investigations were inaugurated, in the spring of 1921, most archeologists working in the Southwest depended upon fragments of pottery to suggest the degree of development at any one site. Pueblo I pottery had a certain sameness, no matter where found; it could never be mistaken for P. III pottery. Therefore potsherds served as evidence both of material progress and passing time. Stratigraphy was the means by which that evidence was acquired.

Hence our first desire, as soon as camp had been organized, was a good look at the Bonito dump. Two conspicuous rubbish piles stand just south of the ruin. Because floor sweepings at the bottom of those piles would be older than sweepings on top, a cross section should reveal every major change in the material culture of the villagers during the period that trash was accumulating.

Previous experience in Utah and Arizona had taught me that certain types of earthenware were associated with early dwellings; other types, with later. But our trench into the larger of the two Bonito rubbish heaps disclosed an intermixture of early and late types from top to bottom. We cut a second stratigraphic section and then a third. Each revealed the same puzzling fact: early sherds were with and above late fragments.

The story of how this mystery finally was solved has been reserved for my chapter on pottery. But the solution, I must add, also provided convincing evidence that a settlement had existed here a long, long while before its population was doubled by an immigrant people. Still later, more foreigners arrived.

Thanks to the late Dr. Clark Wissler, then curator of anthropology, American Museum of Natural History, partial page proof of Pepper's "Pueblo Bonito" was received late in May 1921, shortly after we had turned our attention from the rubbish piles of Pueblo Bonito to the ruin itself. This text, and a number of prints from Pepper negatives purchased through courtesy of B. T. B. Hyde, enabled us at the outset to identify the rooms Pepper had excavated and thus avoid any possible duplication of effort.

Discussing the nature and extent of the Hyde Expeditions' work in his foreword to Pepper's volume, Dr. Wissler says: "Something less than half the rooms in the pueblo were excavated, 198 in all." The total given is apparently a typographical error, for Pepper's text and ground plan include only 189, plus the sunken shrine in the East Court, No. 190. The ground plan, it is explained, was prepared by B. T. B. Hyde from Pepper's field notes and a sketch made in 1916 by N. C. Nelson. That such a composite should contain a few dis-

crepancies was perhaps inevitable and was anticipated by Mr. Nelson (*in* Pepper, 1920, p. 387). Wherever disclosed during the course of our own explorations, these errors have been corrected. On the plan appearing herein, figure 2, rooms numbered 1-190 are those excavated by the Hyde Expeditions; with a few exceptions those examined by the National Geographic Society are numbered 200-351 and the kivas are lettered. In our text the letters B, C, and D indicate, respectively, the second, third, and fourth stories. Five rooms (210,

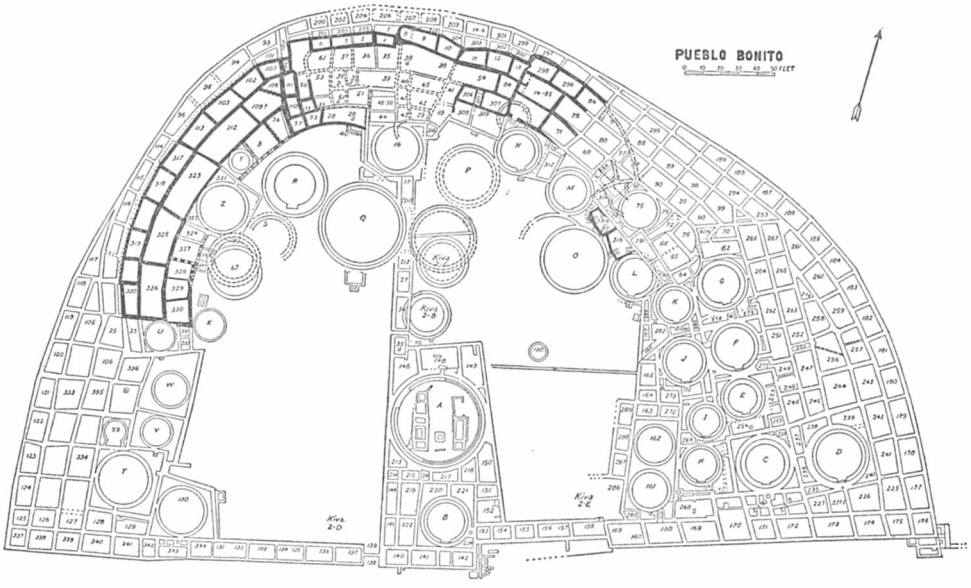


FIG. 2.—A crescent of Old Bonitian houses formed the nucleus of Pueblo Bonito and influenced each successive addition to the village. (Drawn from the original survey by Oscar B. Walsh.)

227, 295, 299, 300) and two kivas (Y, Z) were cleared by unknown persons between 1900 and 1920. In addition to those left unnumbered, Rooms 205-208, 297, 301-303 were purposely not excavated; and Kivas O, P, S, and 2-C were merely tested. These, I hoped, might be reserved for examination some years hence.

It was my desire, and one in which the Society's Committee on Research unanimously concurred, to save Pueblo Bonito for what it actually is, a ruined prehistoric town, and let its empty rooms tell their own story. Toward this end we did a great deal each season to strengthen standing walls in order that they might be preserved as we found them. A repair crew was kept constantly at work as excavations progressed, patching broken masonry, replacing missing

door lintels, and taking other reasonable precautions to check further disintegration.

To provide drainage in rooms that we opened in the eastern part of the ruin, a hole often was dug in the middle floor, filled with rocks, and covered with sand. To protect the ruder stonework of the western half, our rooms were wholly or partially refilled, the refill being cupped in the middle. For like reasons we carted away the excess dirt and rock the Hyde Expeditions had thrown out of their excavations. Hewett (1936, p. 32) was well aware of this when he sought to belittle our program by stating that the Society had reexcavated the Pepper rooms.

Pueblo Bonito well merits preservation. It is at once the largest and oldest of the major Chaco Canyon towns. It is a complex, the union of several distinct parts. It is the work of two similar but unlike peoples. Despite joint occupancy of the village for 100 years or more, these peoples were culturally two or three generations apart, as we shall see presently.

THE PEOPLE OF PUEBLO BONITO

Pueblo Bonito originated in the ninth or early tenth century as a cluster of rudely constructed masonry houses. This original house cluster, occupying the slight elevation where a Pueblo I pit village formerly stood, expanded crescentically to right and left as new homes were required. Then, perhaps in the second quarter of the eleventh century, the local population was suddenly increased by arrival of the second group, emigrating from some as yet undetermined point of departure, presumably in the north.

These newcomers, culturally more advanced than their hosts and perhaps numerically superior, lost little time in assuming leadership of the community. They encompassed the old village in their first constructional enthusiasm; later they unhesitatingly razed their own and neighboring houses to make way for successive alterations; they increased the impregnability of the pueblo and twice enlarged it, the last time after having abandoned plans that would have doubled its ground area.

Differences between the two peoples responsible for Pueblo Bonito are evident in many ways. The one group was old fashioned, unchanging; the other, alert and progressive. Each had its preferences in architecture; each had its favored shapes for kitchen utensils. Since we do not know the real name of either we shall hereinafter, merely for convenience, designate the first people the "Old Bonitians" both because they were the original settlers and because they remained

so stubbornly conservative until the end. We shall refer to the second group as the "Late Bonitians" since they were, in fact, late comers. It was these latter who molded Pueblo Bonito to its final form, gave it the mastery in art and architecture that set the tempo for all Chaco Canyon, and won for it a fame that echoed down the beaches of Lower California and through the jungles of Veracruz. Together, these two peoples naturally become the "Bonitians."

Old Bonitian houses were built usually of sandstone slabs as wide as the wall was thick. The slabs might vary in length and weight, but they were always reduced to standard width by breaking away the sides. Since spalling left the edges thinner than the middle, quantities of mud were required to bed the slabs evenly. And because that mud was spread and pressed into place by human hands, fingerprints invariably appear on the surface. Sometimes a mosaic of stone chips on outside walls protected the mortar from rain and windblown sand. Interior walls occasionally were made of upright poles bound together with willows and packed between with mud and chunks of sandstone, a practice handed down from Basket Maker III and Pueblo I times.

In contrast, Late Bonitian masonry consists of a core of rubble and adobe, faced on both sides by neatly laid stonework. Ignoring for the time being several nondescript but contemporaneous varieties, we may recognize three successive styles in Late Bonitian wall construction: (a) that veneered with blocks of friable sandstone of unequal size and shape but all pecked or rubbed smooth on the exposed surface only and chinked with pieces of laminate sandstone about a quarter inch thick; (b) that with fairly uniform, dressed blocks of friable sandstone, or laminate sandstone, alternating with bands composed of laminate tablets an inch in thickness, more or less; and (c) that faced solely with laminate sandstone. Beginning with that peculiar to the old people, these four kinds of masonry will be referred to hereinafter as types 1, 2, 3, and 4 (pl. 5). Their relative ages may be approximated from the fact that tree-ring dates for 65 beams range from A.D. 919 to 1130, as published by Douglass (1935, p. 51).

The Old Bonitian part of town (fig. 2) was built earlier, and it was occupied later than the remainder. Five feet of blown sand had accumulated against the outer wall of the original settlement before the Late Bonitians arrived and built their homes upon that accumulation. More sand had gathered against old and new walls before extensive alterations introduced the third type of stonework. Still later, construction on a very considerable northeast addition was

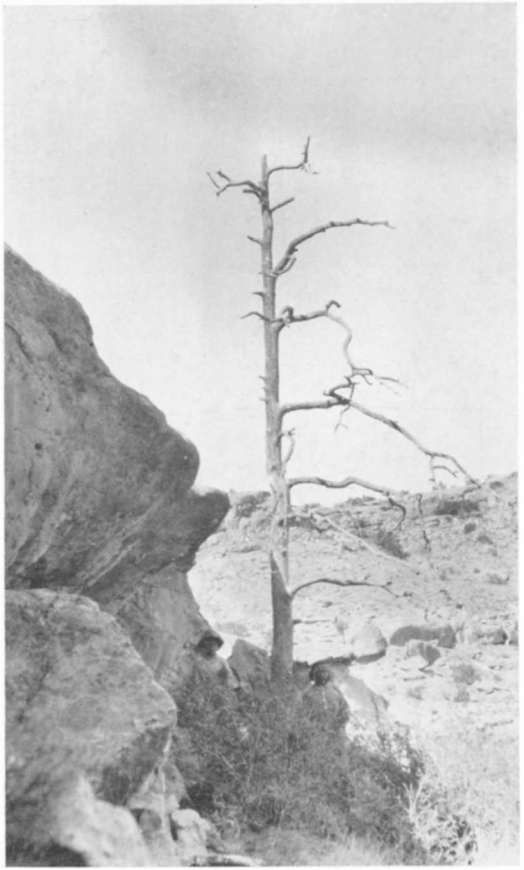
interrupted in favor of plans that brought Pueblo Bonito to its final form.

I believe the Old Bonitians continued in residence longer than the Late Bonitians because practically all the cultural material recovered by the Hyde Expeditions, and by the National Geographic Society, came from Old Bonitian rooms. Some of these rooms are former dwellings; others clearly had been designed for storage. Eventually eight of them, both storerooms and one-time habitations, were requisitioned for burial purposes. Materials stored at the time, religious or otherwise, were abandoned when the first body was brought in.

Late Bonitian houses, on the other hand, appear to have been emptied of their contents and leisurely vacated. Windblown sand sifted in, and subsequently flooring and stonework from upper stories collapsed upon that sand. No Late Bonitian room had been used for burials, but a number came to be recognized, sooner or later, as more convenient places than the village dump for disposal of household sweepings.

Dumping household waste in convenient corners was not a Late Bonitian trait exclusively. The Old Bonitians were equally guilty. Indeed, there is probably not a ground-floor room in the entire village that wholly escaped the bearer of trash. Some of the lesser quantities we encountered might have been brushed through open hatchways by housewives living on the floor above, but larger accumulations represent repeated contributions by all families in the vicinity. Room 323 was a neighborhood dump both before and after its ceiling collapsed. Trash from a single source was often thrown in various places. A bowl with drilled holes evidencing ancient repairs (U.S.N.M. No. 336297) is one of several vessels we restored from fragments recovered from two or more separate debris heaps.

Where vegetal matter is lacking it is not always possible to distinguish between intentional and unintentional rubbish deposits. Fireplace ashes may be quite inconspicuous where blown sand is predominant. At first it seemed reasonable to recognize as a trash repository any room in which we found 1,000 or more fragments of broken pottery. But potsherds alone are not enough. Room 247, for example, with 2,732 sherds, was not really a dump, but the southwest corner of Room 245, with only 329 fragments present, obviously was. Here floor sweepings had been poured through a side door of Room 246B, in the second story, until it formed a 5-foot-high pile in the corner of the ground-floor room below and adjoining. An unusual number of potsherds plus an unusual number of discarded implements such as bone awls, hammerstones, and manos, is a more reliable measure



Dead pine at the head of Wirito's Rincon, southeast of Pueblo Bonito. (Photograph by Karl Ruppert, 1922.)



Decayed remains of a great pine that stood within the West Court of Pueblo Bonito. (Photograph by O. C. Havens, 1924.)

PLATE 2



Old Wello and Padilla, Navaho neighbors and frequent visitors at the National Geographic Society's Pueblo Bonito camp. (Photograph by O. C. Havens, 1925.)



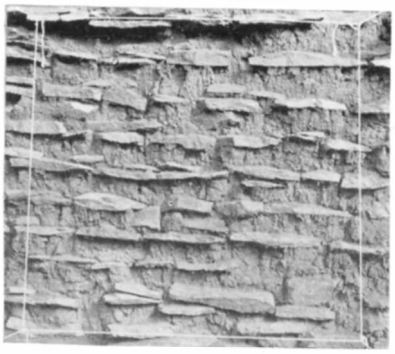
Hosteen Beyal (Mister Money) who remembered Chaco Canyon as it was about 1840. (Photograph by Neil M. Judd, 1927.)

PLATE 3

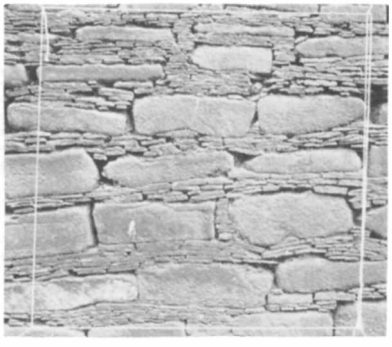
PLATE 4

Upper: The Chaco in flood. Wetherill's well, destroyed a few weeks later, stands at the left; below it, wagon tracks on the crossing used until 1928. (Photograph by O. C. Havens, 1921.)

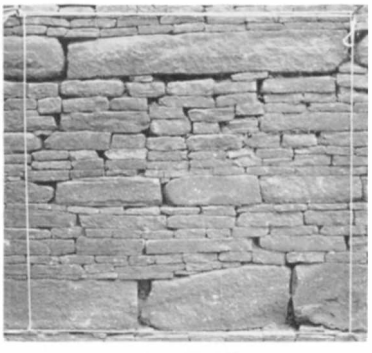
Lower: Layers of silt deposited by gently flowing floodwaters underlie a small ruin, a contemporary of Pueblo Bonito. Pueblo del Arroyo appears at the right. (Photograph by Charles Martin, 1920.)



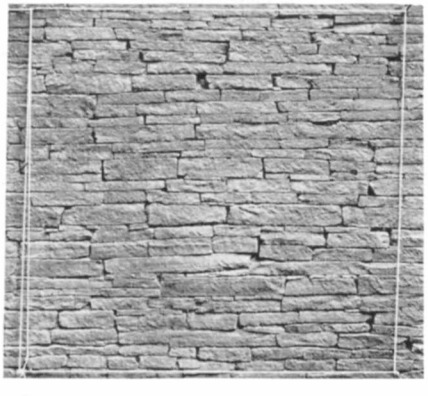
1. Spalled-sandstone slabs of wall width laid in abundant quantities of mud and often protected from the elements by closely placed stone chips.



2. Rubble veneered with casual blocks of friable sandstone dressed on the face only and chinked all around with chips of laminate sandstone.



3. Rubble veneered with matched blocks, either of laminate or dressed friable sandstone or both, alternating with bands of inch-thick tablets of laminated sandstone.



4. Rubble veneered with laminate sandstone of fairly uniform thickness laid with a minimum of mud plaster between.

PLATE 5.—The four principal types of masonry at Pueblo Bonito, each represented by a 2-foot square section.

of the deliberate rubbish pile than potsherds alone. The wattled partition crossing Room 256 may have been built to retain trash piled deeper behind the wall than in front of it.

Whenever Transitional, Early Hachure, Solid, and Plain-banded types of pottery were preponderant in a given accumulation we assumed that most of it came from Old Bonitian dwellings. By the same token a Late Bonitian source was indicated if Late Hachure, Chaco–San Juan, Mesa Verde, and Corrugated-coil culinary wares

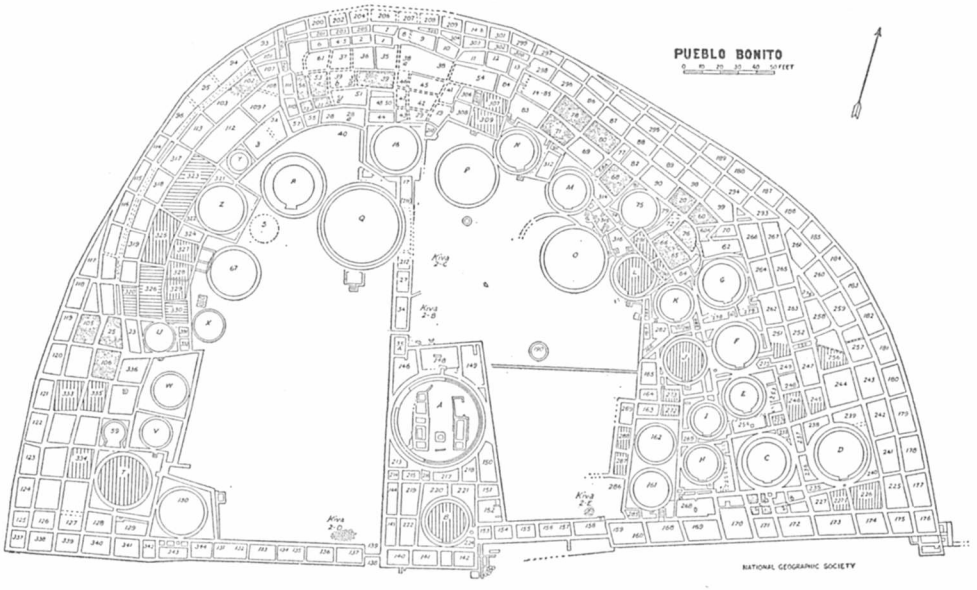


FIG. 3.—Abandoned ground-floor rooms used for rubbish. Key: Horizontal hatching, Old Bonitian; vertical hatching, Late Bonitian; stippled, probable dump (no data).

predominated. With these yardsticks 70 percent of 24,587 sherds tabulated from Room 323 were Old Bonitian varieties, while, curiously enough, 51.3 percent of those from Room 325, next on the south, were Late Bonitian. Our data do not identify Kiva Q as a communal dump, and yet of the 4,527 fragments collected there 33.4 percent were Old Bonitian and 37.2 percent were Late. Of 5,558 sherds from rubbish in Late Bonitian Room 334, 60.2 percent were Late Bonitian types, but of 642 from a test pit beneath the floor of that same room 52.4 percent were Old Bonitian.

In figure 3 I have attempted to show the distribution of trash accumulations within the walls of Pueblo Bonito. Our evidence is conclusive in some instances but not in all. Of the rooms and kivas

excavated by the National Geographic Society I recognize 34 as certain or probable dumps, while if 1,000 or more potsherds were our only criterion I should have to add nine more rooms and seven kivas. Pepper's text identifies only four of his excavated rooms (24, 25, 67, 105) as rubbish repositories but I have marked 10 others as probable dumps on the basis of Hyde's tabulation (Pepper, 1920, pp. 359-372) of specimens recovered. His four burial rooms are included because our four (320, 326, 329, 330) all contained debris of occupation intentionally carried in to cover the bodies. Of 628 potsherds among household trash covering the 10 burials in Room 320, 46.1 percent were Old Bonitian and 25.0 percent Late Bonitian, while of 622 like fragments among additional debris above the second-floor level the percentages were 41.6 and 30.8, respectively. Clearly both Old Bonitian and Late Bonitian families dwelt hereabout and had contributed proportionally to the earlier as well as the later part of the room fill.

Intramural trash heaps, each marking an abandoned room, suggest either a shifting of families within the pueblo or a gradual reduction of population. A decrease in population could have been brought about by an epidemic, by failure of the water supply, or by any one of various lesser causes. The most likely, however, and one for which we have supporting evidence, is annual reduction in the amount of arable land. A dwindling food supply spurs discontent; famine has repeatedly impelled Pueblo migrations within historic times. Families uprooted and forced from their homes by dissension would leave most of their possessions behind, as at Oraibi in 1906. Thus, voluntary departure of their occupants seems a plausible explanation for the emptiness of Late Bonitian dwellings. Presence of Late Bonitian utensils in Old Bonitian houses evidences contemporaneity.

Room 28 is a case in point but with complicating factors. Here Pepper uncovered an astonishing hoard of earthenware vessels and other objects. According to Hyde's tables (Pepper, 1920, pp. 359-372), the specimens from this one room included 111 cylindrical vases, 39 bowls, 24 pitchers, 2 effigy vessels, 75 stone jar covers, and various other items. Some of them had been burned or blackened by fire. Several coiled baskets and 33 earthenware vessels bearing either Old Bonitian or Late Bonitian designs, lay in the northeast corner at the level of, and actually on, the sill of the door connecting with Room 51a. About 7 feet to the west, 110 cylindrical vases, 18 pitchers, and 8 bowls had been piled in five layers on "an area of 20 square feet" (ibid., pp. 119-120). There can be no question that this remarkable assemblage had been intentionally placed where Pepper found it.

Only Late Bonitian pottery types, in form and decoration, are discernible in his illustrations.

As he describes excavation of the room, Pepper enumerates many objects not listed by Hyde; he repeatedly mentions both shell and turquoise ornaments; 400 shell beads were "associated directly with the pottery vessels." (Ibid., p. 125.)

Pepper's published field notes are not always easy to follow, but careful study of them makes it clear that Rooms 28 and 28a originally formed a single ground-floor Old Bonitian dwelling about 40 feet long. An introduced partition later divided this long chamber. Room 28 extends from the partition westward beneath Rooms 55 and 57. These latter are 2-story Late Bonitian structures whose east walls rest upon logs inserted at ceiling level of the old room below. The concave north side of that old room was straightened by the Late Bonitians, but they left the convex south side undisturbed to serve as foundation for a new wall they built to enclose a second-story chamber over the east half of Room 28 and all of 28a. This second-story chamber, on a level with the first stories of Rooms 55 and 57, we shall henceforth refer to as 28B.

Pepper's description of Rooms 28 and 28a leaves no doubt that they were originally constructed of first-type, or Old Bonitian, stonework. But his figure 44 (1920, p. 116) and his previously unpublished prints 103, 104, and 120 (herein pls. 6, upper and lower; 7, lower), together with our own notes, show that the substitute north wall of Room 28, westward to its junction with the outer southeast corner of Old Bonitian Room 33, is constructed of laminate sandstone, chinked with thin little tablets in the manner of our second-type masonry; that the west and north walls of 28B, including continuation of the latter to Room 58 (the second story of Room 33), are of second-type stonework in which dressed blocks of friable sandstone predominate.

Bonitian architecture is often bewildering. I give it thought in this place only because I believe architecture helps explain the cultural complexity in Room 28 and adjacent structures. My deductions are drawn almost entirely from Pepper's notes and photographs, since our own efforts hereabout were directed toward leveling piles of previously turned earth and stone the better to control surface drainage. In the course of this undertaking we laid bare as many second-story walls as seemed wise and made a few observations upon them.

If I interpret Pepper correctly, Room 28 was a 1-story Old Bonitian house that the Late Bonitians altered without wholly dispossessing its owners. The newcomers corrected the asymmetry of its north wall just to provide a straighter foundation for the dwelling they

wished to construct above. This latter, 28B, we know to have been one of a series of early (second-type masonry) Late Bonitian houses that overlay Old Bonitian rooms west and south as far as Room 327. The original ceiling beams in Room 28 were replaced by pine logs whose north ends were socketed 2 or 3 inches in the old walls. Supporting posts, if not provided at the time, were inserted later. During these alterations constructional debris was allowed to lie where it fell; upon this accumulation, with sand carried in for the purpose, a new surface was created at, or just below, the sill level of the doors into Rooms 32, 51, and 51a.

The partition separating 28 and 28a, if not built while these changes were under way, was introduced shortly after. Pepper's figure 44, illustrating pottery in the northeast corner of Room 28, shows that the mud with which the partition was coated had been pressed against the previously plastered north wall. Here the partition was "about a foot thick and four feet high" (ibid., p. 117). Described from Room 28a, this same partition was 6 feet high and supported by a 2½-foot foundation of large stones which, in turn, rested upon the original floor, 8½ feet below the ceiling (ibid., p. 126). In other words, approximately 4½ feet of constructional debris and sand was already present in the northeast corner of Room 28 when that pottery was left at the door into Room 51a. With only a 4-foot headway remaining, Room 28 obviously had little use thereafter except storage. On a 4- by 5-foot space in the middle of its floor, 136 vases, bowls, and pitchers were carefully piled. Miscellaneous stone slabs, tools, and other possessions were carried in from time to time and left about the room. Meanwhile sand drifted in with every windstorm until it half covered the piled pottery, the tools, and utensils.

Some time later 28B and the room or rooms immediately west of it were partially destroyed by fire. Their floor timbers and supporting posts were burned, or partly burned; walls were reddened and the blown sand "vitrified and formed into a slag" (ibid., p. 125).

Reconstruction soon followed, in 1083 or thereafter.[2] The burned walls were razed; charred timbers, discarded building stones, and mud mortar were dumped into the storeroom below. By this time, however, a third variety of stonework was in vogue among the Late Bonitians; the substitute walls they built on the south side of Rooms 28B, 55, and 57, and between the latter two, were not of second-type, but of fourth-type masonry—the kind utilized in the latest addition to the east and southeast quarter of the pueblo. The west walls of

[2] At least one ceiling beam in Room 57 was felled in A.D. 1071; a horizontal supporting log built into the wall between 55 and 57 was cut in 1083.

28B and 57 survived the conflagration in large part, for they stand today as examples of second-type masonry with fourth-type repairs. The beams and "cedarbark floor covering" mentioned by Pepper (ibid., p. 216) in Room 55 are relics of this second reconstruction.[3]

Now when and why were 136 bowls, pitchers, and cylindrical vases piled in the middle of Room 28? An answer to the first question, at least, may be deduced from Pepper's notes. Describing Rooms 55 and 57, he remarks that their east and west wall "foundations" were "simply the debris of the burnt-out portions of the rooms" (ibid., pp. 216, 219). Below the cedarbark-and-adobe floor of 55, which had been crushed down "about 4 feet" (thus evidencing an open space beneath), the "excavations were carried to a depth of over 4 feet . . . but nothing but clean sand was discovered." Over 4 feet of clean sand plus 4 feet of open space above thus approximate the 8½-foot ceiling height reported for Room 28a.

Again, in Room 28, Pepper observed (ibid., p. 117) that "the lower portion . . . was filled with sand that had drifted and washed in before the ceiling fell" and (p. 120) that most of the vessels stacked on the middle floor "were imbedded in the debris that formed the foundation of the western wall." Now his print No. 103, first published herein (pl. 6, lower), identifies this "western wall" as that at the west end of Room 28B, which was built upon a beam bridging the Old Bonitian room below. The debris of reconstruction, which Pepper recognized as such but carelessly misnamed, actually flowed down from beam height into direct contact with the stored pottery. Because most of the tabular stones visible in that debris slope down and away from Room 55 it seems clear this waste was poured through a hole in the floor on the east side of 55. Beyond this dump, in the west third of Room 28, the quantity of waste was much less, for it did not prevent the rebuilt floors of Rooms 55 and 57 from sagging 4 feet when they, in turn, were later broken by collapse of upper walls. Striated sand against the west wall of 28B proves that the second-story floor here, as in Rooms 55 and 57, remained in place for some time after abandonment.

After he had laid bare all the artifacts in Room 28, Pepper photographed them from various angles. One of the most illuminating views is that taken from directly above and reproduced as his figure 42 (ibid., p. 114). If the reader will hold this reproduction in reverse, thus to orient it with the room, he will recognize in the upper right corner some of the vessels shown (fig. 44, p. 116) at sill level of the

[3] The Hyde Expeditions' unpublished print No. 208 shows the remains of a like floor in Room 57.

Room 51a door. To the left of these, ranged along the base of the north wall, are fragments of a stone tablet, two large stones, one upon the other, a beam-supporting post with charred top (seen more clearly in print 103), and then a jumble of stone implements apparently unearthed elsewhere in the room and temporarily stacked here. Lastly, in the upper left corner of the photograph, one notes a bulging section of masonry. That bulge marks a sealed door to Room 32.

Pepper first mentions this sealed door while reporting the excavation of 32, a burial room. The one body interred here lay about 6 inches above doorsill level, or approximately 18 inches above the floor. A foot and a half of wind- and water-borne sand had collected before the body was brought in. That the room continued in use while this sand was accumulating is evidenced by earthenware vessels and other objects left at various distances above the floor.

Pepper's four burial rooms, 32, 33, 53, and 56, opened one into the other, yet their only known connection with the outside was the door from 32 into 28. Presumably each of the bodies interred in the three inner chambers had been dragged through this same door. The Room 32 burial, therefore, must have been last of the series, for it was left 6 inches above sill level; a number of grave offerings, including two Mesa Verde mugs, a typical San Juan kiva jar, and a bowl (ibid., p. 124, figs. 47a, c, 48b; p. 132, fig. 49) were pushed in after and the door was sealed. Since our stratigraphic tests prove that Mesa Verde pottery reached Pueblo Bonito quite late, it is obvious the Old Bonitians remained long in occupancy of their section of the village. They remained there long enough to augment their own characteristic tableware with vessels produced at various times by the Late Bonitians: long enough to welcome, during the final years of Pueblo Bonito, a few immigrant families from the Mesa Verde country.

However, the door to Room 32 must have been sealed before Room 28B was rebuilt with fourth-type masonry, since debris of reconstruction dumped in at that time not only covered the pottery piled on the floor of 28 but banked up against the north wall. Had the door then been open, this waste would have flowed through and into 32.

But even though the western part of Room 28 was isolated by a pile of debris rising ceiling high, a corridor at the east end remained open and in use. Witness, in the northeast corner, an assemblage of 33 pieces of pottery and two or three coiled baskets at sill level of the open door to Room 51a but under "a heap of sand 3 feet high and $3\frac{1}{2}$ feet in width" (ibid., pp. 117-119). Sand so compressed suggests a

wall paralleling the partition, but one sees no trace of it in note or photograph.

Open doors connected Rooms 28 and 51a, 51a and 39b, 39b and 37, 37 and 4. But the only means of access to the series, other than the ceiling hatchway in 39b, was my assumed corridor at the east end of Room 28 and a door cut through the south wall of the latter directly opposite the entrance to 51a. Pepper does not mention this south door, but it may be seen behind the shovel handle in the lower left corner of his print 103 (herein pl. 6, lower) and in the same relative position on print 104 (herein pl. 6, upper), beneath a rubbish-filled door. This latter is the westernmost of the two blocked, T-shaped doors in the south wall of 28B. By a flight of stone steps this south door gave access to the terrace overlooking Kivas Q and R; its exit, at floor level of Room 28B, is Pepper's "bin" in nonexistent Room 40.

That the entire east end of 28 remained open for a long while after the pile of constructional waste was dumped in from Room 55 is further indicated by the quantity of blown sand that had gradually accumulated in and below the stepped doorway in the southeast corner. Pepper's print No. 115 (herein pl. 7, upper) shows the broken west jamb of that doorway and the imprint of a decayed post directly above a pitcher and a cylindrical vase. This latter stands on approximately 8 inches of stratified sand, the strata slanting down to the right toward the little 4-handled bowl, No. 145. Pepper mentions (ibid., p. 118) "a cache of stone jar covers" between the bowl and the other two pieces; from his unpublished print No. 105 I judge the covers to be on the same level as the store of 136 vessels and the little bowl to be perhaps a couple of inches higher.[4]

Thus, from Pepper's data I conclude that Room 28, a one-time Old Bonitian house, became a storeroom when the Late Bonitians erected one of their dwellings above it. This Late Bonitian dwelling, Room 28B, was occupied throughout the period of maximum expansion and architectural change elsewhere in the village. Sometime during this period, and most likely during the second or third quarter of the eleventh century, 136 earthenware vessels, apparently all of Late Bonitian manufacture, were piled on 20 square feet in the middle of Room 28. Whether they were placed there by the Late Bonitian occupants of 28B or by Old Bonitian owners of adjacent structures is a question I cannot answer. Neither can I guess the motive for

[4] I am pleased to acknowledge my obligation to Dr. Harry L. Shapiro, chairman of the department of anthropology, American Museum of Natural History, for prints 105, 115, and others, received in mid-June 1950, as this chapter was being written.

the assemblage or why the vessels were stacked in five layers instead of being arranged in rows against the wall. They were piled on an indefinite surface formed by sand carried in to conceal constructional debris covering the original floor. When fire later gutted Rooms 28B, 55, and 57, the pottery stored below, undamaged by the conflagration, was abandoned where it lay. A sacrificial offering of shell beads was scattered over the pile, and then debris of reconstruction was dumped in upon it. The burned dwellings were rebuilt, in 1083 or later, and life went on as before. Reoccupancy of these second-story rooms and those adjoining is established by Pepper's finds in them, finds that include cylindrical vases and other varieties of Late Bonitian pottery.

Just as windblown sand had found a way into Room 28, so, too, sand had collected in other ground-floor rooms throughout the pueblo. In the eastern section, for example, we repeatedly noted 1 to 18 inches of clean sand on the floors of Late Bonitian houses with fallen masonry on top. This fact suggests that the rooms had stood empty for a time prior to collapse of their upper walls. Contrary evidence comes from Old Bonitian dwellings.

In Old Bonitian houses sand gathered while the rooms were still inhabited; blown sand was frequently overlain by occupational debris. Sand had collected in Room 325 to an average depth of 16 inches before nearby residents began to use the place as a convenient dump for floor sweepings and kitchen refuse. Room 323, next on the north, became a dumping place also, and so too did 328. This latter, a smallish structure built in front of 325, was filled almost ceiling high with blown sand and household rubbish. Some of these rooms remained open and accessible for a time, but the sand deepening in them year after year eventually invited burials when circumstances barred access to the accustomed places of interment.

It was probably compelling necessity rather than family preference that first dictated use of storeroom 320 for burial purposes. The room was free of blown sand at the time, for most of the skeletons we found there lay directly upon the flagstones. Altogether, 68 individuals were buried in the four adjoining rooms, 320, 326, 329, and 330. These four are situated at the extreme southwestern end of the old, original settlement; solid walls separate them from Late Bonitian houses abutting on the west and south. Of the 24 bodies in Room 329, two rested upon the floor and the others in an overlying 14 inches of sand mixed with debris of occupation. Old Bonitian graves were shallow, hastily dug, and hastily refilled.

These several factors—Late Bonitian houses stripped of their

furnishings and vacated; Old Bonitian families crowded together in their corner of the village; abandoned utensils and ceremonial equipment; eight Old Bonitian rooms transformed into sepulchers for a hundred dead that could not be buried outside the walled town—appear ample reason for believing that the population of Pueblo Bonito was first halved by migration of Late Bonitian clans and then further reduced through piecemeal separations prompted by impoverished farmlands or enemy attacks or both.

That the inhabitants of Pueblo Bonito were plagued by marauding bands over a long period is proved by the successive measures they took to strengthen their defenses. The original settlement had no door in its convex, or cliffward, wall. When the Late Bonitians built an abutting tier against that wall they provided each room, even those in the second and third stories, with external doorways. But these were soon closed, and permanently. In each subsequent major building program the Late Bonitians deliberately strove to increase the impregnability of the pueblo. They never again placed a door in the outer, rear wall; eventually they closed, or partially closed, all ventilators in that wall and they barred the only gateway to the village.

The lone town gate, that at the southeast corner of the West Court, was provided when the Late Bonitians were pressing their second expansion program. Shortly thereafter they built a transverse wall across the passage but left an ordinary door through the middle. When this small opening was subsequently blocked with masonry, Pueblo Bonito was as unassailable as its occupants could make it. From that time forward there was no gate, no open door, anywhere in the outside wall of the town. From that day every man going out to work in his field, every woman seeking water or fuel, went and returned by ladders that led up to and across the rooftops of 1-story houses enclosing the two courts on the south.

CULTURAL RELATIONSHIPS

Now who were these people—the Old Bonitians and the Late Bonitians? Where did they come from, and where did they go? Our data point to certain possibilities but without conviction. The Old Bonitians may have descended from earlier Chaco Canyon settlers, but it is more likely they were immigrants from beyond the San Juan River. They were the founders of Pueblo Bonito as we now know it, although the same site had been previously occupied by Pueblo I families. We discovered the slab-lined floor of a typical Pueblo I pit house out in front of Old Bonito and under 12 feet of Old Bonitian rubbish, and other pit houses probably lie at the same deep level.

Archeologists have learned that Pueblo I pit houses usually were succeeded by above-ground structures having jacal, or post-and-mud, walls. Although this type of construction is present in Old Bonito it occurs infrequently. Hence I find it easier to believe the Old Bonitians had moved in from the north as a body and employed their newly acquired knowledge of masonry in constructing their Chaco Canyon home.

Old Bonito, separated from later accretions, consists of a double row of rectangular rooms, grouped crescentically and facing southeast (fig. 2). Close within the crescent and below its foundations were several circular, ceremonial chambers or kivas. We exposed sections of three but did not venture more for fear of endangering the buildings that had supplanted them. The whole assemblage—an arc of dwellings with adjoining storerooms at the rear; sunken, ceremonial rooms in front, and the village dump beyond—parallels Late Basket Maker and Early Pueblo settlements north of the Rio San Juan.

Roberts (1930), Martin (1938, 1939), Morris (1939), and Brew (1946) have reported upon a number of these B.M. III and P. I villages. They have shown that living quarters evolved from deep, earth-walled pits to dwellings having floors only 6 to 18 inches below the surface and upper walls of mud supported by posts; thereafter, to rectangular rooms joined end to end and curving about the north or west side of a depression. Some of these later above-ground structures were provided with fireplaces; each was accompanied by one or two storerooms in a second tier immediately behind the first—precisely the arrangement we have already noted in Old Bonito. Sandstone slabs on end as a sort of baseboard and rocks used as fillers in post-and-mud walls are features repeatedly noted in P. I rectangular dwellings and, as one might expect, they are to be seen here and there in Old Bonito.

These and other outmoded constructional practices will be considered at greater length in our study of the architecture of Pueblo Bonito. For the present I wish merely to record my belief that such survivals, especially the traditional grouping of dwellings, storerooms, kivas, and trash piles, all point to southwestern Colorado as the most likely place of origin for the culture that brought Old Bonito into being. It is there, also, north of the San Juan, that one finds the prototype of the "great kiva" in its earliest recognizable manifestation, and the great kiva is undeniably one of the distinguishing elements in what has come to be called "The Chaco culture." From southwestern Colorado southward through Aztec and Chaco Canyon to the

Zuñi Mountains, the obvious importance of the great kiva in the religious life of the community increases directly with distance.

Table and kitchen ware may be as informative as architecture, or more so. Part of the earthenware we recovered at Pueblo Bonito had been imported, but the bulk of it was produced locally and by the Old Bonitians. The same shapes and ornamentation are represented by fragments from the Old Bonitian dump under the West Court. We named this preponderant ware "Transitional" because in 1925, at the time our sherd analysis was made, it seemed to us a sort of transition from what we would now call Pueblo I to Pueblo II pottery.

Every archeologist acquainted with the San Juan country is familiar with our Transitional ware although perhaps under another name. It is a widely distributed variety, rock- or sherd-tempered, grayish white in color, slipped, polished, and ornamented with black mineral paint.

The dominant pottery at Lowry Ruin, northwest of the Mesa Verde, is called "Mancos black-on-white" by Martin (1936, p. 94). It is to him evidence of a northward flow of Chaco culture from "the area between Gallup and Shiprock" (ibid., p. 111). Martin's description and illustrations show that some of his Mancos black-on-white is indistinguishable from Old Bonito "Transitional." Brew (1946) illustrates Mancos black-on-white designs from P. II sites on Alkali Ridge, southeastern Utah, and Morris (1939) finds the same decorative elements on P. II pottery from the La Plata district, southwestern Colorado. While bowl rims were rarely, if ever, blackened at Alkali Ridge P. II sites or at Lowry Ruin, Morris finds approximately half of those from La Plata P. II sites so treated. At Old Bonito the black rim line is a constant feature.

Typical Old Bonitian designs are to be seen on vessels and sherds from Chaco Canyon small-house sites identified as P. II by University of New Mexico archeologists (Brand et al., 1937; Dutton, 1938; Kluckhohn et al., 1939), but other fragments from the same ruins I should call P. I or P. III. During the 1925 season we made a partial survey of small-house remains in the Chaco district and are confident some of them were built before, some after, Pueblo Bonito.

Fragments of two charred poles from a Pueblo I pit house that we examined in 1922 were subsequently dated A.D. 777 and 777 ± 10 (Douglass, 1935, p. 51). Gladwin (1945, p. 43) lists several other P. I structures the tree-ring dates of which range from 785 to 867. He includes Morris's Site 33, in southwestern Colorado, with its great kiva dated A.D. $831 \pm$. Pottery, rather than architecture, bridges the half century between our Chaco pit house and Site 33.

Morris (1939, p. 85) places the principal occupancy of Site 33 in Pueblo I times but recognizes the possibility of initial settlement during the preceding period. Buildings I, II, and III were aggregations of post-and-mud rooms arranged crescentically with dwellings in front, storerooms at the rear. Roberts (1930, 1939), Martin (1939), and Brew (1946) describe similar structures, similarly grouped. The arrangement, but not the construction, is what we have noted in the old, original part of Pueblo Bonito.

The builders of Old Bonito had advanced beyond the post-and-mud stage of P. I civilization. They built almost exclusively with masonry. Their dwellings were rectangular, standing end to end in a wide crescent, storerooms behind. Their kivas were deep, with flaring walls, an encircling bench, and low pilasters. From the architectural point of view, we can only recognize the Old Bonitians as a P. II people.

The stonework of Old Bonito is one of its distinctive features. There is nothing like it elsewhere in the Chaco country, so far as I could ascertain, except in a number of ground-floor rooms at Peñasco Blanco. One must go north of the San Juan to find its counterpart.

Morris's (1939, p. 34) description of Pueblo II masonry on the La Plata, wherein the individual blocks of stone were reduced to size by "spalling back the edges much as a flint blade would be chipped to shape," accurately mirrors Old Bonitian stonework. If anything is lacking it is the external mosaic of sandstone chips employed at Old Bonito as protection against wind and rain. Here, too, the outside walls customarily sloped to a floor-level thickness twice that at ceiling height—a constructional practice that possibly reflects the batter of P. I house walls. Thus Old Bonitian architecture seems to be a blend of La Plata P. I and P. II, with certain features retained even from B.M. III times.

Late Bonitian masonry likewise appears to be of northern inspiration. It is dominant in both quality and quantity and completely overshadows that of the Old Bonitians. It includes three successive varieties, each characterized by a core of mud and broken rock faced with carefully chosen and prepared building stones. Late Bonitian dwellings are noteworthy not only for the quality of their masonry but also for an almost measured regularity, neatly squared corners, and ceiling timbers selected with discrimination, cut, and peeled while green. The Late Bonitians unhesitatingly razed living rooms to provide space for kivas within the house mass.

All these features are to be seen in ruins of southeastern Utah and southwestern Colorado. Even though allowance be made for the

superior workability of Chaco Canyon sandstone, a Chaco-like quality is apparent at many sites throughout that area. This assertion is based partly upon personal recollections gained during an apprenticeship there in 1907 and 1908 and, in larger measure, upon the more seasoned opinions of other investigators.

Jeancon (1922, p. 31) noted resemblances to Chaco masonry and room arrangement while excavating a large pueblo on the Piedra Parada, or Chimney Rock Mesa, near Pagosa Springs, Colo., in 1921. A year later Roberts (1922) not only confirmed Jeacon's observation but also remarked a striking similarity between Chimney Rock pottery and that from Chaco ruins. He added: "The Piedra Parada ware appears to be of an earlier development, however," the first recorded suggestion, so far as the present writer knows, that the beginnings of Chaco culture might lie north of the San Juan. Kidder (1924, p. 68) likewise remarked the apparent relationship between pottery from certain ruins north of the San Juan and that from small-house sites in Chaco Canyon.

At Lowry Ruin, where he obtained tree-ring dates between A.D. 1086 and 1106, Martin (1936, p. 204) recognized both Chaco masonry and Chaco pottery. Building I, at Site 39 on the La Plata, is described by Morris (1939, p. 53) as a compact, Chaco-type structure erected upon the remains of a P. II house. Among debris of occupation in Building I, Morris noted pottery fragments comparable to Chaco-like sherds he had recovered from lower levels in the West Pueblo at Aztec. Other examples could be cited but these few will serve to indicate the existence of a strong cultural bond between some of the Early Pueblo III communities north of the San Juan and their contemporaries to the south. Another tie is the "great kiva."

As illustrated at Aztec Ruin, Pueblo Bonito, Chettro Kettle, Casa Rinconada, and elsewhere, the great kiva is an important diagnostic of Chaco culture at its height. Its beginnings, however, lie in the humble surroundings of B.M. III and P. I villages whose inhabitants dwelt in pits or, at best, in post-and-adobe surface structures. The two at Martin's Site 1 in the Ackmen-Lowry area, southwestern Colorado (Martin, 1939), that at Morris's P. I Site 33 on the La Plata (Morris, 1939), and the one at Roberts's B.M. III village, Shabik'eshchee, in Chaco Canyon (Roberts, 1929), are indubitably precursors of the P. III examples mentioned above. Although that at Shabik'eshchee lacks the wall and bench masonry of Martin's two, it is so similar in other respects there can be no question that it served a like purpose. The great kiva so conspicuous at Pueblo Bonito was of late construction, since we found Mesa Verde and Little Colorado River potsherds beneath its floor.

Thus the great kiva, both early and late, and its associated domestic architecture and ceramics, seem to me to be products of Anasazi cultures evolved among the canyons and mesas along the lower Utah-Colorado border and carried thence south and east by migrant groups. In their search for more fertile fields, or greater security, some of these groups obviously traveled farther than others; some bypassed Chaco Canyon altogether. The evidence before us does not suggest a common point of departure for all these migrant peoples or simultaneous emigration. Pueblo I-III remains, differing in no appreciable degree from their kind in Chaco Canyon, are to be seen many miles to the south.

In the autumn of 1921 Pete Havens and I had visited a number of lesser ruins in the vicinity of Gallup, source of many fine examples of Chaco-like pottery in local collections. Both early and late vessels were represented. We also observed Chaco-like masonry at several sites, including three in a nameless canyon extending southeast from Manuelito. Here, occupying a south promontory, was a conspicuous ruin with two rows of second-story loopholes commanding the landward approach. Near another late P. III ruin, similarly situated, we found a great kiva noteworthy both for its size and the quality of its stonework. Although we never returned for a second, unhurried examination, it is still my impression those ruins evidence a late, perhaps even a post-Bonito, shift of clans from the Chaco country. On the trash pile of another ruin a few miles farther south and east I gathered an assortment of potsherds that includes both San Juan and Tularosa black-on-white, Little Colorado polychrome, and ancestral Zuñi (U.S.N.M. No. 317192).[5]

It was in this same general area, between the Rio Puerco of the West and headwaters of the Zuñi River, that Roberts carried to completion three brilliant studies in sequential Pueblo history. Through architecture and ceramics he traced the degree of civilization represented at Kiatuthlanna (1931), at the Village of the Great Kivas (1932), and in the Whitewater district (1939, 1940) back to earlier stages of development in the Chaco and beyond. His conclusions are thus diametrically opposed to those of Gladwin (1945) and Martin (1936, 1939), who see the Chaco culture spreading in the opposite direction, from south to north.

Beginning with what he calls "the White Mound Phase," approximately A.D. 750 to 800, Gladwin (1945) pursues Chaco-like elements through his Kiatuthlanna, Red Mesa, Wingate, and Hosta Butte

[5] United States National Museum catalog numbers given in parentheses refer to specimens not herein illustrated.

Phases to Chaco Canyon itself. He describes the Hosta Butte Phase as a period of small P. III settlements, each of from 20 to 30 rooms, constructed and occupied between A.D. 1010 and 1080. The "Bonito Phase" followed. He groups in the Hosta Butte Phase half a hundred small-house sites along the south side of Chaco Canyon, several of which we identified in 1925, on the basis of surface sherd collections, as either earlier than Pueblo Bonito, or later. Black-on-white vessels classed as Red Mesa and Wingate have their counterparts in our Transitional ware. But more of these controversial subjects, pottery and architecture, in the several reports to follow!

Gladwin believes the Chaco culture died out in Chaco Canyon. He knows of no Classic Chaco site later than 1130, which is our latest Pueblo Bonito date, and neither do I. Apparently the unity of purpose that built the Chaco towns and perfected the way of life practiced therein was not transferable. It did not take root with equal vigor elsewhere. But the evidence available at this writing suggests to me a dissociation and dispersal rather than stagnation and decay. Our data indicate that the two peoples who dwelt in Pueblo Bonito, having surpassed their contemporaries in communal achievement, had abruptly terminated their compact and separated. The Old Bonitians were content to remain in their ancestral home but the Late Bonitians moved on, presumably seeking fields where erosion was not a problem.

Chaco-like qualities in ruins north of the San Juan suggest to me a common heritage rather than influence from Chaco Canyon. Toward the south, however, the opposite is true. A Chaco influence that predominated from Pueblo I to Pueblo III times is undeniable at the scene of Roberts's Whitewater study; late contacts from the same source are evident also at his Village of the Great Kivas (Roberts, 1932). Reports have it that there is a small Classic Chaco ruin on the Navaho reservation about 7 miles west of San Mateo and others farther north, along the Continental Divide.

Constructional features in the two circular pre-Zuñi kivas that Hodge (1923, p. 34) excavated near Hawikuh are unquestionably of late Chaco origin. Superior masonry underlying Ketchipauan, one of Coronado's Seven Cities of Cibola, is thought to represent the same period as the two kivas. The older portion of Zuñi has always seemed to me, in some indefinable way, a reflection of Pueblo Bonito, and if I were to seek the lost trail of the Late Bonitians I should turn first of all to the Zuñi Mountains and their surroundings.

Our seven summers of field work in Chaco Canyon left many questions unanswered and many riddles unsolved. If descendants of the Late Bonitians survive in present-day pueblos, the fact has not been

made known. We found no Pueblo myths that lead positively and exclusively to Chaco Canyon. Roberts (1931, p. 8) relates a Zuñi myth in which the Winter People, in their search for The Middle, traveled north to Chaco Canyon and Aztec, thence east to the Chama River, down the Rio Grande, and finally reached their goal in Zuñi Valley—a myth at variance with archeological fact. So-called traditions of the Navaho that purport to prove contact with the Bonitians are, I am almost convinced, chiefly tales told by old men around winter fires. I heard several such, no two alike, but hesitate to denounce them all as without foundation. Whenever I am tempted to do so I recall the fragments of pointed-bottom cook pots we found in Late Bonitian rubbish—pots that, in all probability, were made in the Gallina country, ancestral home of the Navaho.

Analysis of our data shows that Pueblo Bonito is the product of two distinct peoples. These I have called the "Old Bonitians" and the "Late Bonitians" because the names by which they knew each other have been lost. The Old Bonitians were the real founders of the community; the Late Bonitians, eleventh-century immigrants. The two peoples were co-occupants for a hundred years or more, and yet the houses they built and lived in, the tools they made and used, differ so much that physical, linguistic, and mental differences between the two may be presumed. The Late Bonitians were aggressive; they usurped leadership of the village immediately upon arrival. In contrast, the Old Bonitians were ultraconservative; they clung tenaciously to their old ways, their old habits and customs. The Late Bonitians created the Classic Chaco culture, most advanced in all the Southwest. The Old Bonitians, dwelling next door, lagged a century behind. They were intellectually dormant. They were a Pueblo II people living in Pueblo III times!

PARTIAL LIST OF TRAIT COMPARISONS

(Based solely on findings of the National Geographic Society)

Item	Old Bonitian	Late Bonitian
Masonry	Spalled slabs, wall width	Veneered rubble
Ceilings	Cottonwood and pinyon beams, chico brush and adobe	Pine beams and poles, willows or juniper shakes, cedarbark and adobe
Doors	Somewhat oval; rounded jambs and corners; high sill	Rectangular; secondary jambs and lintels frequent; low sill
T-shaped doors	2	30
Clothes racks	None	7

Continued



PLATE 6

Upper: Cylindrical vases and pitchers piled in middle of Room 28 and, above them, west wall of Room 28B. In foreground, rounded top of partition between Rooms 28 and 28a. At lower left, door with steps to court level; at right, open door to Room 51a.

Lower: Debris of reconstruction under Room 55 buried the pottery piled in Room 28. At right, above left edge of post, the right jamb of blocked door to Room 32.

(Hyde Expedition photographs by George H. Pepper, courtesy of B. T. B. Hyde.)





PLATE 7

Upper: Late Bonitian vessels on drifted sand, southeast corner of Room 28. (Hyde Expedition photograph by George H. Pepper, courtesy of American Museum of Natural History.)

Lower: With its blocking removed, the door connecting Rooms 28 and 32 reveals the later north wall of Room 28 (foreground) built against the original Old Bonitian masonry; beyond, two Mesa Verde mugs in Room 32. (Hyde Expedition photograph by George H. Pepper, courtesy of B. T. B. Hyde.)

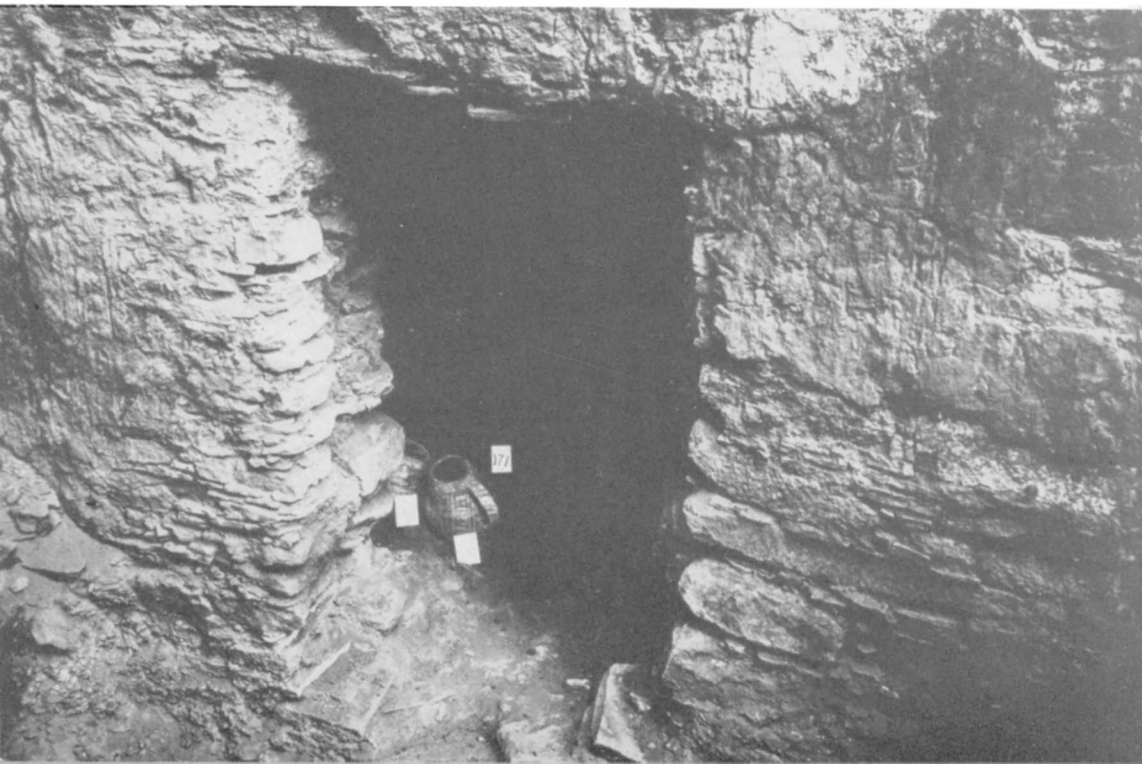




PLATE 8

Upper: A Zuñi looks through the south door of Room 299B, whose secondary jambs and lintel once supported a sandstone door slab. (Photograph by Neil M. Judd, 1923.)

Lower: An elevated doorway in the Hopi pueblo of Mishongnovi. (Photograph by O. C. Havens, 1924.)



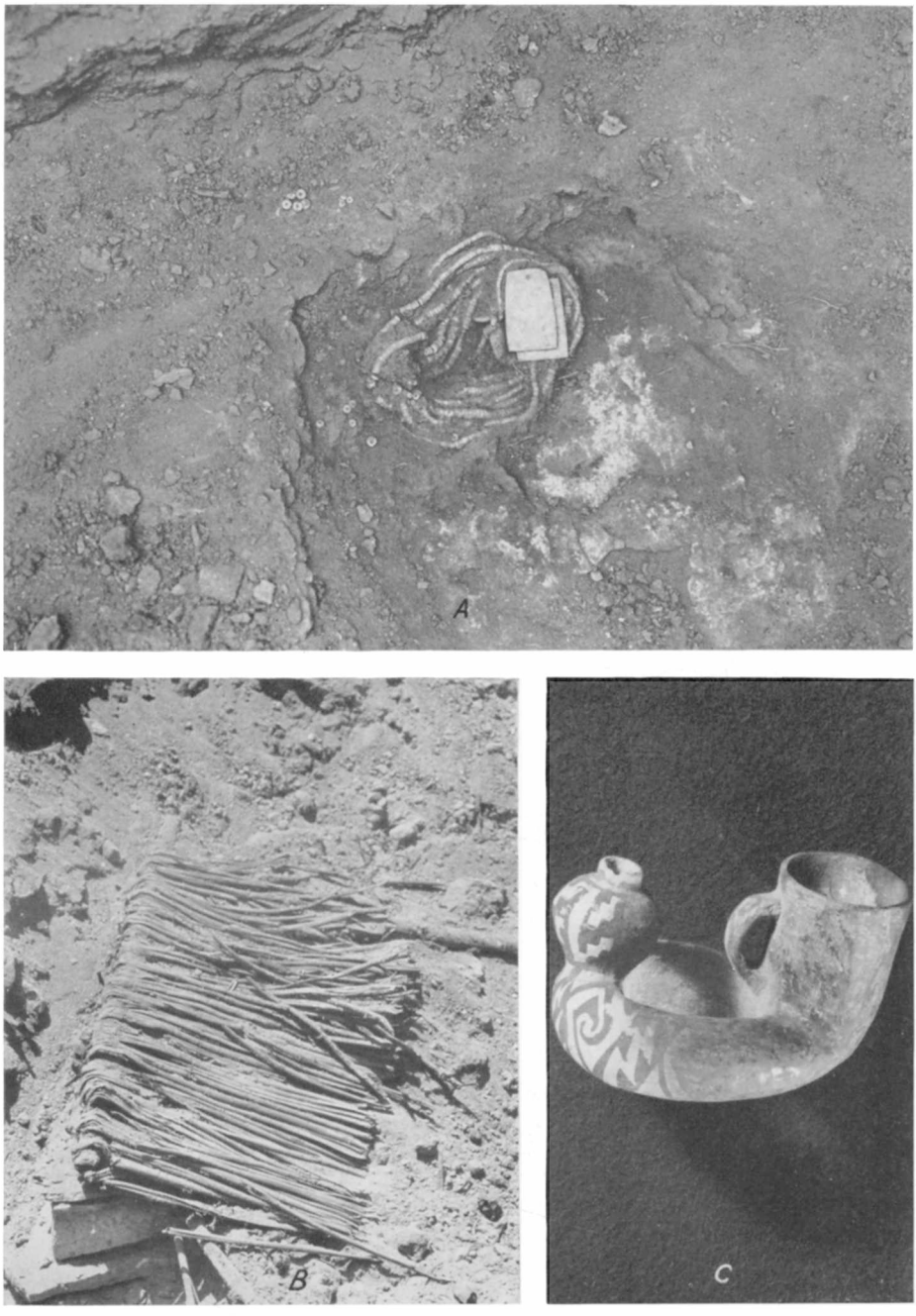


PLATE 9.—*A*, Turquoise necklace and ear bobs in situ, Room 320. (Photograph by O. C. Havens, 1924.) *B*, Remains of a presumed cradle. (Photograph by Neil M. Judd, 1921.) *C*, A "ring-bottomed" vessel from Room 249. (Photograph by B. Anthony Stewart.)

PARTIAL LIST OF TRAIT COMPARISONS—*concluded*

Item	Old Bonitian	Late Bonitian
Pole shelves	4	12
Wall pegs	2	16
Wall pockets or cupboards	12	103
Fixed work slabs	None	6
Storage pits and bins	13	20
Beads: olivella	Spire removed	One or both ends removed
"saucer-shaped"	None	Few
stone	About 90 percent	About 10 percent
figure-8	Few	About 90 percent
Chama, etc.	Few	Common
Tubular bone "beads"	6	37
Bone "pins"	None	32
Copper bells and fragments	2	17
Red claystone	10 lots	31 lots
Galena	3 lots	4 lots
Mica	None	7 lots
Hematite	4 lots	5 lots
Selenite and calcite	5 lots	30 lots
Azurite and malachite	13 lots	18 lots
Metates, troughed with open end	Thin, tabular, wide border; no metate bin	Thick, massive, rarely shaped; single or multiple bin
Sandstone saws	1	6
Deer humeri scrapers	5	15
Deer phalanx scrapers	1 (?)	12
Bone chisels	None	6
Cylindrical baskets	16	3
Tumplines	Twisted or braided yucca fiber, oval end loops	Woven band, triangular eyelets
Pottery: cook pots	Plain body, banded or coiled neck, direct rim; later, "exuberant" neck decoration	Over-all corrugated coil, flaring rim; geometric pinched decoration frequent
bowls	Hemispherical; direct, tapering rim; own designs	Same as Old Bonitian but own designs; later, some rim flattening
pitchers	Full body, rounded bottom, sloping shoulders; over-all or 2-zone decoration	Small body, often concave base, tall cylindrical neck; 2-zone decoration

Continued

PARTIAL LIST OF TRAIT COMPARISONS—*concluded*

Item	Old Bonitian	Late Bonitian
ladles	Half-gourd shape	Bowl-and-handle
storage jars	Tall, egg-shaped; high shoulders with occasional bulge; low neck	Squat to globular; higher neck; inset or down-raking handles
cylindrical vases	16, all with L.B. decoration in 4 burial rooms	1
Arrowheads: A type	25 percent	75 percent
B type	76 percent	24 percent
Earthenware pipes and fragments	1	9
Elliptical basket trays	4	None
Bifurcated baskets and fragments	5 in 2 burial rooms	None
Earthenware models of bifurcated baskets	2	3

II. SUBSISTENCE AND LIVING CONDITIONS

Like all other peoples, ancient and modern, the inhabitants of Pueblo Bonito faced the daily problems of food and shelter. They met the latter with homemade garments and stone houses; the problem of food, by growing what was needed. Maize, or Indian corn, constituted at least three-fourths of their fare, but this was supplemented by the fruits of other plants and by occasional game.[6]

That the Bonitians had fairly mastered the subsistence problem is evidenced by their architectural achievements and by lesser products of their industry. A group wholly absorbed in the quest for something to eat builds no permanent home and accumulates few possessions.

While Mindeleff (1891) was studying Pueblo architecture in the middle 1880's he witnessed the weakening of several old, deeply rooted customs. He saw ground-floor rooms, their solid masonry no longer needed for a defense, provided with outside doors and otherwise transformed from storage to dwelling purposes. He saw ventilators and portholes converted into windows and the windows fitted with glass. Furniture, as we use the word, was then practically unknown to the Hopi and Zuñi. Maize was their staff of life, and each day's supply was ground daily on milling stones resting upon the living-room floor. Food reserves were stored on shelves made of poles, in earthen jars buried to the rim, and in slab-sided bins. Weather permitting, the family cooking was done in the open air, out upon the rooftops.

When I first visited the Hopi towns, 35 years after Mindeleff, ground-floor rooms without exterior doors or windows were still to be seen; rabbit-fur blankets had not yet been wholly superseded by mail-order quilts; tables and chairs were still lacking in most homes, and white-enameled bedsteads, if present, were prized for their ornamental rather than slumberous properties. At night, sheepskins and Pendleton blankets were unrolled upon the floor; the family slept in groups, side by side, as had always been done. Domestic water was fetched in jars from springs at the foot of the mesa or ladled from surface pools where children splashed and dogs and donkeys drank.

A Pueblo village is a veritable swallow colony—a cluster of cells

[6] Hough (1930, p. 69) has estimated the ancient Pueblo diet as 85 percent cereal, 9 percent vegetal other than cereal, 5 percent animal, and 1 percent mineral.

occupied by individuals free to fly at will yet bound to the group by the stout bonds of instinct and family. Unlike the swallow's nest, however, a Pueblo home may shelter an unpredictable number. It may consist of one room or several.

LIVING CONDITIONS IN PUEBLO BONITO

Family life in Pueblo Bonito probably differed very little from that which Mindeleff saw among the western Pueblos in the final quarter of the nineteenth century. Descent was unquestionably matrilineal, as it still is; the mother, rather than the father, was head of the household. Married daughters, with their husbands and children, continued to live in the maternal home. All shared the same living quarters, the same hearth and kitchen utensils. Meals were eaten twice a day from food bowls placed directly upon the floor; fingers served in lieu of forks. Blankets and pelts were folded as seats by day and spread upon the floor at night. The living room was just that—a place in which to live, eat, sleep, work, and entertain visitors.

As a rule, Bonitian homes consisted of a general living room and one or more rooms for storage. These were on the same level and adjoining. Interior steps and hatchways suggest also some degree of vertical proprietorship, but we can only guess as to the extent of it. Because the upper floors had fallen, our observations were restricted largely to first-story rooms. A number of these, originally constructed and utilized as dwellings, had subsequently been vacated when additional rooms were built in front of or above them. By the time Pueblo Bonito reached its peak, owners of most ground-floor apartments had obviously moved to the better-lighted second, third, and fourth stories.

Old Bonitian homes look pretty casual when compared with those in the newer sections of town. Their ruder stonework was heavily plastered with mud; the mud was pitted with imprints of the plasterer's fingers and sometimes studded with sandstone chips. Interior walls were sometimes whitewashed; sandals and other designs were occasionally scratched upon them. Ceilings were seemingly constructed of whatever materials were nearest at the time. Cottonwood, juniper, and pinyon were most frequently utilized for beams. Resting directly upon these beams was a layer of brush, coarse grass, or cedar bark as support for the adobe floor of the room directly above.

In contrast, Late Bonitian houses are neater and more regular. They exhibit a superior skill in planning and execution. They disclose three successive types of masonry, each of a quality to awaken present-day admiration and each invariably hidden under a thin coat of plaster. By way of ornamentation, the dado was often whitened or

washed with a contrasting clay or set apart by a single white band. Sandal designs and other figures were sometimes chalked upon, or scratched into, the plaster. Ceilings consisted of carefully selected pine beams supporting layers of matched poles, peeled willows or juniper shakes, cedar bark, and adobe.

For whitewash the Late Bonitians used a soft, muddy-looking sandstone. We found several worked pieces during the course of our excavations, including one (U.S.N.M. No. 335637) that had been rubbed in a liquid. This fact suggested an experiment in which we learned that the sandstone in question readily disintegrates in water and produces a grayish pigment identical in all outward appearances with that employed by the ancients. At least one source of it is a clayey pocket on the south side of Chaco Canyon, on a ledge below Sinklezin ruin. Clearly this exposure had been worked in early times. We unearthed a quantity of the material in a room at Pueblo del Arroyo; Pepper (1920, p. 112) found a still larger store in Room 27, Pueblo Bonito.

Posts lashed together at intervals with willows, and the space between crowded with chunks of sandstone and mud, substituted for masonry walls in several Old Bonitian houses. A superior wattlework, one in which willows were bound horizontally to one side of the uprights and plastered over, was utilized in Late Bonitian Room 256 in order to keep a clear passage to storeroom 257, likewise divided by wattling.

Bonitian houses differed in other ways. The average capacity of 10 Late ground-floor rooms in the southeast quarter of the pueblo is 1,732 cubic feet; their average ceiling height, 7 feet 10 inches. An equal number of Old Bonitian dwellings averages 1,214.8 cubic feet and 6 feet 8 inches, respectively.

After describing walls and roof very little remains to be said of a Pueblo house. This was Mindeleff's conclusion (1891, p. 108) upon completion of his Hopi studies in 1890, but it applies with equal aptness to the houses of Pueblo Bonito, built 800 years before. Among these latter one notes an occasional fireplace, wall pocket and storage bin, seatings of former pole shelves and clothes racks, doors of one sort or another, and that is about all. These architectural accessories, so to speak, help us to an understanding of the conditions under which the Bonitians lived day after day.

Doors.—The almost complete lack of external ground-floor doorways is a noteworthy feature at Pueblo Bonito. There was none in the rear cliffward wall of the original pueblo. When the Late Bonitians arrived and constructed an encompassing tier of rooms against

that old wall they provided each compartment with an outside door, even those in the second and third stories. But it was not long before all were securely and permanently closed. In subsequent additions the Late Bonitians omitted exterior doorways altogether.

Solid first-story walls, with movable ladders giving access to the rooftops, were purely a defensive measure among the western Pueblos. They continued to rely upon it until the third quarter of the nineteenth century when United States troops brought an end to Navaho and Apache depredations. Not until then did the Hopi and Zuñi feel secure enough to risk ground-floor living rooms and doors opening upon the village square.

We have record of only seven outside ground-floor doors in Old Bonitian houses. Each gives direct access to the courtyard. Five of them may have been cut through when later rooms were built in front of Rooms 306, 307, 323, 325, and 326. Those in Rooms 28 and 83 possibly were in use before the outside accumulation of blown sand necessitated the construction of steps to reach court level.

Old Bonitian doors are somewhat oval, 23 or 24 inches wide and about 30 inches high. Adobe mud fills the corners and conceals the rude stonework. Sill height ranges from 12 inches to 4 feet 9 inches. The latter figure is that for the door connecting Room 325 with its unexcavated northwest storeroom. Below the door a section of an 8-inch log, 2½ feet long, leaned against the wall as a step, supplementing a 1½-inch-deep toehold in the plaster 35 inches above the floor. To facilitate access to the north door of Room 325 two posts were set in the floor, one fronting the other, forming steps 18 and 33 inches high, respectively.

A metate endwise in the floor provided a 15-inch step for the door of Room 320. In Room 296, two protruding wall stones served a like function. Our tabulation shows steps were required to reach 15 first-story Old Bonitian doors, but this total includes only seven in rooms excavated by the Hyde Expedition.

Late Bonitian doors are nearer the floor, larger, and more rectangular. Their lintels consist of selected pine poles, frequently eight in number, of uniform diameter, peeled, and bound side by side. Where the masonry had broken away it was noted that the outermost poles, at least, ordinarily extended 2 feet or more on each side of the door and thus were concealed within the stonework as the walls were rising. Steps, if any, were posts, wall recesses, protruding stones, or blocks of plastered masonry.

In the southwest corner of ground-floor Room 245 a cleverly contrived door gave oblique access to the second story of Room 246.

The sill, 3 feet 11 inches above the floor, was reached by aid of a post step 2 feet high; within the doorframe a 16-inch masonry step with hewn-plank tread halved the remaining distance. Few Bonitian housewives succeeded so well in lessening indoor distances.

Doors diagonally through the corner of a room are peculiar to the fourth and final phase in local architecture. We counted seven, all but one being in the second story. That exception, connecting Rooms 257 and 258, obviously was an afterthought, since its construction blocked a former ventilator between Rooms 258 and 259. Rooms 225B and 242B had two corner doors each. Pepper (1920, p. 316) places one in the northwest corner of 99B. It is quite possible other diagonal doors have disappeared with crumbling masonry.

T-shaped doors likewise were essentially a Late Bonitian feature. Of 32 T-doors on our list, 17 appear in walls of third-type masonry and 12 in those of fourth-type. Only one was noted in a second-period wall, and that was on the east side of closet-sized Room 332, extensively altered when Kiva U was built. We found only two T-doors in Old Bonitian houses, and one of them, in the east wall of Room 323, was so conspicuously framed in third-type stonework as to suggest that it was cut through at time of construction of the room or rooms that preceded Kiva Z.

Of our 32 T-shaped doors, 23 appear in the first story, 8 in the second, and 1 in the third. There may well have been others, since lost with collapse of the upper walls. Most of those still visible originally faced one of the courts, but a few, like those in the west walls of Rooms 226 and 227-I and that connecting third-story Rooms 174 and 175, must always have been internal. Our T-doors vary considerably in size. That in Room 332 has a width of 18 inches for the lower portion, 30 inches for the upper, and stood perhaps 4 feet high. The now-blocked T-door in the southwest wall of Room 88 measured 28 and 49 inches in lower and upper width, respectively, and was more than 6 feet high. It was contemporaneously duplicated in the front walls of Rooms 89 and 90, next on the east. Nine T-doors, including three in the second story, measure 45 inches or more in maximum width.

It is a curious fact that all except the T-door in Room 109B, and possibly that in 174C, had been carefully closed with masonry. In most instances the blocking had been piecemeal: first, reduction to the customary rectangular form by filling in the shoulders; perhaps further reduction by raising the sill; then conversion into a window or cupboard; and eventually complete closure. Our observations provide no clue to the original purpose of T-shaped doors. The oft-

quoted theory that they were designed to permit a burden bearer to enter before putting down his load finds little credence with me, for I have seen many individual burdens carried on human backs to open doorways in Walpi, Oraibi, and Zuñi. In each instance the load was put off outside and left there while the carrier went in unencumbered.

Storeroom doors at Pueblo Bonito were invariably equipped with secondary lintels and slanting jambs to support a stone door, but all others apparently remained open. During his study of Pueblo architecture, Mindeleff (1891, p. 182) noted small poles built into doorways a few inches below the lintel proper and assumed they were intended to support blankets or rabbit-skin robes in cold weather. Similar poles, singly or paired, had been provided for many of the doors in Pueblo Bonito, but the space between them and the primary lintels was usually filled with masonry. We observed nothing, neither free poles nor wall pegs at lintel height, to suggest utilization of hangings for winter protection.

Ventilators were, or once had been, present in many Bonitian rooms, especially storerooms. Considering only those specifically mentioned in our own field notes, tabulation shows 182 in 89 rooms. Twelve of the rooms are Old Bonitian, nine on the ground floor and three in the second story. Together, they have 29 ventilators, of which 11 appear in the three second-story chambers. One room alone, 317, originally had three ventilators in its first-story northwest wall and seven in the corresponding wall of the second story. But all 10 were subsequently closed, presumably when Late Bonitian Room 114 was constructed outside.

In 50 fourth-period houses we count 110 ventilators, as follows: 41 in 23 ground-floor rooms; 59 in 21 second-story rooms, and 10 in 6 third-story rooms. Here, as elsewhere, the vents lie well up toward the ceiling and average about a foot square. A majority occur in former storerooms, but in the course of time nearly all had been either reduced in size or blocked entirely. Occasionally a former door, neatly sealed and plastered over, had been left with a sort of transom.

Windows, in our sense of the word, were unknown to the builders of Pueblo Bonito. Whatever light entered their dwellings came through the front door and diminished progressively as it passed inward from one room to another. An occasional transom in an otherwise blocked door admitted a modicum of both light and air, but a torch must have been necessary when the innermost storerooms were visited.

Fireplaces.—There were more than 300 ground-floor rooms in

Pueblo Bonito. Our data show 59 hearths in 48 of them. Sixteen Old Bonitian dwellings have a total of 20 fireplaces. Of 39 Late fireplaces recorded, 31 appear in rooms of third-type construction. Circular or oval hearths predominate over quadrangular; the ratio of slab-lined to masonry-lined is nearly 5 to 1. Firedogs were encountered in only four instances, all in Late Bonitian homes: two of 3 sandstone blocks each, one of 5, and one of 2 only. In this latter case the fireplace rim doubtless served as a third support for round-bottomed pots. Because houses lacked chimneys, walls and ceilings were usually smoke-stained and sooted.

Pepper (1920, p. 299) describes a hearth in the middle floor of Room 92 (second story of 97) with only a thin layer of dried adobe mud separating it from the brush ceiling of the room below. The omission even of such simple safeguards as stone slabs undoubtedly caused many a second- and third-story fire. In 1882 the upper rooms of Hopi homes still had their floor hearths although the family cooking was done principally on the roof of the first story (Mindeleff, 1891, p. 104).

Clothes racks.—Anticipating the modern Zuñi practice, our Bonitians sometimes built in, at time of construction, single poles for suspension of surplus blankets and wearing apparel. These poles invariably crossed the lesser dimension of the room. Although we observed the seatings for only seven examples, many others unquestionably were once present. All seven occurred in Late Bonitian rooms, and five of these, 200, 203, 204, 209, and 299, are of second-type stonework and stand in the outermost tier at the north arc of the pueblo. The seatings averaged 5 feet 2 inches above the floor and varied from 16 to 20 inches from the end walls. Racks suspended from ceiling beams in the Hopi manner (Mindeleff, 1891, p. 110) would leave no trace.

Pole shelves.—We have record of 16 pole shelves in first- and second-story rooms originally built for storage or subsequently converted to such use. Twelve of them are in 10 Late Bonitian houses. The poles, 3 to 11 or more in number, had their ends firmly embedded in the side walls at time of construction. Because masonry had been dislodged when these poles were wrenched loose, it was not always possible to determine the exact number.

Pole holes in the walls of Room 264 mark the positions of two shelves each 4 feet 6 inches above the floor. That at the north end was 7 feet in depth while the south shelf was only 5. Together, these two pole shelves occupied 12 feet of the total room length, 17 feet 4 inches. Comparable storage facilities assuredly were provided for third- and fourth-floor dwellings.

In Room 299 a former clothes rack 5 feet 2 inches above the floor and 3 feet from the west wall had been converted into a shelf merely by resting upon it a number of sticks and embedding their rear ends in the west-wall masonry. Ceiling height here is 9 feet 9 inches.

In contrast, our records show only four pole shelves in Old Bonitian houses and each clearly was a postconstruction feature. For example, in Room 320 two peeled pine poles had been placed 5 inches apart with their ends resting upon the sills of the south ventilators and there fixed in position when the two openings were closed with masonry. Again, at the west end of Room 298B and 3 feet 9 inches above the floor, several building stones were removed to permit the seating of five parallel poles whose ends were then anchored with sandstone chips and adobe mud. A 3-pole shelf 22 inches deep was introduced by like means into Room 315.

Lesser shelves, cupboards, and wall pegs.—In the east corner of Room 293, where the third-type northeast wall meets the older southeast side, a triangular shelf was formed simply by extending three small poles across the angle. Triangular spaces above corner doorways, an occasional projecting stone, a board set into the wall masonry, and even irregularities left during reconstruction—all afforded a measure of security for small objects and so were utilized as shelves.

Doors and ventilators no longer needed were closed with masonry, usually in a manner to leave a recess on the side facing the quarters still occupied. These recesses vary in depth from 2 to 24 inches and are almost always neatly plastered. Lesser cupboards within the wall masonry were left at time of construction or created subsequently by removal of several building stones. Such receptacles often had hewn boards for lintel or sill. Of 115 wall recesses and cupboards, irrespective of shape or size, at least 26 are identifiable as blocked doors, 25 as blocked ventilators. All but 12 occur in Late Bonitian houses.

Slender implements such as spindles, drill shafts, and planting sticks doubtless were thrust for safekeeping between adjacent ceiling poles just as they are in present-day Pueblo homes. We found necklaces and other ornaments among the fallen roof timbers of more than one kiva.

As hangers, willow branches and antler prongs quite likely were used more commonly than our evidence suggests. We have, for instance, record of but 18 wall pegs, only 2 of which appear in an Old Bonitian house and, in this case, in the same room. The east and south walls were favored, only one peg having been noted on the north side.

Fixed work (?) slabs.—At least one dressed sandstone slab was

embedded flush with the adobe floor in each of six Late Bonitian houses. We have no clue to their purpose; none bore any revealing mark and nothing was concealed beneath. One example (U.S.N.M. No. 335898), of fine-grained sandstone smoothed on three edges and one face, occupied the middle floor of Room 291. It measures 9½ inches wide by 11½ inches long by 1½ in maximum thickness and appears to be part of a tabular metate. Its one unsmoothed edge had been neatly dressed with stone hammers.

A tabular milling stone, 22½ inches wide by 26 inches long, lies embedded in the floor of Room 300B 6½ inches from the east wall and 8 inches from the north. Since the room itself is only 3 feet 8 inches wide, the mill in its present position could not possibly have been used for grinding meal.

Benches, intentional and unintentional, were noted in a number of rooms. Some resulted from constructional carelessness. When a prepared foundation proved wider than necessary the difference appears as an offset. Such an offset might be wider at one end than at the other; it might, or might not, extend the entire length of the wall. In either case the irregularity, if above floor level, became an accepted fact and usually was turned to advantage.

In Room 309 a bench 9 inches wide and 7 inches high extends the entire width of the chamber, 12 feet 9 inches. It had been plastered and replastered until its 15 successive coats totaled 2 inches. At each end a block of plastered masonry formed a lesser but superposed shelf. In the southeast corner of Room 327 the plastered east and south walls are abutted by a masonry bench 25 inches long, 28 inches high, 7 inches wide at one end and 16 inches at the other. Similarly, a triangular bench only 14 inches high but 4 feet 4 inches wide and 35 inches in maximum depth, occupies the southeast corner of Room 333.

The rude masonry bench across the east end of Room 300 is a post-Hyde Expedition relic. Jack Martin, who had freighted for Richard Wetherill, said that Wetherill used this closet as a smokehouse. In corroboration, there are nails in the ceiling beams and pendent baling wire, recent smoke stains on walls and ceiling, nails in the door lintel for support of a blanket. Room 299, next on the north, likewise bristling with nails and wire, is unquestionably the "general storeroom" mentioned by Pepper (1920, p. 27), for his figure 4 shows the expedition's dining room and kitchen under construction against the outer wall of Room 14b.

Storage rooms and bins.—Rear rooms, especially ground-floor rear rooms, were ordinarily used for storage. They were dark and as a

rule indefinitely floored. By way of contrast, Room 320 was paved with sandstone slabs, while 296 and 298 were carpeted with woodpile chips and juniper bark. Storeroom doors invariably were provided with secondary jambs and lintel against which a fitted stone slab could be leaned from the outside. Nowhere did we observe incontestable evidence that such a slab had been sealed in place with adobe mud.

Bins occur both in storerooms and in living rooms. Some were constructed of masonry; some of wattlework; still others were excavations under the floor. In Room 85 Pepper (1920, pp. 270-286) found a number of masonry bins, rudely built but provided with doors and roofed over. In Room 78 (ibid., fig. 108, p. 261) he uncovered a large painted water jar, buried to its middle, and two dug pits designed to be closed with stone slabs at floor level. The four old cooking pots we discovered under the floor of Room 128 (pl. 51, lower) had been placed there for storage purposes. One still held a quantity of grass seed.

During excavation of Room 266 we unexpectedly discovered five subfloor storage pits. They averaged 4 feet 6 inches deep and 3 feet 6 inches in maximum diameter. Each was olla-shaped and its orifice so situated that it could be covered and perhaps sealed without interfering with normal activities in the room. Pits and bins together, our compilation shows perhaps 13 in 5 Old Bonitian houses; 20 in 12 Late Bonitian rooms.

Mindeleff (1891, pp. 209-210) describes wall cupboards and slab-sided Hopi bins for storage of beans and small grains and, for like purpose, a water jar buried to its neck in a masonry bench at Zuñi.

In 1881 Bourke (1884, p. 298) saw in a house at Mishongnovi "great stores of blue and white corn, piled up separately; dried pumpkins in long twisted strings hanging from the rafters; . . . mutton-tallow in bladder casings, gourd water-jugs, . . . baskets, . . . stone mortars, sheep pelts, rabbit-skin mantles, . . . pottery and blankets, . . . and a supply of tortoise-shell and gourd rattles, masks, headdresses, sashes, and other appurtenances of their dances."

From Zuñi Mrs. Stevenson (1904, p. 352) wrote a briefer but equally clear picture: "A Zuñi storage room contains a promiscuous mass of material ranging from objects of the most sacred character to those of little or no value."

Such practices merely reflect an inheritance from the more-distant past. There can be no doubt the Bonitians, like yesterday's Zuñi and Hopi, endeavored to keep in reserve at all times at least a year's supply of maize and other foodstuffs. This buttress against the possi-

bility of drought was stored in various ways and in various places just as comparable reserves were stored in the western pueblos 800 years later.

Furniture and furnishings.—Built-in shelves, hearths, and cupboards have already been discussed. It remains now to present such data as we have on movable furnishings. And that is indeed a simple task, for in all the rooms of Pueblo Bonito we found but one piece of furniture—a stool made from a section of pine log (pl. 66, B). This was on the floor of Room 268 and measures $9\frac{3}{4}$ inches in diameter by $9\frac{1}{2}$ inches high. Both ends, cut with stone axes and smoothed with sandstone abraders, remain slightly convex.

In 1883 neither the Hopi nor Zuñi considered chairs and tables necessary house furnishings. "Small stools are sometimes seen," writes Mindeleff (1891, p. 213), "but the need . . . does not seem to be keenly felt . . . Though movable chairs or stools are rare, nearly all of the dwellings are provided with the low ledge or bench around the rooms." If this disregard for physical comfort seems beyond our understanding we have only to recall that chairs were likewise unknown in the average English home until near the end of the fifteenth century.

Lacking tables, the Bonitians served meals from one or more earthenware bowls set out upon the living-room floor. The daily piece de resistance undoubtedly was a stew or some sort of gruel. There were no forks and no knives except blades of flint and obsidian. The family simply seated itself or squatted about the food bowl—men and boys on one side, women and children on the other—and dipped in fingers or a scoop improvised from a bread crust or a sherd of squash rind. It was want of tables rather than shortage of tableware that placed the Bonitians behind contemporary Europeans in mealtime etiquette. Even our New England forefathers ate with their fingers. The 2-tined fork was still a novelty as late as 1700, when wooden and pewter dishes held the cornmeal mush or the boiled meats and vegetables that comprised the daily fare in most Colonial homes (Dow, 1935, pp. 28-41).

Many of the earthenware vessels described in a following chapter are of a size to suggest intended individual use. Gourd ladles and spoons made of wood or mountain-sheep horn doubtless were at hand. We found none in Pueblo Bonito, but they are known from cliff dwellings of approximately the same age.

Among blown sand and fallen masonry near the floor of Room 225 we unearthed what I believe to be part of a cradle (pl. 9, B). The relic consists of a bent willow frame over which reeds have been

looped and bound. If my identification be correct, this is the only one of its kind. We had a right to expect something more elaborate from a Late Bonitian dwelling; something approaching, in form and execution, the hooded P. III cradle recovered in the Kayenta country by Guernsey (1931, p. 105).

Bonitian beds, to judge from remnants found with burials, consisted of one or two thin rush mats, nothing more. For covering there were daytime cotton garments, turkey-feather robes, and perhaps the tanned hides of deer, antelope, and mountain sheep. Hides and robes served also by day as living-room seats and may have been hung over otherwise open doorways during inclement weather.

At least 3 of the 10 bodies interred in Room 320 had been laid upon mats. Two rested side by side upon a mat made of bulrushes (*Scirpus acutus* Muhl.) three-fourths of an inch wide in their present compressed condition, fastened together at 5-inch intervals by twined strings. The eastern edge of that burial mat partially overlay another composed of young willow shoots $36\frac{1}{2}$ inches long and less than one-fourth inch in diameter, laid tip to butt, square cut at both ends, with all knots abraded. The willows had been carefully peeled except those comprising four transverse bands. Thirteen warps of 3-ply string were threaded through holes punched $1\frac{1}{4}$ inches from each end and at 3-inch intervals. Paraffined in the field and rolled upon a metal cylinder for safer transportation, this mat has since been sewed to heavy muslin with black thread (U.S.N.M. No. 335288).

A second willow mat, with nine warps only and no decorative band, lay across the middle floor (pl. 10, A). Here, again, the damp fragile shoots began to warp and crack, even while our photograph was being made and, despite a hurried application of preservative, it was impossible to remove the specimen intact. It had measured $35\frac{1}{2}$ inches wide by $53\frac{1}{2}$ inches long. The larger portion, likewise stitched to muslin with black thread, is shown on plate 10, B. These two are the only mats in our collection not composed of some species of rush.

One fragment shows an assemblage of quarter-inch reeds, laid parallel and sewed together in the manner described above. Ten pieces are twilled: six in over-two-under-two technique and four in over-three-under-three. None has a design, plain or colored, so far as I can determine. In these 10 fragments strip width varies from one-eighth to three-eighths inch. Plate 11, figure *b*, shows broad and narrow strips alternating. Two scraps, figures *f*, *h*, have a double selvage, joined at the inside edge. One side is formed by parallel body elements; the other, by those at right angles. Woven in upon its fellows, over-two-under-two, each element was folded back and to

the right from the outer edge of the border and severed at the inner margin.

Another fragment (U.S.N.M. No. 335312, orig. No. 1406) exhibits a selvage wherein the plaited elements were doubled back over a string, like a ring-basket rim, and there bound by twined cords. Plate 11, *a*, shows three short sections of braided rush leaves formerly tied together by a fine 2-ply string. Each piece measures three-eighths inch wide and a trifle over one-eighth in thickness; each is flattened on both sides. The three may not, of course, represent a sleeping pad at all, but one made of rush leaves united in this manner would appear at first thought to offer more comfort than any other we have considered.

When Pepper first entered Room 33, a small first-story chamber in the old northwest quarter, he observed the end of a "burial-mat" protruding from the accumulated sand. He described it as "made of thin osiers fastened together at three points by means of a two-strand cord which passed through holes provided for the purpose" (Pepper, 1909, p. 236). Another magnificent specimen, 5 feet 3 inches by 6 feet, removed from an adjacent room in 1897, is now preserved in the Robert S. Peabody Foundation for Archaeology at Andover, Mass. My notes [7] describe it as composed of unpeeled willow shoots, square-cut at the ends and threaded upon nine warp cords spaced 2 inches from each end and at intervals averaging $7\frac{1}{4}$ inches. Each cord is knotted at its extremities and on either side of the individual transverse elements.

These mats, together with cold hearths, broken food bowls, and other evidence from the ruins, tell us how the Bonitians lived, ate, and slept. Theirs seems a severe, unadorned existence. The Spartan simplicity of their homes again reminds one of Mindeleff's (1891, p. 108) pithy summation of Pueblo architecture: "When the walls and roof . . . have been fully recorded, little remains to be described about a Pueblo house."

Housewives pursued their daily tasks out of doors when possible—making pottery, preparing food, tending babies, etc.—on the terraced rooftops or in the courtyard below. Naked children romped, like happy puppies, all over the place. In out-of-the-way corners of the yard, shelters of cottonwood boughs were occasionally provided for summertime comfort. Two such arbors are marked 286 and 310 on our ground plan, figure 2.

Floor sweepings, kitchen refuse, and waste from household indus-

[7] Generously supplemented in October 1941 by Douglas S. Byers, Director of the Foundation.

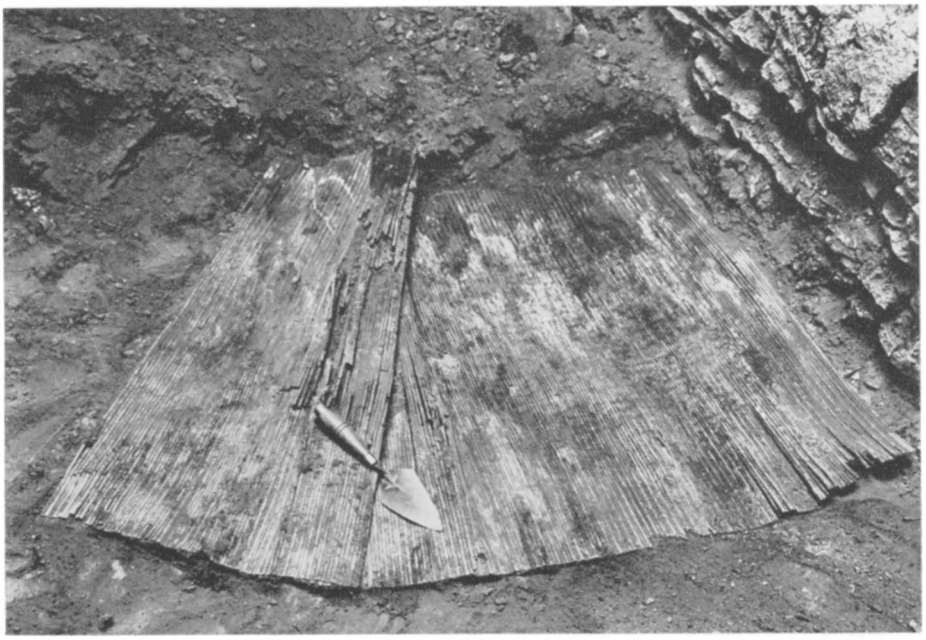
tries were thrown into the nearest abandoned room or carried outside the village to the community dump. Personal convenience rather than any thought of sanitation dictated the place of deposition. Repeatedly we found fragments of a given vessel in two or more rubbish piles; fragments of one basket-molded bowl were retrieved from an abandoned kiva in the East Court and from the surface of the east refuse mound.

SUBSISTENCE

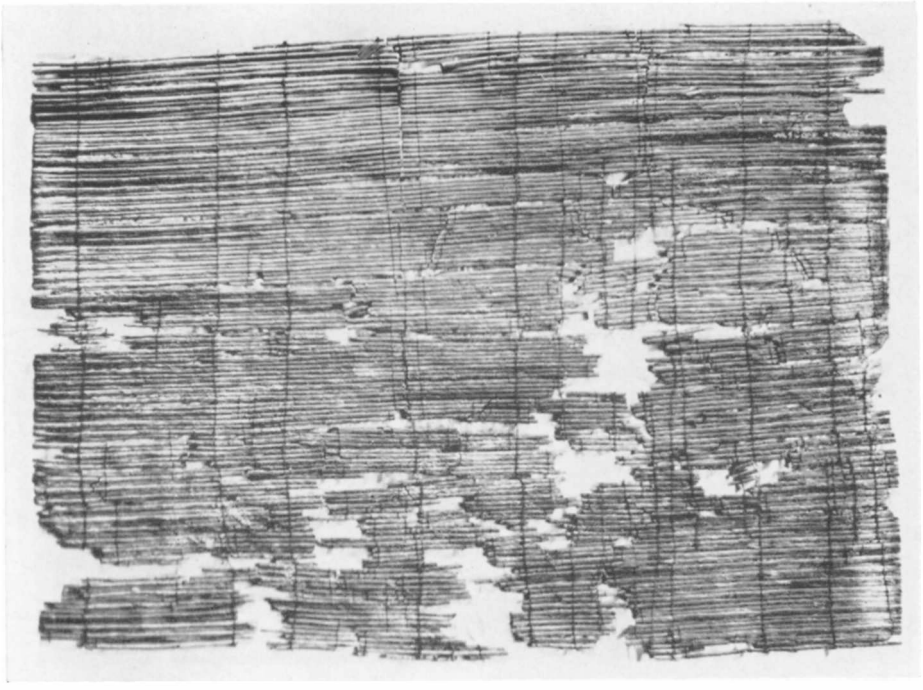
Pueblo Bonito was built and occupied by farmers. Their livelihood depended upon cultivated plants, and these, in turn, were subject to a capricious climate. If winter snows sufficed, seeds germinated and broke the surface; if summer rains fell at the right time and in the right place, plants grew to maturity. But summer rains in Chaco Canyon are vagrant. They might drench one farm and leave the next dry; they might come too late or not at all. To meet these uncertainties, Bonitian farmers located their fields in the paths of rainwater running off higher land, or in areas where low earth dams impounded such transient floods and thus multiplied the result of local precipitation. This "floodwater" method of irrigation is still widely practiced by Southwestern tribes; it is the method profitably employed today by Navaho families throughout the Chaco country.

We may confidently identify the Bonitians as floodwater farmers because they had no choice. There has never been a permanent stream in Chaco Canyon. The valley fill, made up of soil transported and deposited by runoff during countless rainy seasons, presumably supported a lush vegetation of native grasses and shrubs in the days of Pueblo Bonito. Cottonwoods and willows followed a shallow, intermittent channel down the middle of the canyon. We take for granted that Indian gardens flourished wherever sufficient moisture could be provided.

Today, 800 years later, an entirely different aspect presents itself. The once prosperous village stands in ruins, surrounded by barren fields. An arroyo 30 feet or more in depth and 100 to 300 feet wide has gutted the valley and lowered its water table beyond reach of indigenous vegetation. In consequence, the abundance and variety of plant life are greatly diminished. Without a ground cover to check runoff, storm waters quickly drain into the arroyo, deepening and widening it in the process. As this gully system expands year after year it is repeating the devastation caused by an earlier arroyo, in existence when Pueblo Bonito was inhabited. By gradually washing away their farms, that earlier arroyo may have forced the Bonitians to vacate Chaco Canyon. Now, with another erosion cycle well ad-



A, Willow mattress, as found, on the floor of Room 320. (Photograph by O. C. Havens, 1924.)



B, Part of the willow mat seen in *A*, stitched on muslin for preservation.

PLATE 10

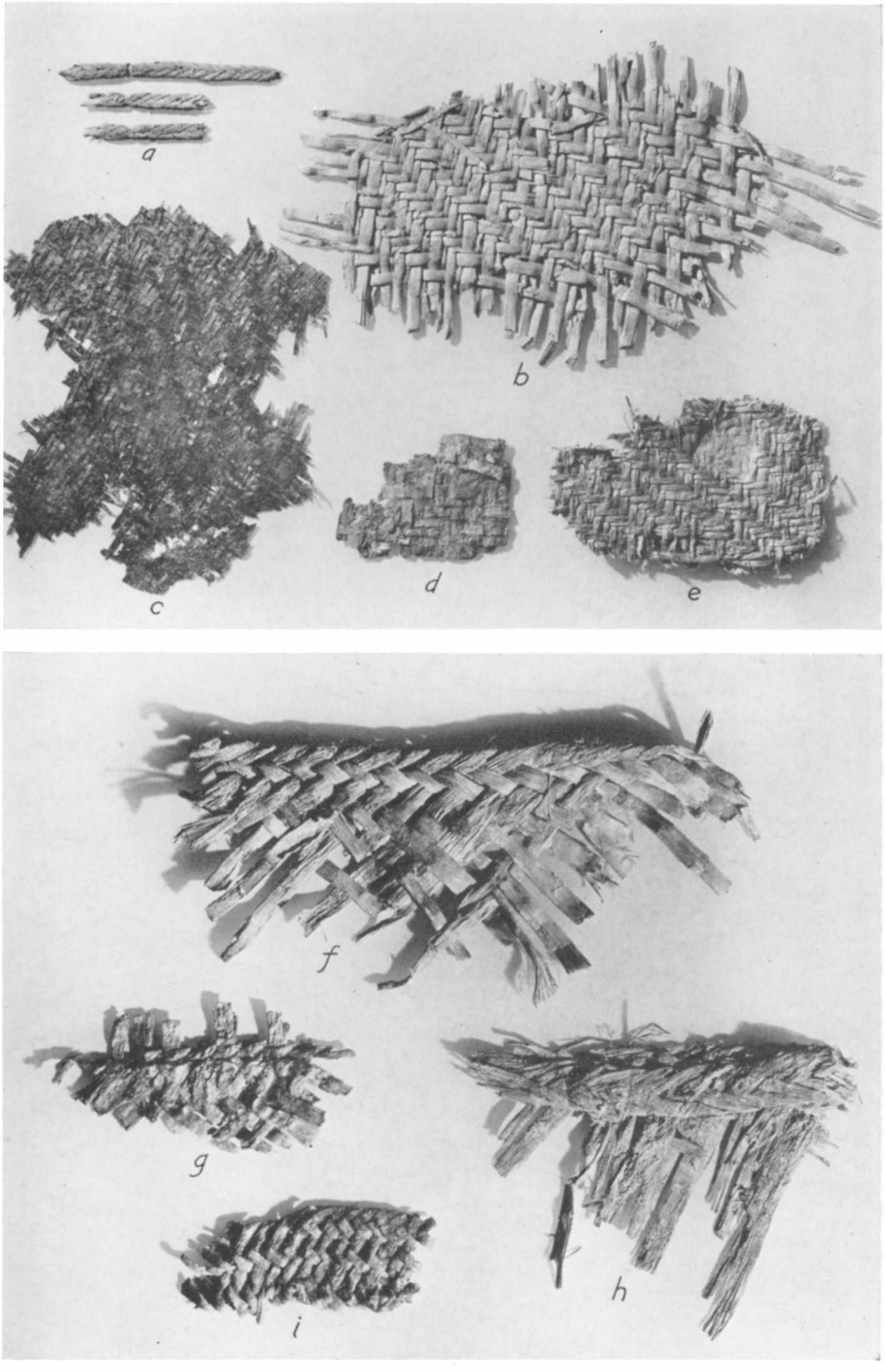
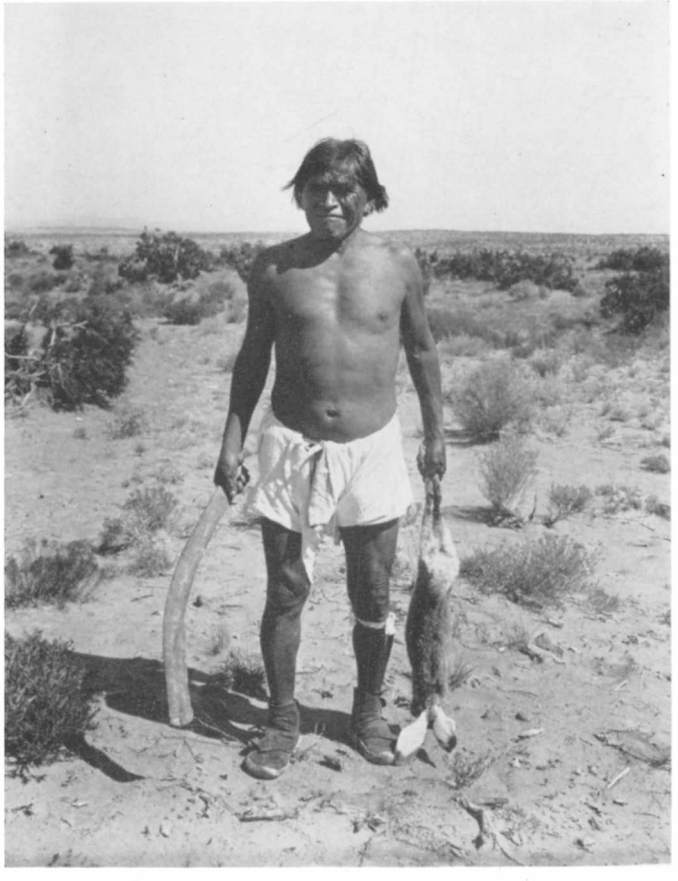


PLATE 11.—Fragments of matting woven of rush leaves.



Tom Chischilly-begay in his cornfield.
(Photograph by O. C. Havens, 1925.)



Hopi rabbit hunter with throwing club.
(Photograph by O. C. Havens, 1924.)

PLATE 12

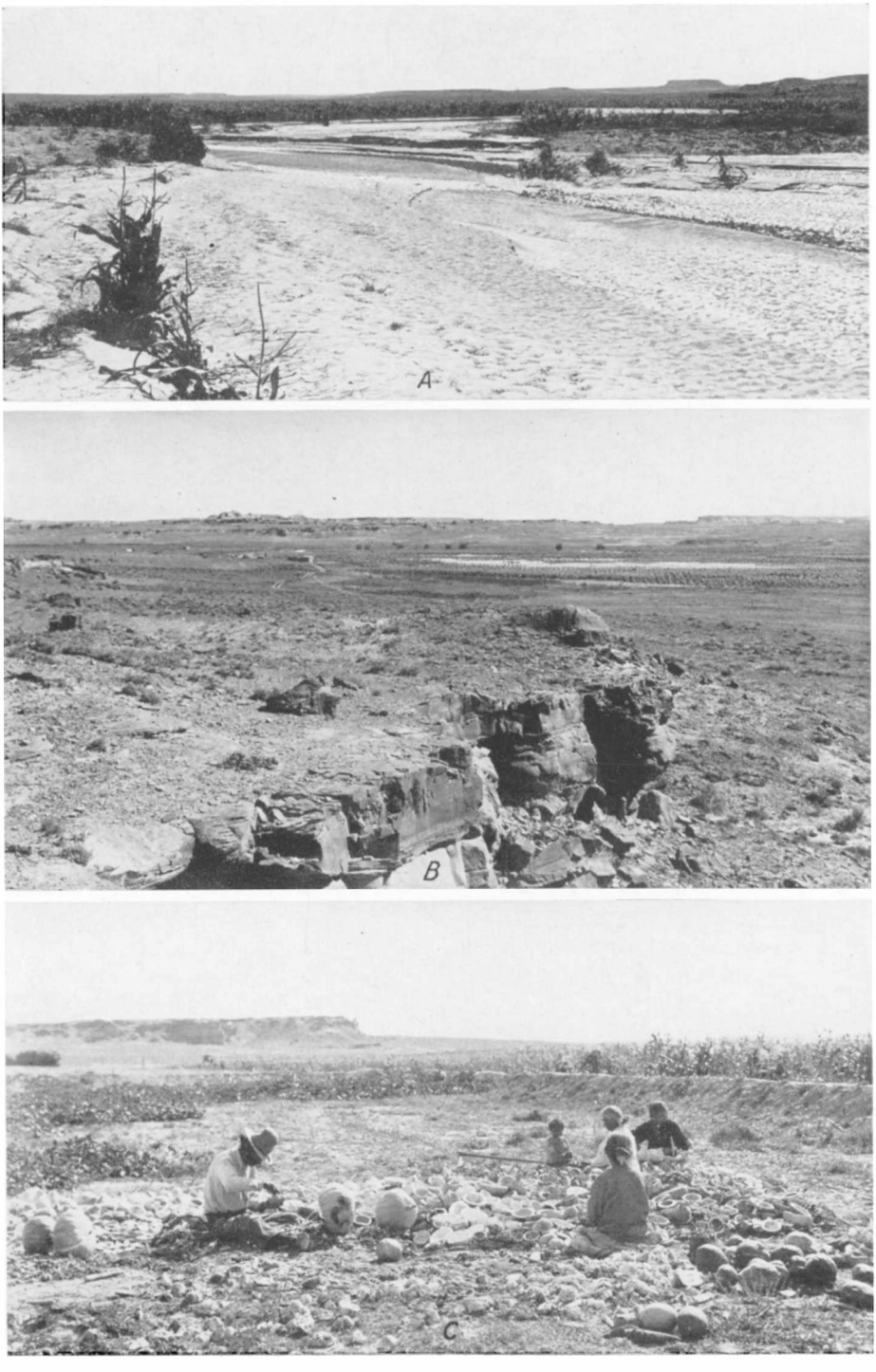


PLATE 13.—Chischilly-begay's floodwater farm in Kinbiniyol Valley showing (*A*, *B*) damage by uncontrolled floods, and (*C*) the family preparing pumpkins and squashes for winter use. (Photographs by O. C. Havens, 1925.)

vanced, the canyon is once again being deserted. Few Navaho continue there today.

At the turn of the century, however, many more families lived within a couple of hours' horseback ride, for Holsinger reports that the Hyde Expeditions employed about 100 men in excavation of Pueblo Bonito. Hogan sites and vestiges of former garden plots remain today as evidence of a larger past population. We examined

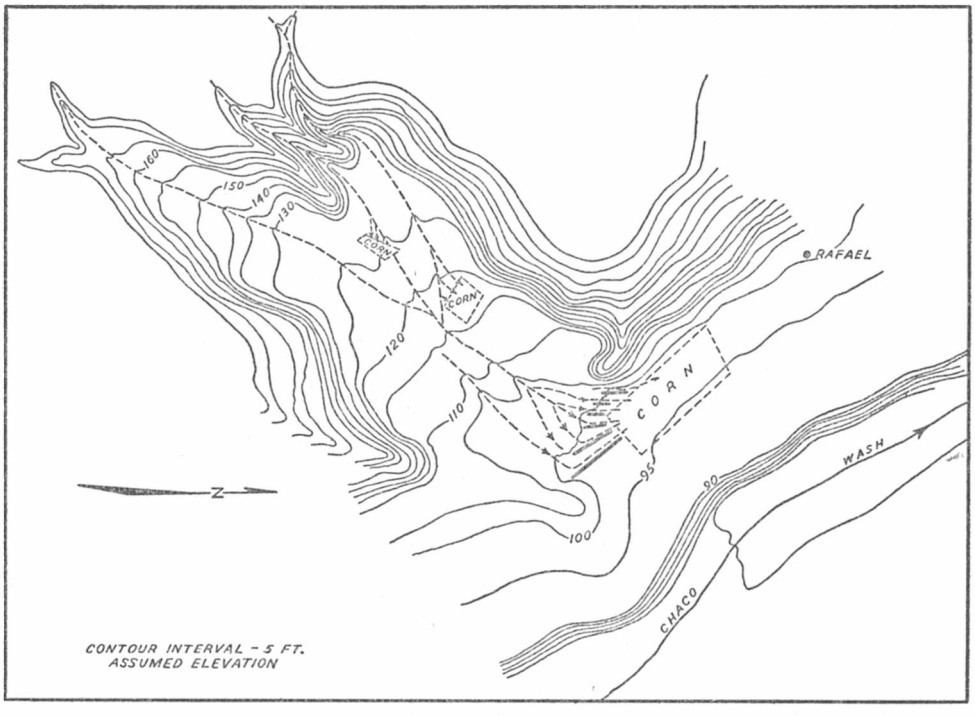


FIG. 4.—Drainage area controlled by Rafael. (Plane-table survey by Oscar B. Walsh, 1925.)

a dozen or more forgotten fields, all different yet somewhat alike. They may be 20 years old or 200. They are once-cleared areas onto which storm waters were guided by a series of low earth ridges. The number of such ridges, their extent and grouping, was clearly suggested by the immediate surroundings. Our Navaho workmen employ like means to meet like problems.

With half a dozen miniature dikes Rafael waters his principal cornfield on the south side of the valley a mile west of Pueblo Bonito. A handful of grass or a chunk of sandstone suffices to turn a lesser runoff onto smaller plots higher up the slope (fig. 4). Dan Cly takes

full advantage of natural drainage on the steplike ledges of Rincon del Camino (fig. 5).

Successful floodwater irrigation depends not only upon understanding of the principles of runoff but also upon knowledge of soils. As

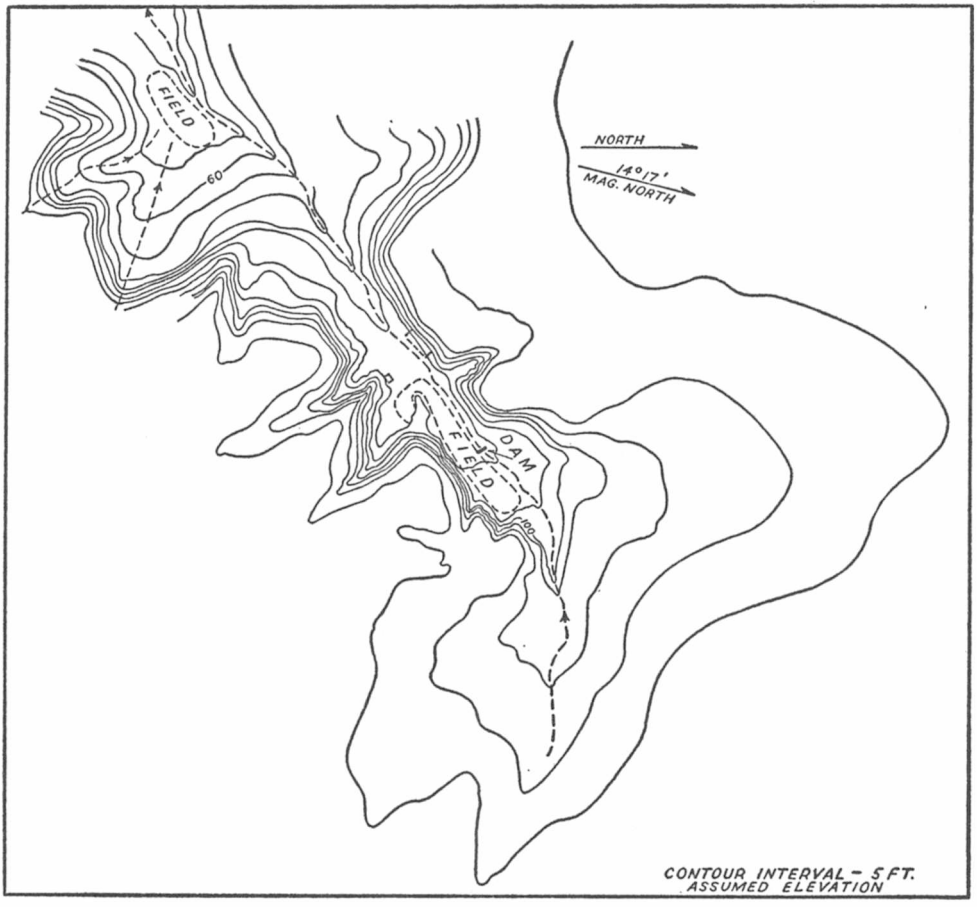


FIG. 5.—Dan Cly's floodwater field, Rincon del Camino. (Plane-table survey by Oscar B. Walsh, 1925.)

Bryan (1941, pp. 224-225) sums up his observations: "The essential feature is the selection . . . of a place overflowed by flood water. The overflow must be sufficient to saturate the ground and thus irrigate the crop and yet not so violent as to wash out the plants . . . Broad valley floors over which the flood-run-off after rain spreads widely are favorable areas." Chaco Canyon was just such an area.

During periods of alluviation, layers of silt and sand were deposited uniformly across the valley floor (pl. 4, lower).

The preeminent Navaho farmer in the Chaco district today lives on the Kinbiniyol, a few miles below the ruin of that name and about 12 miles southwest of Pueblo Bonito. He is Tom Chischilly-begay (pl. 12, left), who says he began to cultivate these particular fields about 1918. He learned his method from Juan Etcitty, since de-

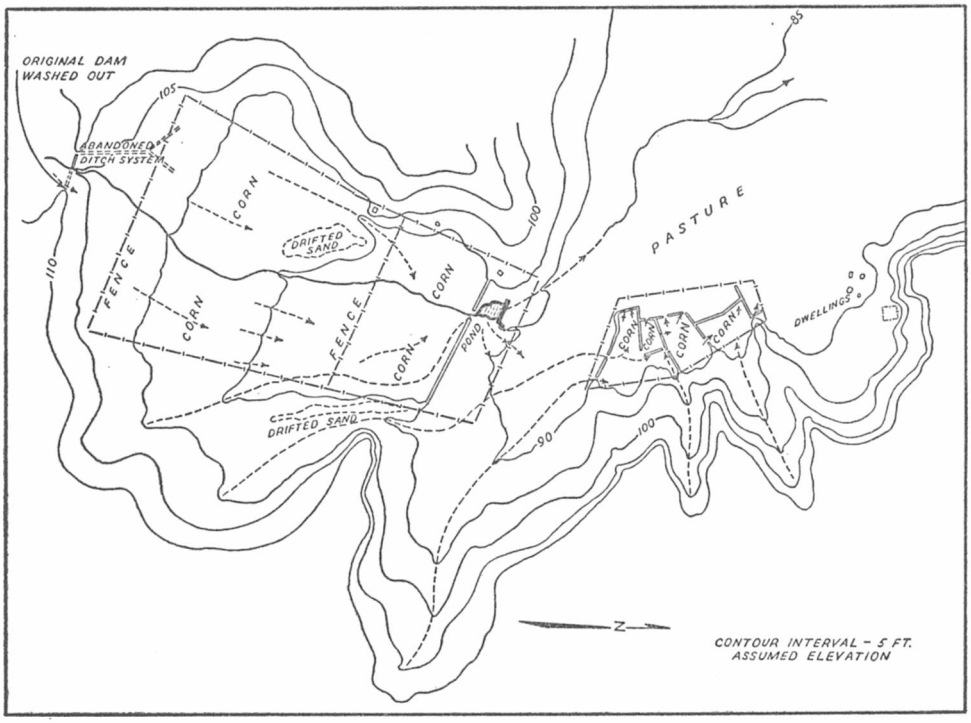


FIG. 6.—Floodwater fields and check dams of Chischilly-begay, Kinbiniyol Valley. (Plane-table survey by Oscar B. Walsh, 1925.)

ceased, who created Juan's Lake 4 or 5 miles below Tom's place and farmed there successfully until his dam burst one season causing an arroyo that ruined everything.

By a system of check dams and embankments Chischilly-begay utilizes the entire drainage of the Kinbiniyol (fig. 6). A low earth dam is the initial control but it apparently washes out each year. Originally a ditch was intended to take out from the dam but it was abandoned before completion. Now (1925) Tom endeavors to meet each onrush of floodwater and spread it laterally across his fields.

Throughout the rainy season he has to be especially watchful, and on the job constantly whenever water is running. In another 5 years, Tom says, he will be too old to work so hard and an arroyo is bound to get started. As a matter of fact this eventuality was narrowly averted in 1923, a year of almost unprecedented rainfall, when Tom's corn was partially washed out and his diked areas half filled with silt. A few weeks before our 1925 visit, floodwaters once again had cut a wide path through his fields (pl. 13).

Tom told us other Navaho sometimes come long distances just to see his farm. None has yet attempted his system of floodwater irrigation because no one else "has the same kind of a valley." When he first began to farm here he planted a broad strip of white Santo Domingo corn right through the middle of his Navaho planting. He has since specialized in this white variety and insists it is now pure Navaho. An ear of it collected at the time of our visit measured 18 inches long when it reached the Department of Agriculture in Washington, although it subsequently shrank 2 inches in drying.

As a further byproduct of that 1925 visit we were given a "multiple" ear and several "tassel" ears. The latter, Tom said, often occur when more than five kernels are planted in a single hill. If eight are planted, for example, one or more stalks *may* produce tassel ears. I did not learn at the time whether the Navaho have any special beliefs concerning such abnormalities but they were "laughing ears" to our Zuñi. "If you eat them, they will make you laugh."

Multiple, or branched, ears are saved for goat fodder because they "increase the number of kids." Men sometimes eat kernels from such ears, Tom informed us, but women rarely do.

A few miles above Chischilly-begay's productive acres is Kinbiniyol ruin. It stands at the edge of a shallow, wet-weather pond which had been enlarged in ancient times by a simple rock dam at the foot of a low, sandstone knoll southwest of the ruin. From that dam a ditch led downvalley, cutting through natural obstacles to irrigate the village fields (fig. 7). We did not attempt to trace its course throughout or to discover its ending, but Hewett (1905, p. 329) describes it as "fully two miles long." The lower side of the portion we plotted had been reenforced repeatedly by slabs on end, and even by masonry (pl. 14). In one place an exposed section showed a gravel fill 42 inches in depth.

This impressive remnant is one of those named by Special Agent S. J. Holsinger who reported to the General Land Office under date of December 5, 1901, that "at least five artificial reservoirs are plainly discernible, each having a system of irrigation ditches" (Holsinger, Ms., p. 10). Hewett (1905, 1930, 1936) closely follows Holsinger.

Some of the ancient works specified have since disappeared; others have been altered, by time or man.

Kinklizhin, the Black House, stands about 7 miles southwest of Pueblo Bonito, on the trail to Kinbiniyol. A couple of hundred yards north of the ruin is a dirt dam with an outlet cut through a sandstone outcropping at the east end. Hewett, who gives more details than Holsinger in this instance, mentions a "stone" dam and says its asso-

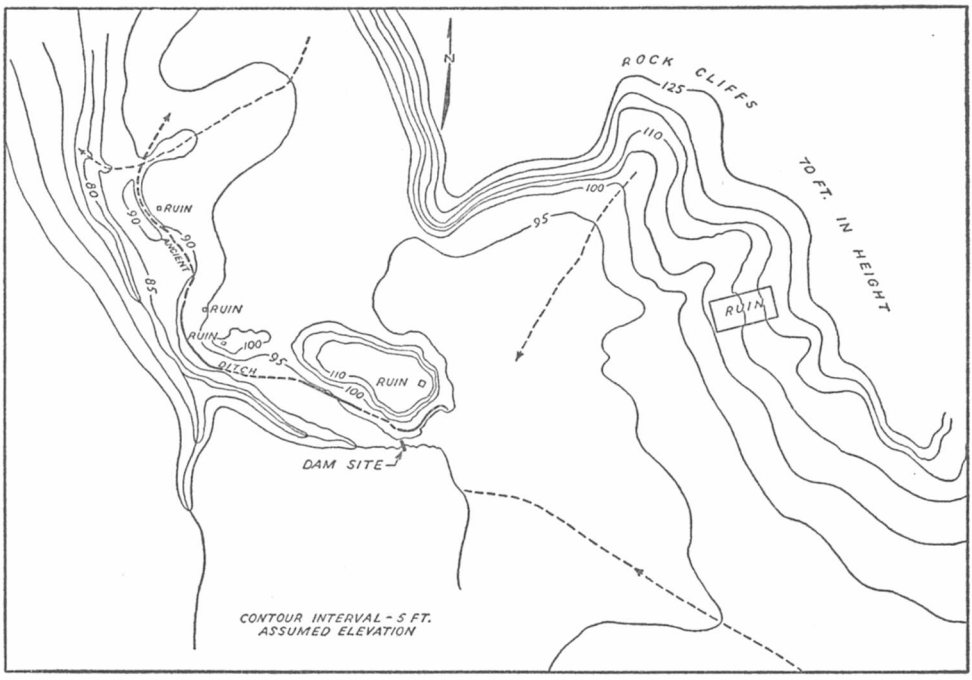


FIG. 7.—Portion of ancient diversion ditch near Kinbiniyol ruin. (Plane-table survey by Oscar B. Walsh, 1925.)

ciated ditch, sand-filled but traceable, conveyed the reservoir water to fields possibly 200 acres in area (Hewett, 1905, p. 326). In 1875 Lt. C. C. Morrison visited this same dam and described it (1876, p. 360) as " a built wall of earth, with stone revetment—10 feet across the top, five feet high, and 15 feet across the base." Richard Wetherill filed claim on and presumably farmed these same acres, but Dan Cly, one of our Navaho workmen, insisted that his brother built both dam and ditch. What we have here, therefore, probably should be regarded as a post-1905 Navaho conversion and reutilization of a P. III irrigation work.

At the foot of the cliff northeast of Peñasco Blanco, a few rods above the point where Chaco Canyon turns west to meet the Escavada, Holsinger observed another rock dam and ditch. They had been exposed, presumably only a year or two before, by a "freshet in the Chaco." Floodwaters dashing against the same bank year after year eventually destroyed both dam and ditch. My old Navaho friend Padilla fixed disintegration of the dam at about 1910; what was undoubtedly the last vestige of the nearby ditch vanished during the rainy season of 1920. A single slab on edge, its base about 3 feet below the surface, was all that remained visible when I passed by on August 11 of that year. Because the slab's significance was not recognized at the time, no photograph was made. It was undercut and lost with the next flood.

According to Holsinger (Ms., p. 10), the associated reservoir "was built in a great bed of sand and was lined with slabs of stone and clay." He says Navaho were then cultivating the ancient fields below the reservoir but without benefit of the latter. The site, I feel confident, is where Wello had his cornfield, a hundred yards more or less below the old ranch buildings where he lived, on the south side at the mouth of the Escavada. And the slab-lined ditch to which Padilla refers (herein, chapter IX, p. 350) probably lies under the same sand-covered field.

A reservoir and system of ditches near Una Vida that Hewett (1905, p. 326) describes as "the best preserved works in the canyon" somehow eluded our search. Holsinger barely mentions them, and his fifth locality, the Chaco-type ruin near Crownpoint where "remnants of a dam" and "a very large canal" are to be found (Holsinger, Ms., p. 11), does not concern us at this time.

Old Hosteen Beyal professed to remember (see chapter IX, p. 345) a ditch that began at the head of Chaco Canyon and continued along the south side to a point beyond Pueblo Bonito. There is no trace of such a ditch today, but opposite, on the north side, there is still to be seen the one Richard Wetherill plowed from Wejegi to his reservoir at the southeast corner of Pueblo Bonito. This post-1901 effort [8] to conserve the north cliff runoff has sometimes been attributed to the Bonitians.

Part of a sand-filled ditch is discernible on the south side of the Escavada just east of the Bonito-Farmington road (1923). Padilla recalled this work as being very distinct when he was a youth, and

[8] The Wetherill dam at the southeast corner of Pueblo Bonito does not appear on any of the Hyde Expedition photographs available to me, and it is not mentioned in the Holsinger report of 1901.

one of our younger Navaho said it can be followed for 6 miles even now. What Padilla referred to as a "wagon road" at the south end of The Gap, and what others call a "canal," is, in the writer's opinion, part of a processional path—a type of feature to be discussed elsewhere.

If the Bonitians ever constructed in Chaco Canyon irrigation works on a par with those named above, the remains lie buried under the 2 to 6 feet of alluvium piled upon the valley floor since Pueblo Bonito was abandoned. The sloping banks of shallow ditches or channels were exposed by our exploratory trenches, but all surface constructions we saw—divertive ridges, check dams, or dikes—date from the period of Navaho occupancy. They were clearly designed to control and utilize runoff; they are similar in every respect to controls raised by Navaho now living in or near the canyon. Jackson (1878, p. 433) in 1877 observed that Navaho families east of Pueblo Pintado had dammed the arroyo to create a small pool from which they drew water by ditch to irrigate their cornfields. This is precisely what the Chacoans did at Peñasco Blanco and Kinbiniyol back in the eleventh and twelfth centuries; it is what Tom Chischilly-begay was trying to do on the Kinbiniyol in 1925.

In 1911, when the water table at Pueblo Bonito was but 20 feet below the surface, Ellsworth Huntington (1914, p. 81) learned of only two local Indians "reasonably sure of a good crop of corn each year." Both lived at the junction of the Chaco and Escavada where water was close to the surface and where individual dams provided for irrigation. During the previous 16 years there had been but two good harvests generally throughout the Chaco country.

The agricultural possibilities of Chaco Canyon, past and present, naturally interested C. S. Scofield, then in charge of the Office of Western Irrigation Agriculture, U. S. Bureau of Plant Industry, and a member of the National Geographic Society's 1920 Committee on Research. It was he who first suggested testing local soils and water in order to ascertain their mineral properties. If they contained an excess of sodium, difficulties were indicated.

Results of the water analyses are given in the preceding chapter. Our soil samples were taken in 1924 from Test Pit No. 3, dug two years previously about midway between camp and the ruin. The pit was 9 feet 2 inches deep, and samples were collected at 10-inch intervals from bottom to top. No. 1, therefore, is lowermost; No. 11, at the surface. Here, again, I am pleased to acknowledge our indebtedness to Messrs. Scofield and Breazeale for their interest and cooperation.

The following extracts from Mr. Breazeale's letter of September 27, 1924, reporting the results of his analysis, are self-explanatory:

All the soils contain a little black alkali, that is, a mixture of sodium carbonate and sodium bicarbonate, and they all contain approximately the same proportion, 0.144 percent, of black alkali, figured as sodium bicarbonate. None of the samples contained any other alkali, such as sodium chloride or sodium sulphate. In their behavior the soils remind me very much of soils that have probably originally contained some other alkali, such as common salt, . . . leached out through a long period of time. The evidence, also, is that the leach water must have been . . . very pure, and that it contained very little lime. A long leaching of most good soils with such water as I have been analyzing for you from Chaco Canyon would probably produce just such effects as I see manifested in this set of soil samples.

As you well know, the first requisite in irrigation agriculture is water penetration, for unless we can get water into a soil we stand little show of getting any crop out of it. So I first set about to see if I could make the soils take water. I rigged up a set of 1-inch glass tubes [10 or 12 inches long, supported upright in a conventional laboratory rack, the bottom of each tube being closed with a wad of absorbent cotton held in place by a piece of cloth and a rubber band] and poured into each one enough pulverized dry soil to make a column 6 inches high, settled this by shaking, and added distilled water to the top of the tube. The water penetrated the soil column very slowly [as shown by change in color of the soil as it was wetted]. Soil No. 11, or the sample taken from 0 to 10 inches deep, probably contained a little organic matter, for it percolated faster than the others, which is not saying much for the others. No. 11 required about 24 hours to wet the six inch column. In the field this, of course, would be much longer. Nos. 10, 9, 8, and 7 went slower than No. 11. It required about 48 hours for these columns to become wet. This takes us to 50 inches deep in the soil. Below that level the soils seemed almost impervious, that is, all the samples will probably require a month each for the water to move downward through the 6-inch layer. I do not think that I have ever handled a soil quite so impermeable to water as are these last six samples.

The Chaco Canyon soil, in all the levels that you sampled, is badly deflocculated and for the reason that it contains an excess of sodium and a scarcity of soluble calcium.

If all the soils that were available to agriculture in the Chaco Canyon are as bad as these samples, I think you have one reason at least to explain why the Bonitians left the Valley. I do not believe an Indian, with his primitive methods, could handle any soil like this.

The presence of sodium carbonate, or black alkali, uniformly throughout our 9-foot test column introduced an unanticipated factor into the subsistence problem at Pueblo Bonito, namely, soil productivity. If 0.144 percent of black alkali is sufficient to render a soil impervious to water, then black alkali, rather than a contemporary arroyo, may be the principal cause for abandonment of Pueblo Bonito. Mr. Breazeale sums up the situation in one sentence: "Unless we can get water into a soil we stand little show of getting any crop out of it."

All the Chaco water we sampled, wells and floods alike, contained an excess of sodium over calcium. Upcanyon, east of Pueblo Bonito, wherever seepage is apparent, there is usually to be seen a more or less conspicuous deposit of gypsum. If annual precipitation in Pueblo Bonito times were only slightly above that of today, as it may have been, those seeps would have flowed more freely than now, dissolving the gypsum and carrying it out where floodwaters could have picked it up and transported it to Bonitian farms. That process, of course, would have been interrupted by inception of the twelfth-century arroyo. Only a little gypsum is required to counteract the effects of 0.144 percent sodium carbonate.

The higher calcium content in surface water from the Kinbiniyol greatly interested Mr. Scofield, as is evidenced by the quotation from his letter of August 24, 1925, in chapter I, page 12. He thought the Bonitians might have had some of their farms over in that valley where agriculture would have been more richly rewarded, as it is today, than in Chaco Canyon. However, while speculating upon this possibility, we must not overlook Rafael's well, a mile west of our camp, which likewise shows a high proportion of calcium. This well apparently taps drainage from the rincon immediately to the south and it is my guess that the sandstone cliffs there, like those upcanyon, contain a little gypsum. Back in the days of Pueblo Bonito, before entrenchment of its contemporary arroyo, calcium distributed by floodwaters would have kept local soils flocculent and productive. Black alkali not only tightens soil against water penetration but kills off vegetation also.

The present arroyo, which allows no possibility of successful agriculture in Chaco Canyon, is at least the third of its kind, as stated in the previous chapter. If geologic history repeats itself once more, this arroyo will be completely filled during the next cycle of alluviation and a new flood plain will be established above it. When that time comes, resident families can again with confidence plant garden foodstuffs such as the Bonitians planted.

Vegetables and fruits.—From household debris in Pueblo Bonito we recovered remains of the following: [9]

Maize (*Zea mays*)
Pumpkins (*Cucurbita pepo; C. moschata*)
Rocky Mountain beeplant (*Cleome serrulata*)
Walnuts (*Juglans major; J. rupestris*)
Grape (*Vitis arizonica*)
Pricklypear (*Opuntia* sp.)
Pinyon nuts (*Pinus edulis*)
Wild potato (*Solanum* sp.)

[9] Identifications by F. V. Coville, Department of Agriculture; C. V. Morton, U. S. National Herbarium; A. T. Erwin, State College of Agriculture, Ames, Iowa.

While this list shows only those actually found during the Society's explorations, the Bonitians unquestionably knew and used many other plant products. From Pepper's observations (1920, p. 298) we may add to our catalog beans and "seeds similar to those of the wild sunflower"; we might also include with confidence a number of desert plants whose roots, young leaves, or fruits are today relished by the Navaho and Hopi. For instance, seeds of Indian rice grass (*Oryzopsis hymenoides*) were unquestionably harvested by the Bonitians, as they still are by many western tribes, since stems of the plant were employed repeatedly in local construction. Among other plants native to the Chaco country and recognized for their food value by the Hopi (Hough, 1897, pp. 37-42; Whiting, 1939) are dropseed (*Sporobolus flexuosus* Thurb.), goosefoot or lambsquarters (*Chenopodium cornutum* B. & H.), pricklypear (*Opuntia*), pigweed (*Amaranthus* sp.), and Rocky Mountain beeplant (*Cleome integrifolia* T. & G.). Cockleburs (*Xanthium saccharatum* Wallr.), such as we found in the wall adobe of Room 47, Pueblo del Arroyo, were probably only pests to the prehistoric farmers of Chaco Canyon.

When the Espejo Expedition in February 1583 approached the Tigua villages above present Albuquerque, the Indians fled from their homes. "All were deserted," writes Luxán (Hammond and Rey, 1929, p. 81), "but contained large quantities of maize, beans, green and sun-dried calabashes, and other vegetables . . ." Today, as in Conquest times and previously, corn, beans, and pumpkins comprise the principal food crops of the Pueblos.

Pueblo society being matrilineal, before American customs began to take root, Pueblo women not only owned the fields, which the husband and unmarried sons cultivated, but also controlled the food supply. Since it was a common practice until a generation ago to reserve at least one year's supply of maize against the possibility of drought or crop failure (Bourke, 1884, p. 135; Matilda Coxe Stevenson, 1904, p. 353; Forde, 1931, p. 393), care of these stores was no light responsibility. Weevils and mice had to be watched as well as family appetites. In what probably was cornmeal, placed in bowls as burial offerings with bodies interred in Room 329, Pueblo Bonito, we noted puparia of a muscoid fly (Calliphoridae) and body parts of ptinid and darkling beetles (*Niptus* sp.; *Alphitobius* sp.).[10] Larvae of both beetles attack stored cereals, while those of the muscoid fly feed primarily on dead animal matter.

One of the three bowls containing the supposed meal also held a

[10] Identifications by E. A. Chapin, U. S. National Museum, and W. S. Fisher, Bureau of Entomology, U. S. Department of Agriculture.

number of dried wild potatoes.[11] Wild potatoes still grow in Chaco Canyon and a few plants had taken root in the East Court of Pueblo Bonito. We protected these latter for a time but neglected to test a statement of our Navaho workmen, namely, that the tubers are not edible until the second year. Wild potatoes are exceedingly bitter, and the Hopi, Zuñi, Navaho, and other Southwestern tribes who gather them as a winter food consume with them clay containing magnesia, to lessen the griping effect.

The 34 fragments of corncobs brought to the Museum laboratories provide but little for study. Most are charred; all are much shrunken. One fragment shows 8 rows of kernels; twelve show 10 rows; seventeen, 12 rows; one, 14 rows; and three, 16 rows. Only one charred fragment has kernels attached and these are rounded, a flint variety. Pure strains of the low-growing, drought-resistant Hopi corn produce ears about 6 inches long with 12 rows of kernels (Forde, 1931, p. 391).

The favorite pumpkin at Pueblo Bonito appears to have been *Cucurbita pepo,* although the striped cushaw type, *C. moschata,* is also represented by seeds, rind, and peduncles. Squashes are not present. Pueblo farmers currently plant with their pumpkins a few gourds for dance rattles, bottles, and ladles. That this practice was also followed by the Bonitians is suggested by two neck fragments of gourd (*Lagenaria leucantha*) canteens, one of which has a small opening at the stem end and a transverse hole for the carrying cord.

[11] Identified in the field by Frank A. Thackery, U. S. Department of Agriculture, as *Solanum jamesii* Torr. Mr. Thackery took a number of fresh fruits with him for experimental purposes and subsequently (September 29, 1937) wrote:

"With the tubers I collected at Pueblo Bonito I was able to get the species well established at Fresnal in the Papago Indian reservation (Pima County, Ariz.) and at the Torrey Pines experiment station in San Diego County, California. From my experience with these two plantings I can say definitely that the plants appear each spring and mature tubers each year. As I recall it the Navaho Indians at Pueblo Bonito told me that the tubers would remain viable through one or more winters at that cold, high altitude."

"From my experience with the plants in Arizona and California, where there was little or no freezing, I am convinced that the tubers will remain in the soil for more than one year and retain their viability. Our Indian foreman at the Fresnal station in Arizona believes that a single tuber might produce a plant one year from an 'eye' on the tuber and then produce another plant the following year from a different 'eye' on the same tuber. I am not able to verify this. I was impressed with the number of tubers a single plant would produce in Arizona and California. Of course these plants received irregular applications of irrigation water. It was not at all uncommon to count as many as 100 tubers on a single plant."

Mammals.—Besides the vegetal remains listed above, the rubbish heaps of Pueblo Bonito yielded bones of the following mammals:[12]

Mule deer (*Odocoileus hemionus*)
Pronghorn (*Antilocapra americana*)
Elk (*Cervus canadensis*)
Mountain sheep (*Ovis canadensis*)
Jack rabbit (*Lepus californicus*)
Cottontail (*Sylvilagus auduboni*)
Grizzly bear (*Ursus horribilis*)
Beaver (*Castor canadensis*)
Badger (*Taxidea taxus*)
Bobcat (*Lynx baileyi*)
Porcupine (*Erethizon epixanthum*)
Gray fox (*Urocyon cinereoargenteus*)
Red fox (*Vulpes* sp.)
Coyote (*Canis lestes*)
Indian dog (*Canis familiaris*)

While some of these were probably trapped only for their pelts, the first six certainly were killed primarily for their flesh. Narrators of the Conquest period repeatedly mention rabbits among Pueblo gifts to the Spaniards. In his letter of August 3, 1540, from the Zuñi village of Hawikuh, Coronado informs the Viceroy: "The food which they eat in this country is corn . . . and beans and venison, which they probably eat (although they say that they do not), because we found many skins of deer and hares and rabbits" (Winship, 1896, p. 559). Ninety years later, enumerating the game to be found in New Mexico, Benavides (Ayer, 1916, p. 37) includes a medium-sized deer of which "there are very, very many; and on these the Indians sustain and clothe themselves."

Deer furnished not only hides for clothing but meat for the table, sinew for bow strings, and bone for implements. Hence it is only natural that the mule deer, which frequents upland country, should be conspicuously represented among the mammalian remains from Pueblo Bonito. Of seven deer, sheep, and pronghorn skulls recovered, six had been broken for extraction of the brain. Seeing these, my older Navaho neighbors remarked that they as young men, and their fathers before them, had hunted pronghorns on nearby mesas—and deer, elk, and sheep in the mountainous country north of the Rio San Juan. Undoubtedly these neighbors of mine were among those who formerly maintained an antelope corral "near Escavada Wash" (Hill, 1938, p. 96).

Pepper (1920, pp. 31, 264, 298) records the finding of a mountain lion claw, in Room 1; a "turtle carcass," in Room 78; the hair, jaw, and two claw fragments of a cinnamon bear, in Room 92. The first and third may well be the nucleus of a story echoed by Special Agent S. J. Holsinger (Ms., p. 18) in his report to the General Land Office, namely, that in a room in the north-central portion of Pueblo

[12] Identifications by Remington Kellogg, H. H. Shamel, and David H. Johnson, division of mammals, U. S. National Museum.

Bonito "the remains of a bear were found and in another that of two cougars or mountain lions."

The Society gathered additional evidence of mountain lions and bears. Included in an offering secreted in the north wall of Kiva Q were a considerable number of grizzly claws and phalanges, 10 claws of the black bear (*Euarctos americanus*), and 4 mountain-lion (*Felis concolor*) claws. We collected another grizzly claw in Room 330 and still another while clearing away fallen masonry and blown sand from an unidentified section of the ruin. The latter two, like those from the repository, were not drilled or otherwise prepared for suspension. According to Hill (1938, pp. 157-160), bear claws and even whole paws are essential in certain Navaho rituals, but the flesh is eaten only when starvation threatens. Bear meat is taboo among the modern Pueblos, and we must suppose it was among their forefathers also.

If dogs, coyotes, and other carnivores were regularly eaten by Southwestern tribes, historic and prehistoric, we have no positive evidence of the fact. Parsons (1939, p. 22) says only compelling necessity would drive the Hopi to such an extreme. But Bourke (1884, p. 253) implies that they actually relished "a good mess of stewed pup," and Stephen (1936, pp. 266, 939) saw two Hopi dogs killed and dressed for leisurely consumption. Thus canid remains from the rubbish piles of Pueblo Bonito may, or may not, indicate that hunger had stalked the village.

Altogether, a dozen Indian dogs and perhaps 30 coyotes are represented in our collection. Only five skeletons were articulated and reasonably complete. Three of these came from Kiva F, Pueblo del Arroyo—one from the floor (pl. 101) and another about 20 inches higher, at bench level. Incomplete skeletons of two dogs, one lacking only the skull, and a coyote were found in Kiva I, same ruin. These and other remains are considered hereinafter (Appendix B) by the late Glover M. Allen, former curator of mammals at the Museum of Comparative Zoology.

In Room 334, Pueblo Bonito, half filled with debris of occupation, we found the detached skulls of a bobcat, a gray fox, two red foxes, a dog, and three coyotes. Present also were three bobcat leg bones and a handful of fox and coyote bones. Why were these eight animals slain and what became of the remainder of their skeletons? The head skins of dogs killed for the purpose cover dog kachina masks of the Hopi (Stephen, 1936, p. 117). Coyotes, foxes, and bobcats are usually taken today for their pelts.

Dr. Allen raises the question whether some of our coyotes and badgers (2 skulls and half a mandible) might have sought shelter in

the ruins and died there. This is possible, of course, but not very probable. With a single exception all the canid bones we collected came from beneath fallen masonry and usually from household rubbish at a depth of 6 feet or more below the present surface. The exception is a coyote skull and neck vertebrae (field No. 1484) found shallowly buried in the depression that marked Kiva R. Except for this lone skull, quite obviously post-Bonito, all our canid remains seem to me undeniably contemporaneous with the ruins in which they were found. Despite the fact that those remains were recovered mostly from debris of occupation, their relative scarcity militates against the idea that dogs and coyotes were customarily eaten. Then, too, there is the puzzle of the headless bodies and the bodiless heads!

The Pueblos had domesticated the dog and the turkey long before the Spaniards arrived. This fact is established both by archeological evidence and by the Conquistadores themselves. The anonymous author of the *Relación del Suceso* states that the Zuñi kept turkeys "more for their feathers than to eat, because they make long robes of them" (Winship, 1896, p. 573). Coronado doubted this limitation, as he wrote from Hawikuh in 1540, because he himself, uninhibited by native custom, considered Zuñi turkeys "very good, and better than those of Mexico" (ibid., p. 559). It is true, nevertheless, that fowl of all kinds have been under a general Pueblo taboo until quite recently.

Three hundred and fifty years after the Conquest, Mrs. Stevenson (1904, p. 368) observed at Zuñi that "chickens are kept for the eggs, the whites of which are used for mixing paints to be applied to wooden objects. The whole egg is sometimes eaten by men to bring them larger families." The four Zuñi men who accompanied me on a reconnaissance of the Chaco region in 1920 may have been unduly cautious, but they always declined the occasional breakfast eggs I offered although they knew at the time that their young relatives had learned to eat eggs at Government boarding schools.

Unworked turkey bones are conspicuous in the trash mounds at Pueblo Bonito. We even found fragments of turkey-egg shells. With the possible exception of deer bones, turkey bones were most frequently utilized in the manufacture of that indispensable household implement, the awl. Thus the ban against turkey flesh, if recognized in prehistoric times, did not extend to the skeleton. Canid bones, on the other hand, were rarely employed at Pueblo Bonito. We have only five implements, for example, made from leg bones of dogs or coyotes. All are awls. In addition, we have an arrowpoint shaped

from what appears to be the ulna of a dog (fig. 69). Fish, also, seem to have been taboo among the ancient Pueblos. At least I find in the archeological literature no reference to fish remains even from ruins situated near rivers and trout streams. Coronado and his countrymen were always glad to add fish to their limited native fare and expressed astonishment that the Pueblos did not. "The Zuñi," observed the unknown author of the *Relación Postrera de Sívola,* "do not know what sort of a thing fish is" (Winship, 1896, p. 569). Navahos avoid fish, so I was told in northern Arizona in 1908, because their ancestors drove the cliffdwellers into the San Juan River where they were transformed into fish.

At modern Isleta, according to Parsons (1932, p. 211), one informant contradicted the statement of another and emphatically denied that fish were eaten locally. The four Zuñi men who accompanied me to Chaco Canyon in 1920, and who patiently watched the preparation of a meager camp supper one rainy night, shrank back in horror when I jestingly identified a bit of salmon skin as rattlesnake. But they shared the contents of the can a few minutes later, albeit with lingering suspicion, after I had pointed to the illustration of a magnificent fish on the wrapper and helped myself to a generous portion.

In what Lummis describes as "the boniest passage in Benavides," Fray Alonso emphasizes the piscatorial possibilities of the Rio Grande in 1630 (Ayer, 1916, pp. 36-37, 261-262). Among others, he names the gar pike. Hence our interest in the identification of nine gar-pike (*Lepisosteus* sp.) scales (U.S.N.M. No. 334958) from Room 44, Pueblo del Arroyo. The gar pike is not recorded from the Rio San Juan, 50 miles to the north, and any fish would have been as great a curiosity in Chaco Canyon a thousand years ago as it would be today. Although we found none in Pueblo Bonito, Pepper reports a fishbone from Room 32.

Elderly Navaho assert that the Chaco country was a veritable paradise before white men came, and most of us can sympathize with their point of view. None will deny that introduction of firearms and horses, cattle, and sheep brought significant changes. Nevertheless, even with the superior range we postulate a hundred years ago, and the increased herds that range would have supported, game alone could not have fed any considerable population. The inhabitants of Pueblo Bonito could probably have slaughtered in a single season every animal within a day's journey, had they been of a mind to do so. But they were farmers, not hunters. The relative infrequence of mammal bones in their rubbish heaps is ample proof that the Bonitians did not depend upon the chase for their subsistence. Their

appetite for maize, beans, and pumpkins—staples in Anasazi fare for uncounted generations—was an inherited appetite. Thus their reliance upon crops from these three cultivated plants was perfectly natural.

Agriculture is a gamble, especially in the Pueblo country. Rains there are unpredictable. Lacking sufficient midsummer moisture, crops do not mature. When harvests fail, people go hungry. Tradition and personal experience both reminded the Pueblo farmer that years of little rain occurred repeatedly. Hence the wisdom of providing, when crops were good, against the possibility of lean harvests. And many Hopi and Zuñi families still follow this centuries-old custom even now, although a village grocery store may stand a stone's throw away.

Throughout the Pueblo country summer rains, rather than winter snows, supply the moisture on which plants grow and ripen. But summer rains frequently fall below normal; they may fail altogether and for two, three, or four years in succession. Dr. Douglass's 1,200-year tree-ring record of southwestern climate, a byproduct of our search for the age of Pueblo Bonito, reveals a surprising number of dry years (Douglass, 1929, 1935, 1935-1936). The Great Drought of 1276-1299 had no effect upon the inhabitants of Pueblo Bonito because they had abandoned Chaco Canyon at least a hundred years before. It was a succession of lesser droughts in the last quarter of the eleventh century, especially that of 1090-1101, that presumably hastened the arroyo which forced emigration of the Bonitians. Since 1540, droughts in the Southwest have repeatedly caused Indian groups to leave their homes and go out seeking temporary relief from others, even from their traditional enemies.

No one can study this testimony of the tree rings without realizing how precarious the Pueblo subsistence problem has always been. Hooton (1930, pp. 317-320) sees in the skeletal remains from Pecos evidence of progressively declining health and attributes that decline to "continual undernourishment." Dietary deficiency is accepted as the probable cause of *Osteoporosis symmetrica,* a condition frequently noted in the crania of Pecos infants and children. The same disease was also present at Pueblo Bonito and doubtless for the same reason, too much maize. Arthritis also left its mark at both villages. Corn, beans, and pumpkins were subsistence staples, but they were not enough at Pecos in 1800 or at Pueblo Bonito 700 years earlier.

PLATE 14

Upper: A prehistoric irrigation ditch near Kinbiniyol ruin reenforced on the downgrade side by masonry and sandstone slabs on end.

Lower: Sandstone slabs and masonry reenforcing a section of the gravel-filled prehistoric irrigation ditch near Kinbiniyol ruin.

(Photographs by O. C. Havens, 1925.)



PLATE 15

Upper: A Hopi cornfield near Oraibi pueblo.

Lower: An Oraibi woman sorting the harvest—white ears to the left, red and blue ears to the rear, and the best of each saved for seed.

(Photographs by O. C. Havens, 1924.)



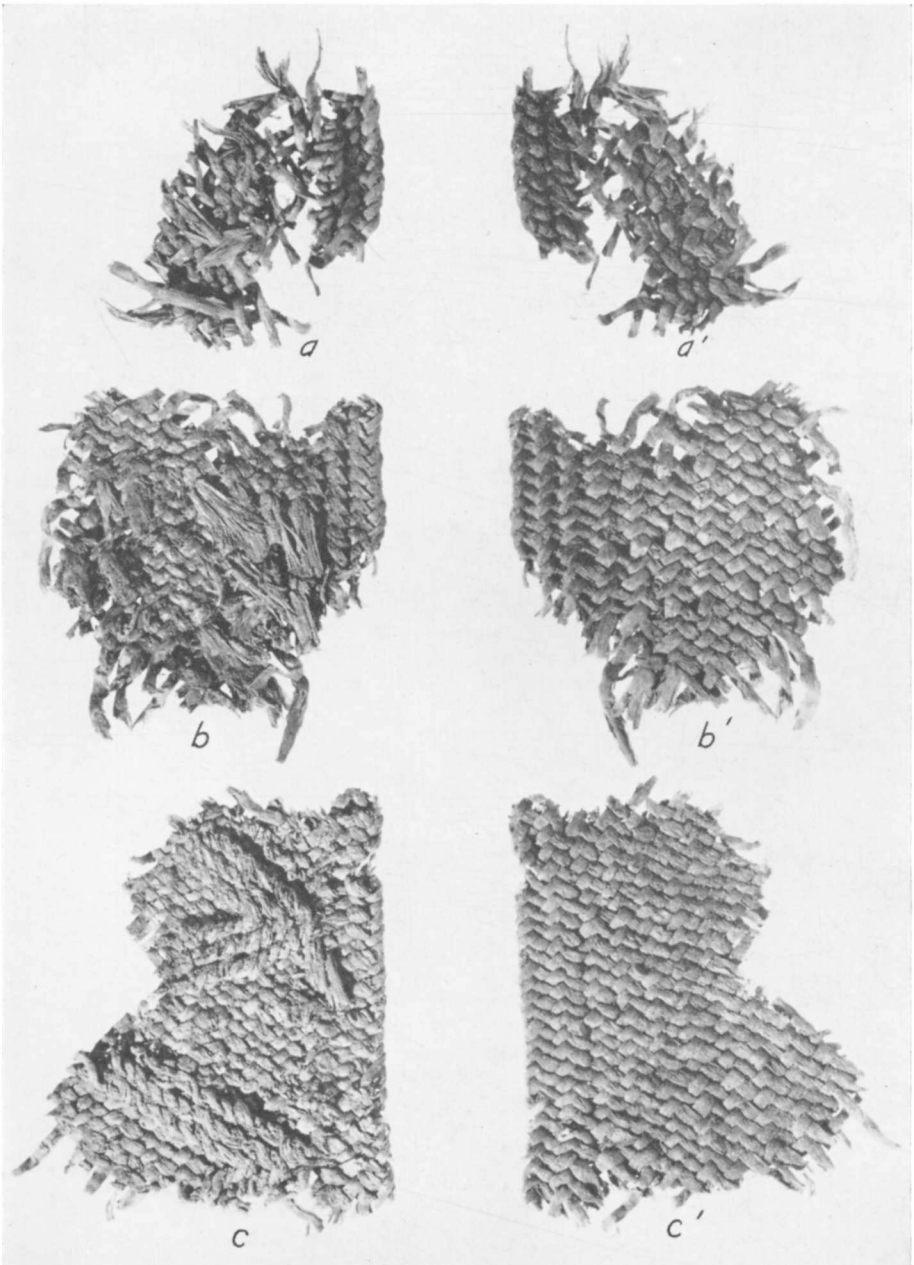


PLATE 16.—Fragments of sandals woven with narrow strips of yucca leaves. Left (*a*, *b*, *c*): sole; right (*a′*, *b′*, *c′*): upper side.

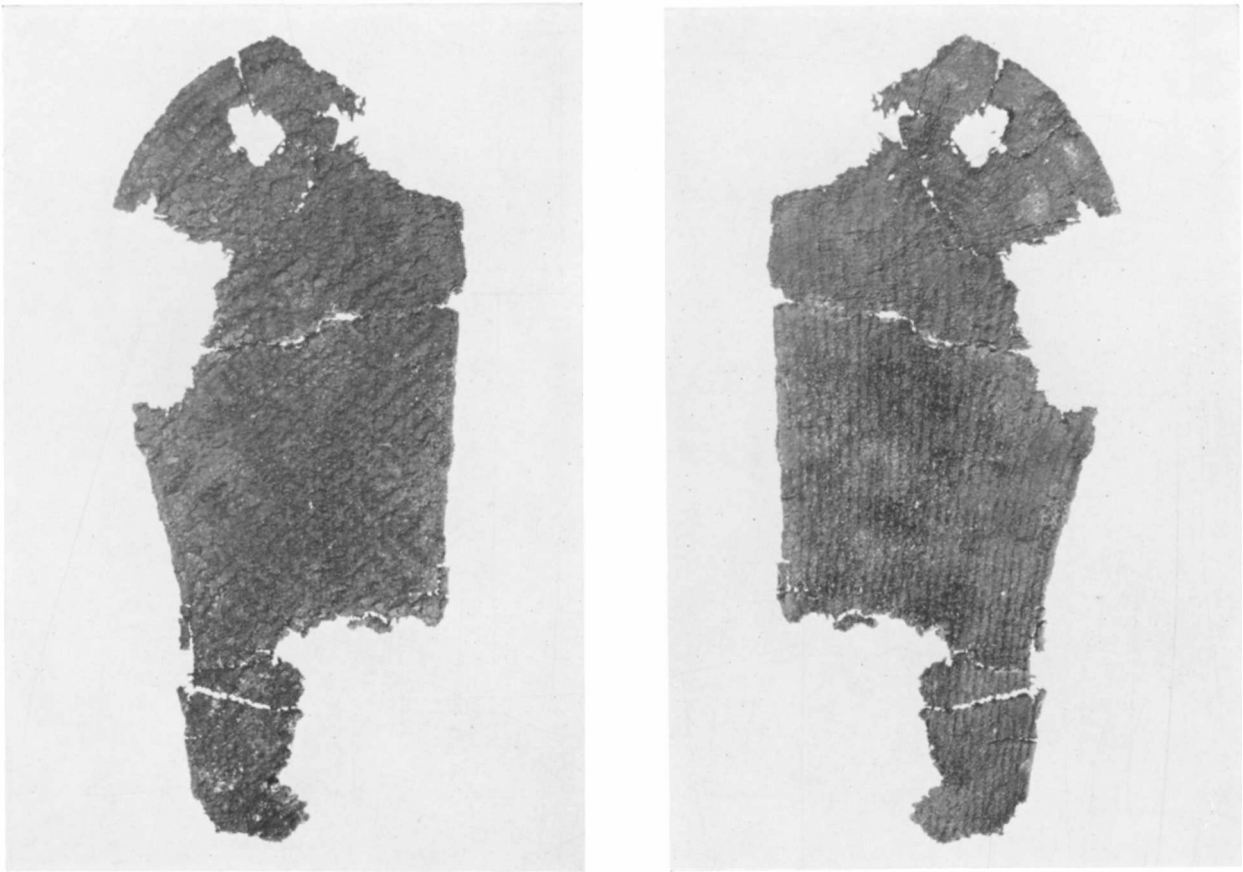


PLATE 17.—Lower (left) and upper sides of a charred cloth sandal from Room 298.

III. DRESS AND ADORNMENT

We gathered little tangible evidence regarding the clothing worn at Pueblo Bonito—a few scraps of cotton cloth, sandal fragments, and feather-wrapped cordage, nothing more. Except one tiny bit of open-work stuff (U.S.N.M. No. 335346), all the cloth fragments are of plain weave. Pepper (1920, p. 108) reports another exception, a piece of diagonal-twilled weaving in three colors from Room 25. His findings and ours together do not provide enough examples on which to base an estimate of the quality and variety of Bonitian fabrics. Confronted by this lack, we turn once more to the results of archeological inquiry elsewhere, and to early historic records, to learn how the Bonitians might have dressed 900 years ago.

Weaving techniques practiced by the prehistoric Pueblos have been summarized by Amsden (1934, pp. 1-7); discarded garments recovered from Arizona cliff dwellings approximating Pueblo Bonito in age have been described by Guernsey (1931), Haury (1934), and others. These descriptions, more detailed than those of Spanish priests and soldiers who participated in the Conquest, clearly prove that in prehistoric times, as in the sixteenth and seventeenth centuries, Pueblo clothing was made of vegetable fibers or tanned skins, depending largely upon environment or the availability of materials. Skins only were worn at Taos, northernmost of the Tigua settlements, in 1540 (Winship, 1896, p. 575). Although cotton was then cultivated from the Rio Grande Valley on the east to the Hopi mesas on the west, it was more generally utilized in the latter district. Prior to 1680 nearly every Spanish visitor to the Hopi villages was the recipient of generous gifts of "towels" and other textiles; several remarked with surprise the extent to which cotton was locally grown.

From documents written between 1540 and 1600 we learn that Pueblo men were then wearing cotton breechcloths, shirts, and blankets, and buckskin jackets and robes; Pueblo women, cotton skirts and blankets bound at the waist with a sash, tanned deerskins, and footgear of buffalo hide and buckskin. The dress of the Tiguas proved especially pleasing to Gallegos, chronicler of the intrepid Rodríguez Expedition, after anxious days among sullen tribes on the barren wastes of south-central New Mexico in 1581. He wrote—

> These people are clothed like the others. I wish to describe here their garments, because, for a barbarous people, it is the best attire that has been found

among them. . . . The men have their hair cut in the fashion of caps. . . . Others wear their hair long, to the shoulders. . . . Some adorn themselves with painted cotton pieces of cloth three spans long and two thirds wide, with which they cover their privy parts. Over this they wear, fastened at the shoulders, a blanket of the same material, painted with many figures and colors. It reaches to their knees like the clothes of the Mexicans. Some, in fact most of them, wear cotton shirts, hand painted and embroidered, that are very charming. They wear shoes. Below the waist the women wear cotton skirts, colored and embroidered, and above, a blanket of the same material, painted and worked like those used by the men. (Hammond and Rey, 1927, p. 265.)

A year later, in a nearby Keresan village, Luxán was less impressed by what he saw. "The dress of the men consists of some blankets, a small cloth for covering their privy parts, and other cloaks, shawls, and leather shoes in the shape of boots. The women wear a blanket over their shoulders tied with a sash at the waist . . . and above a blanket of turkey feathers. It is an ugly dress indeed." (Hammond and Rey, 1929, pp. 84-85.)

Coronado's initial impression of Zuñi men was that they lacked the intelligence to build the houses in which they dwelt because most of them wore nothing but a breechcloth (Winship, 1896, p. 558). It did not occur to him that in late July Pueblo men, daily at work in their fields, habitually wear just as little as custom permits. One of Coronado's companions, the unknown author of the *Relación Postrera de Sivola,* had at least a year's observation behind him when he wrote: "Some of these people wear cloaks of cotton and of the maguey and of tanned deer skin, and they wear shoes made of these skins, reaching up to the knees. They also make cloaks of the skins of hares and rabbits, with which they cover themselves. The women wear cloaks of the maguey, reaching down to the feet" (Winship, 1896, p. 569). Castañeda, narrator of the expedition, is more precise: "The women wear blankets, which they tie or knot over the left shoulder, leaving the right arm out" (Winship, 1896, p. 517)—a description that readily identifies the two-part wool garment Zuñi matrons still wear over a white, machine-made underdress.

With his letter of August 3, 1540, written at Hawikuh two weeks after he had subjugated this the first of the Seven Cities of Cibola, Coronado dispatched to the Viceroy "twelve small mantles, such as the people of this country ordinarily wear" and, as a special token, two cloths "painted with the animals which they have in this country" together with an embroidered garment "of very good workmanship"—the first of its kind the captain-general had seen in the New World (Winship, 1896, p. 562). Obviously, then, Fray Estevan de Perea was generalizing when he wrote of the Zuñi, in 1629: "The women

dress themselves in cotton, and the men in buckskins and hides" (Bloom, 1933, p. 228).

Descriptions of clothing worn in the various pueblos between 1840 and 1885 show that native fashions had not been appreciably altered by 300 years of Spanish example and priestly exhortation. Fragments found in cliff dwellings of the twelfth and thirteenth centuries are of the same materials and indicate garments of the same general type as those that Castañeda, Gallegos, Luxán, and others saw in Pueblo villages prior to 1600. Thus we are entirely justified in assuming that the scraps of yucca sandals, cotton cloth, and turkey-feather robes recovered at Pueblo Bonito represent clothing almost, if not quite, like that of the Conquest period. Both early and late, cotton was woven into squares or rectangles and these were stitched together at two corners to form a poncholike cloak that dropped over the head and left the arms free. There was no cutting and fitting; a belt or sash gathered excess material at the waist.

Yuccas still grow on the mesas overlooking Chaco Canyon, but the source of the cotton once used there is less certain. The altitude is perhaps too great, the nights too cool, for successful cultivation of this tropical plant. No bolls, seeds, or stem fragments were unearthed during our explorations. Presumably, therefore, the Bonitians obtained from tribes to the west or south squares of cotton cloth which they tailored to suit their own fancies. The Hopi were raising large quantities of cotton and trading it, chiefly as woven fabrics, to other peoples when the Spaniards first went among them. They were still selling both finished goods and lint to the Zuñi in 1881. The Zuñi were then weaving cloth resembling that of the Hopi; Hopi and Zuñi textiles were being bartered in Rio Grande villages (Bourke, 1884, pp. 34, 244). Luxán states that, in passing from Walpi to Shongopovi in 1583, the Espejo Expedition "marched two leagues, one of them through cotton fields"; he includes among Hopi gifts to the expedition "much spun and raw cotton" and over 2,600 "blankets, large and small." (Hammond and Rey, 1929, pp. 98, 100-102; see also Hodge, *in* Ayer 1916, p. 56, footnote.) And after 350 years, although native cotton no longer has a place in their economy, the Hopi are still recognized as the most skillful weavers of it in the Southwest.

Apparently the Hopi valleys, at an elevation of about 5,800 feet, mark the upper limit at which the early-maturing cotton *Gossypium hopi* can profitably be grown. Cloth fragments and a hank of yarn preserved in the National Museum from cliff dwellings in southwestern Colorado and southeastern Utah suggest that cotton may formerly have been cultivated by Pueblo peoples in the deep sheltered

gorges north of the Rio San Juan. But we know from historical records that the Zuñi grew little, if any, of it at the time of the Conquest (Jones, 1936), and their fields lie at approximately the same elevation as those of the Bonitians, 6,200 feet. From data now available, therefore, it seems unlikely that cotton for weaving purposes was ever raised in Chaco Canyon.

Fragments of leather garments are even fewer at Pueblo Bonito than those of vegetal fibers. Indeed we found little more than tailor's waste—trimmings such as the edges of hides perforated for stretching pegs and one patched piece of fawn skin with the hair still adhering. A few scraps, exceedingly thin, appear to be tanned rodent hide, but they are too altered for positive identification; they may be parts of a shirt or a light blanket or even a small bag. Pepper (1920, pp. 31, 97, 103, 105) reports the finding of buckskin bags as well as pieces of rawhide and buckskin, occasionally painted. Like vegetal matter, leather soon decays unless protected from moisture, and there are few corners of Pueblo Bonito into which rainwater has not permeated.

Blankets.—The reader will have observed that, in the foregoing references to historic Pueblo dress, blankets are mentioned more than once—blankets of yucca fiber, of cotton, of turkey feathers and rabbit skins. They were used as shawls by day, as bedding at night. Those of fur or feathers naturally provided most protection on chilly mornings and in winter. So far as we know whole rabbit skins were never employed—only narrow strips of hide, and these were wrapped spirally around yucca cords to produce a furry rope half an inch in diameter. So, too, with feathers—only the web or vane was utilized. The technique of manufacture was such that the cordage which gave the blanket strength was completely concealed by the fragile wrappings that provided warmth.

Both feather-string and fur-string robes were produced in the Southwest as early as Basket Maker days. The fur robe is commonly regarded as the older of the two; the feather robe was predominant in Pueblo III times. Castañeda and his fellow chroniclers mention both kinds but those of fur most frequently. Fur blankets were still widely used throughout the Hopi villages when Bourke visited them in 1881. He reports "great numbers of coverlets of mixed wool and fur—loosely stranded woolen framework with long strips of coyote and rabbit fur fastened in—which are made to serve as mattresses, blankets, and curtains for the doors in cold, windy weather." Apparently fur blankets were everywhere preferred but at Shipaulovi Bourke also observed "a few . . . of wool, still fewer of cotton." (Bourke, 1884, pp. 134, 304.)

In this modern Hopi version of the ancient fur-string robe, wool yarn has replaced yucca cordage as the basic material. Mrs. Colton (1938, p. 14), describing present-day methods of manufacture, observes that, in Hopi communities where men are the recognized weavers, the one textile women customarily make, and then only in secret, is the rabbit-skin blanket. We cannot say that women made all the heavy robes used at Pueblo Bonito, but every fragment we recovered showed a strip of feather spiraled about a yucca cord. However, it is entirely reasonable to believe an occasional fur-cloth blanket was also produced locally. Portions of one or more cotton blankets, or garments, lay beneath two adjacent, disturbed burials in Room 329. The fragments saved show several folds of fabric with selvaged edge, plain-twilled, 20 warps and 34 weft threads per inch (U.S.N.M. No. 335349).

Like those of cotton, feather robes varied in size. In a small room in the old, northwest quarter of Pueblo Bonito, Moorehead unearthed the remains of a feather-cloth blanket the original dimensions of which he gives as 1.3 by 2 meters (4′ 3″ by 6′ 7″) (Moorehead, 1906, p. 34). Guernsey (1931, p. 102) reports two from a Pueblo III burial in northeastern Arizona. One measured 18 by 26 inches; the other, incomplete, was 46 inches long. That the use of fur- or feather-wrapped string was not restricted to blankets is evident from the feather-cloth jacket Hough (1914, p. 72) found on a desiccated body in a cave overlooking the Rio Tularosa, southwestern New Mexico, a district that sent earthenware vessels in trade to Pueblo Bonito at the beginning of the twelfth century. Fur or feather blankets were also used by certain California tribes. On the opposite side of the continent, as Jamestown was being colonized, Capt. John Smith observed an occasional Virginia Indian wearing a blanket of turkey feathers "so prettily wrought and woven with threads that nothing could be discerned but the feathers" (Smith, 1819, p. 130).

Sandals.—Of 15 sandal fragments in hand, 6 are made of yucca leaves and 9 of *Apocynum* string. The one most nearly complete (fig. 8) from the second story of Old Bonitian Room 320, is rather an impromptu creation—loosely plaited blades of the broad-leafed yucca (*Y. baccata*); a leaf strip, inserted between plaits 3 inches from the toe and knotted beneath, provided a simple means of attachment. Five other fragments are twill-woven of split yucca, over-two-under-two. The present width of their component strips varies from one-sixteenth to one-fourth inch. Raised sole patterns are present on two fragments, one of which is shown as figures *c, c′* on plate 16. Here the "ground gripper" is composed of three parallel ridges, each of



FIG. 8.—Sandal woven of broad yucca leaves. (Drawn by Hashime Murayama.)

which was formed simply by twining a pair of yucca strips alternately through the sole stitches. Sandals twill-plaited of narrow yucca strips, with a notch or jog on the outer edge just forward of the little toe, are a diagnostic trait of the Pueblo III period and undoubtedly were standard footgear of the Late Bonitians.

Of the three complete sandal figures incised on the south-wall plaster of Room 251, two are undecorated and one of them, unusually pointed at the end, illustrates the little toe notch (fig. 9). A pair of ornamented sandals, one of which is plainly notched, was incised on the north wall of Old Bonitian Room 83 (Pepper, 1920, p. 272, fig. 115). Thus contemporary sketches suggest that both notched and unnotched sandals were worn at Pueblo Bonito and that some of them were decorated.

In contrast with those of yucca, cloth sandals evidence a vast deal of work not only in weaving but also in the gathering and preparation of materials. Our nine fragments, or groups of fragments, are all fashioned from the hemplike fibers of dogbane (*Apocynum* sp.); all are twined; several bear raised geometric patterns, ribs, or nodes on the sole. Only one preserves the outer edge of the forward part, and on this there is no little-toe jog. Six came from Old Bonitian houses; three from rooms of third- and fourth-type masonry, and one of these, Room

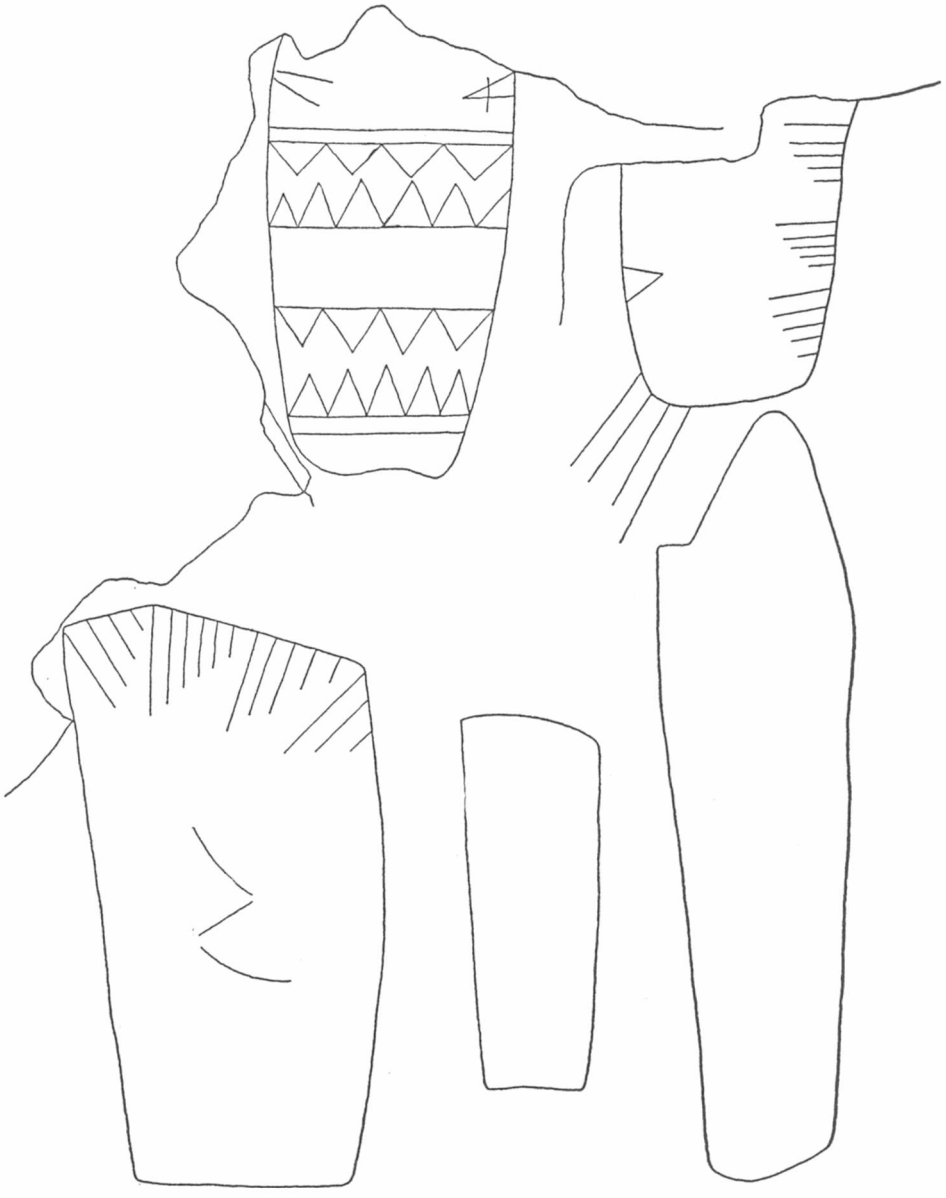


FIG. 9.—Sandal figures scratched in the wall plaster, Room 251. (Lower left figure given as *c* in table of size and provenience.) (Drawn by Irvin E. Alleman from the original field sketches.)

246, had been utilized as a neighborhood dump. The decayed fragments of an exceedingly thin pair were unexpectedly brought to light in the National Museum laboratories while removing the sandy contents of an oval basket (U.S.N.M. No. 335306) from Room 326.

Taking the series as a whole, the highest number of warps noted is 13 to an inch. Weft threads, apparently 2-ply *Apocynum* in every instance, vary from 26 to 46 to the inch. Remarkable for their thinness (of seven measured, three are 2.5, one 3.0, three 3.5 mm.), it seems incredible that sandals such as these were intended for everyday wear on sand and sandstone. And yet there is no reason to believe otherwise. Neither from historic nor prehistoric pueblos do we have the slightest evidence of a sandal made exclusively for use in ceremonials. Our lone fragment bearing a design in color came from Pueblo del Arroyo (U.S.N.M. No. 334714) and will be described elsewhere.

Although I have made no attempt to analyze the technique of weaving in our cloth sandal fragments,[13] some results of superficial examination might prove welcome. From Old Bonitian Room 298 we have an incomplete charred specimen whose original length was at least 10¼ inches; maximum width, 4¼ (pl. 17). It was made for the right foot. Its 30 warps consist of 15 rather stiff 3-ply yucca cords, each of which extends from the heel forward and back again. The middle one, reaching only to the ball and there looped with a slight inclination toward the great toe, was arranged first; paralleling it, up one side and down the other, followed the remaining cords in succession. The heel, which now lacks its selvage, was about 3 inches wide and doubtless slightly cupped by gathering and fastening the warp ends. A raised geometric pattern covers the sole (fig. 10).

This same peculiar arrangement of warp cords is to be seen in each of the only additional fragments, three in number, that preserve the forward end. Two of these, both apparently for the left foot, were found among the rubbish in Room 246. The better of the two is shown in figure 11. Our sketch, traced from a photograph, shows the sole because it is the more interesting side. Some of its warps have been exposed by wear; the change in weft alignment (at 2:30 o'clock) is perfectly evident; the knotted end of a leather toe loop is visible and, above and to the left of it, a quarter-inch hole through which the companion knot had been pulled. (The indistinct pattern of raised nodes is not represented in our drawing.)

Pivoting on the ball, and assuming the sole to have been the work

[13] For such a study, see Kidder and Guernsey, 1919, pp. 100-107; Kidder, 1926, pp. 618-632.

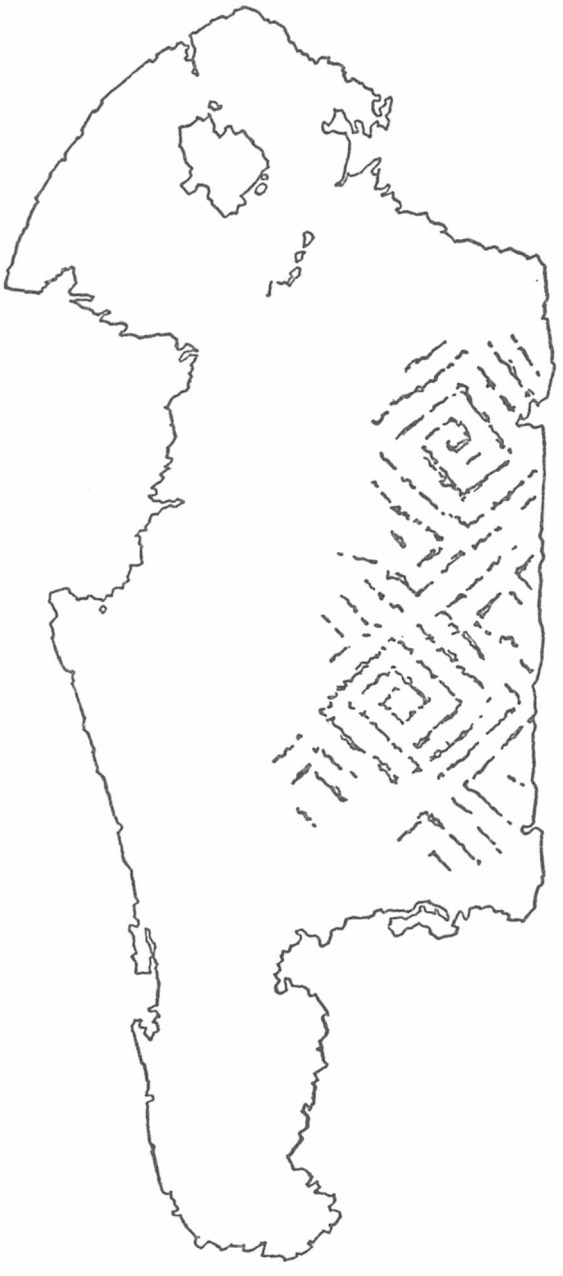


FIG. 10.—Pattern on sole of charred cloth sandal from Room 298. (Drawn by Hashime Murayama.)



FIG. 11.—Fragments of a cloth sandal showing foundation of weave. (Drawn by Hashime Murayama.)

surface, weaving apparently was begun at about 8:45 and continued thence, embracing only half the warps, clockwise to 2:30. Here a change in direction was forced by the angle in the warps and, to help surmount the difficulty, a long V-shaped filler was introduced. Thereafter the weft threads were carried all the way across. These several features are clearly seen in the sectional enlargement on plate 18.

When these fragments were assembled between glass for preservation, the two detached pieces shown in our drawing might well have been omitted. That on the right, with paired holes for heel lashings, could belong, but the other is most likely from a third sandal. At least I find no definite place for it among the fragments that comprise our two mounted specimens. Its warps possess a curvature that fixes its position either forward at the ball or at the heel, where we have it. But, in this latter position, observe that the warps possess an outward bend corresponding to the inward turn at the toe. Such an arrangement could have been brought about only by a single long warp cord, doubled and looped about from the middle outward to the very edge. This layout, it seems to me, would have introduced so many complexities and difficulties as to discourage even the most patient of Anasazi weavers. Numerous spacers would have been required to keep the 32 warps equidistant at the curved ends and in between. Therefore, I believe we erred in placing this particular fragment. The simpler warp arrangement in the charred specimen from Room 298 probably held for all.

For these cloth sandals there was no supporting frame. Twined weaving, and the wrapping and knotting of stitches that produced raised designs on the sole, necessitated flexible warps. Yet the fine fibers employed in Bonitian cloth sandals were so flexible, warp and weft alike, and the sandals themselves so very thin, that it seems utterly impossible they could have been woven, even with warp spacers, freehand as were those of plaited yucca leaves. However, I detect in our fragments no provision for suspension during the weaving process.

On the fragments before us attachment loops have not survived. Even so, two pieces among those from Room 246 show paired holes punched through between the second and third outermost warps for heel tie strings the size of a pencil lead; another retains on its under side the knotted end of a leather toe loop. The charred specimen from Room 298 (pl. 17) probably had a similar toe loop, knotted below, and an ankle wrapping attached to the extreme rear edge of the sandal or to its projecting warp ends. Although none of our fragments exhibits the familiar little-toe notch, we assume this was a common feature of Pueblo Bonito sandals, especially those twill-plaited of

narrow yucca strips. Pepper (1920, pp. 93-95) notes its presence on several of the specimens he recovered from Room 24 (N.G.S. Room 229B). One of these was woven of "some very fine white vegetable fiber" and boasted a fretted design in brown and orange-yellow. Its heel was intentionally cupped; its toe loop had been repaired with a buckskin thong passed through the fabric and knotted on the under side. At Aztec Ruin, Morris (1919a, p. 50) unearthed 20 twined-cloth sandals, all of which were provided with the toe jog and a slightly cupped heel.

Together with a sandal "made from feather cord and quilted with a heavy cord of human hair," from Room 25, Pepper reports fragments of two turkey-feather stockings. Comparable specimens, from northern Arizona caves, are described by Kidder and Guernsey (1919, p. 100); an unusually fine example from southeastern Utah, now in the U.S. National Museum, covered both foot and calf. Pueblo men wore knee-length buckskin leggings, dyed to match their moccasins, in 1540; identical garments were still common at Zuñi in 1879 when, according to Mrs. Stevenson (1904, p. 371), Zuñi men knit footless stockings not only for themselves but also for the female members of their families. Wool from Spanish sheep merely replaced the fur- or feather-wrapped cord of an older day. Even now, despite general adoption of American-made shoes, footless stockings are commonly worn by the Navaho and Hopi, as well as by the Zuñi.

The meagerness of our findings concerning their clothing is at least partially compensated for by abundant data relating to the ornaments with which our Bonitians bedecked themselves. Indeed, from the number and diversity of those ornaments we may be quite sure the inhabitants of Pueblo Bonito did not want for clothing—the best that could be obtained anywhere in the Southwest.

ORNAMENTS

Free from the influences that so often determine our own choice of objects for personal adornment, primitive man finds beauty in relatively simple things—brightly colored rocks, feathers, and flowers. His preference will generally settle upon some product of the locality he calls home, but it may go winging off to distant lands. Thus the Pueblo Indians, to whom New Mexico turquoise is extraordinarily precious, have, during many generations, sent periodically to the Pacific for certain kinds of seashells.

In 1910 an old resident of San Ildefonso told me he had as a young man twice ridden horseback from his Rio Grande village to the west coast to obtain shells. Bandelier (1892, p. 4) states that the Pueblos

secured most of their shells from the Gulf of California; that until 1859 they "made annual trading expeditions into Sonora, exchanging blankets, buffalo robes, turquoises, etc., for shells, coral, and parrots' feathers." Feathers were wanted for use in rituals; shells, chiefly for beads and pendants. Pendants and beads of various types, and of diverse materials, have been popular Pueblo ornaments since earliest times.

However much the average Pueblo Indian may prize jewels made from Pacific shells, he holds those fashioned from turquoise in still higher esteem. For turquoise, he thinks, is a gift from the gods, symbolizing the west; it reflects the blue of both Pacific waters and New Mexico's summer skies.

Wherever turquoise outcrops in the Southwest one sees evidence of aboriginal mining operations. Fray Gerónimo de Zárate Salmerón, reporting upon his observations in New Mexico between 1618 and 1626, refers to turquoise mines "which the Indians work in their paganism, since to them it is as diamonds and precious stones" (Hodge, *in* Ayer, 1916, p. 217).

Most extensive of all are the old diggings in the Cerrillos district, about 25 miles southwest of Santa Fe. Here, in 1911, the main pit measured fully 200 feet across and 130 feet deep; waste from this single aboriginal mine covered more than two acres, and in it stone hammers and other primitive quarrying tools were frequently found. Pogue (1915, p. 52), from whose monograph the foregoing figures are taken, believed most of the excavation was made before advent of the Spaniards and that this and other Cerrillos mines supplied a large portion of the turquoise distributed throughout the southwestern United States and Mexico prior to 1540. This belief has been greatly strengthened within the past 10 years by archeological investigations at Chichen Itzá, Yucatán (Morris, 1931, p. 218), Monte Albán, Oaxaca (Caso, 1932, pp. 509-510), and other prehistoric cities in Mexico.

Although none has yet been found, Dr. Caso believes turquoise mines exist in Oaxaca and Guerrero and were worked in pre-Conquest times. He bases his conviction on two facts: Indian towns in those states are credited in the Aztec tribute books with payments in turquoise; the quantity of turquoise recovered at Monte Albán is such that one cannot believe all of it originated in far New Mexico.[14]

Some of the gifts sent by Montezuma to Cortés in 1520 were orna-

[14] In Mexico City in the autumn of 1935 archeologists and geologists expressed to me their convictions that ancient turquoise mines eventually will be found also in the states of Aguascalientes, Zacatecas, and Baja California.

mented with turquoise mosaic. Until nearer, adequate sources have been discovered, it must be assumed that the Aztecs, Zapotecs, and Mayas obtained much, if not all, of their turquoise indirectly through trade from New Mexico and Arizona. In contrast, the southerners found in the northern country no market for the native Mexican jades which they themselves valued above all other minerals. At least jade never has been reported, so far as I am aware, from one of our Southwestern ruins.

Turquoise is prized by desert peoples the world over but by none more than the Zuñi. Both men and women take vast pride in their wealth of personal ornaments and let pass no fitting occasion for its display. Summarizing their mythology, Pogue (1915, p. 123) notes that the Zuñi believe "perfect blue turquoise is male; the off-color, female. Their upper world is symbolized by the sun, eagle, and turquoise. . . . The west, also, is known as the blue world, 'not only because of the blue or gray twilight at evening, but also because westward from Zuñiland lies the blue Pacific.' " Turquoise Man, who lives in a sacred mountain southwest of Zuñi salt lake, came from Santo Domingo (Stevenson, 1904, p. 58).

From earliest times the Zuñi obtained most of their turquoise from the mines at Los Cerrillos by trade, first with the now extinct Tano and, later, with the Keres of San Felipe and Santo Domingo (Hodge, 1921, pp. 5-6). What they did not keep for themselves they passed on, through exchange, west and south to other tribes. It was the tale told by a Mexican Indian, be it remembered, who as a youth had gone with his father to the Zuñi villages to barter parrot feathers for turquoise, that in 1529 initiated Spanish search for the mysterious Seven Cities. Eleven years later Coronado's army advanced along the same path these traders had followed.

With all this in mind, and with knowledge of the extent to which aboriginal mining operations were carried on both before and after the Conquest, it is rather surprising that turquoise is so seldom found in Southwestern ruins. Of the many explored and reported upon by archeologists, Pueblo Bonito alone has yielded turquoise ornaments in quantity.

Describing the remarkable series of artifacts he recovered from Room 33, Pepper (1909, pp. 222-225) lists nearly 15,000 turquoise beads and pendants among the objects accompanying burials 13 and 14. The stones from which these were made, he states categorically, came from Los Cerrillos. Now this certainly is the most logical source both because of its proximity—but little more than 125 miles by trail from Pueblo Bonito—and because the old Tano mines have long been

famous for the rich color of their mineral. Many Bonitian ornaments seem quite as blue as the best turquoise produced at Los Cerrillos.

Appearance is not enough, however. Both good and worthless turquoise may come from the same mine, even the same vein. One piece holds its color while another fades. Most of the turquoise mined is discarded because of its unfavorable color. Sky-blue tones have everywhere been preferred, but the ancient Pueblos were not averse to those of lesser merit. The Bonitians, for example, often used pale blue or greenish stones for mosaics and beads; less frequently, for pendants. And, with native canniness, when called upon to make personal offerings they sacrificed their off-color ornaments first. We noted relatively few prize stones in ceremonial offerings.

Pepper's conviction that Los Cerrillos was the principal source of Pueblo Bonito turquoise seemed reasonable but unproved. So we selected from our series those few ornaments to which matrix still adhered and submitted them for mineralogical examination. In each case the feldspars had been so altered through use that satisfactory comparison with mineralogical samples could not be made. Spectrochemical analyses likewise failed to identify our specimens with known sources. While the better beads and pendants agree in color most closely with ores from Los Cerrillos and the Jicarilla Mountains in New Mexico and the Mineral Park and Kingman fields in Arizona, color alone is an inadequate diagnostic. Thus we do not yet know whether the Bonitians looked east or west for the turquoise with which they were so prodigal.

One of our Chaco Canyon neighbors, Old Wello, in 1925 expressed his conviction that the Bonitians mined their own turquoise in Rincon del Camino, a mile below the pueblo, and indicated a shallow cave near Dan Cly's house where great blocks of sandstone had been undercut by seepage. However, friend Padilla countered, and quite correctly, that New Mexico turquoise never occurs in sandstone.

In their day the Bonitians were known far and wide for the quality and quantity of their turquoise ornaments. But they used other minerals also, both local and foreign, the seeds of certain trees and shrubs, and a variety of Pacific shells. From these diverse materials their lapidaries fashioned rings, pendants, beads, and bracelets.

Beads.—Excepting the olivellas, most beads in our collection are discoidal. They are made of shell, slaty or tufaceous stone, and turquoise; they vary in diameter from 2.0 to 13.0 mm. The smallest are turquoise, the largest, shell. Approximate averages are: Turquoise, 4; shell, 5; and stone, 6 mm., respectively.

In one lot of 800 miscellaneous turquoise beads (U.S.N.M. No.

335730) diameter varies from 2.0 to 10.3 mm.; thickness, from less than 1 to 6.8 mm. All are flat-sided except three, and two of these are planoconvex in cross section while the third has both edges rounded (fig. 12). Perhaps a half dozen similar specimens were noted among oblations from kiva pilasters; also, a few cylindrical turquoise beads, the largest of which measures 12.0 mm. in diameter and, with both ends broken, 15 mm. long (U.S.N.M. No. 335973).

Our most treasured turquoise ornament was found quite by chance. Baskets, earthenware vessels, and disarticulated skeletons had been encountered deep in Room 320, and I had joined the two Zuñi men working there. The floor was half cleared, and we were preparing to remove a couple of baskets from below the east door when I had a sudden impulse to turn once more to the north end. The second stroke of my trowel on a floor already swept with hand brooms brought several beads to light. A few moments more with awl and brush and

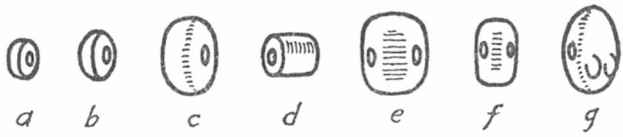


FIG. 12.—Variations in turquoise beads. (Drawn by Irvin E. Alleman.)

there lay a carefully coiled turquoise necklace, accompanied by two pairs of marvelously blue eardrops (pl. 9, A).

I cannot adequately describe the thrill of that discovery. It was so unexpected, so unforeseen. A casual scrape of a trowel across the ash-strewn floor, a stroke as mechanical as a thousand other strokes made every day, exposed the long-hidden treasure. Room 320 had been paved with flagstones, and it is my impression that a hollow between two flags had been deliberately chosen as a hiding place; that the necklace had been coiled and laid within and the whole concealed by a handful of sandy mud that was spread out, and packed down, and then disguised with ashes until the patch was indistinguishable in the room's darkness.

The speed with which news of the find reached other workmen distributed about the ruin was remarkable. In a matter of minutes every Zuñi, every Navaho, and every one of my white assistants was draped over the wall above and looking down upon our spectacular find. No word, no signal, so far as I know, ever left the room. We were down about 12 feet, the two Zuñis and I, and completely absorbed with the task of brushing and blowing the sand away from the beads and pendants. And then I was suddenly aware of our audience. In response

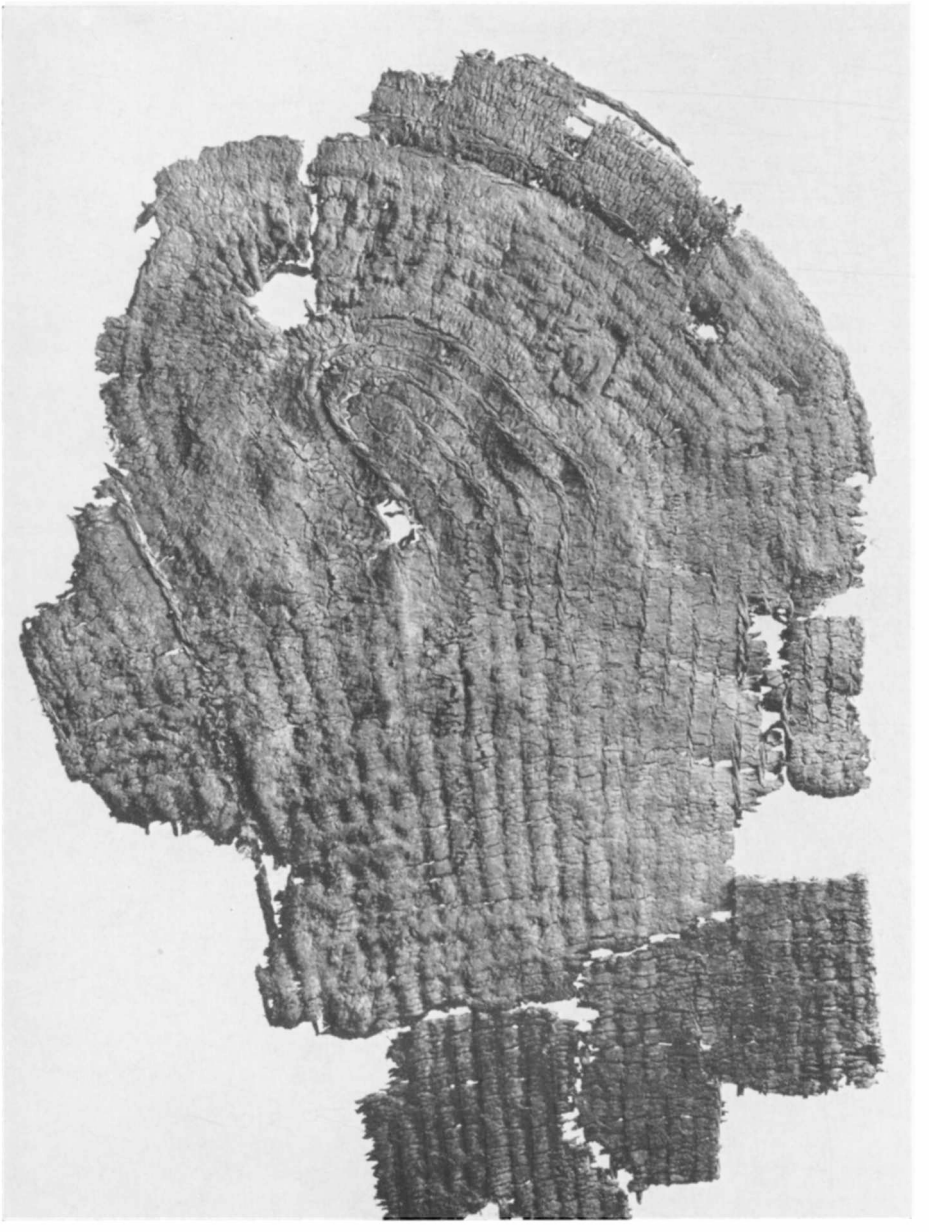


PLATE 18.—The worn sole of a cloth sandal reveals the technique of its weaver.

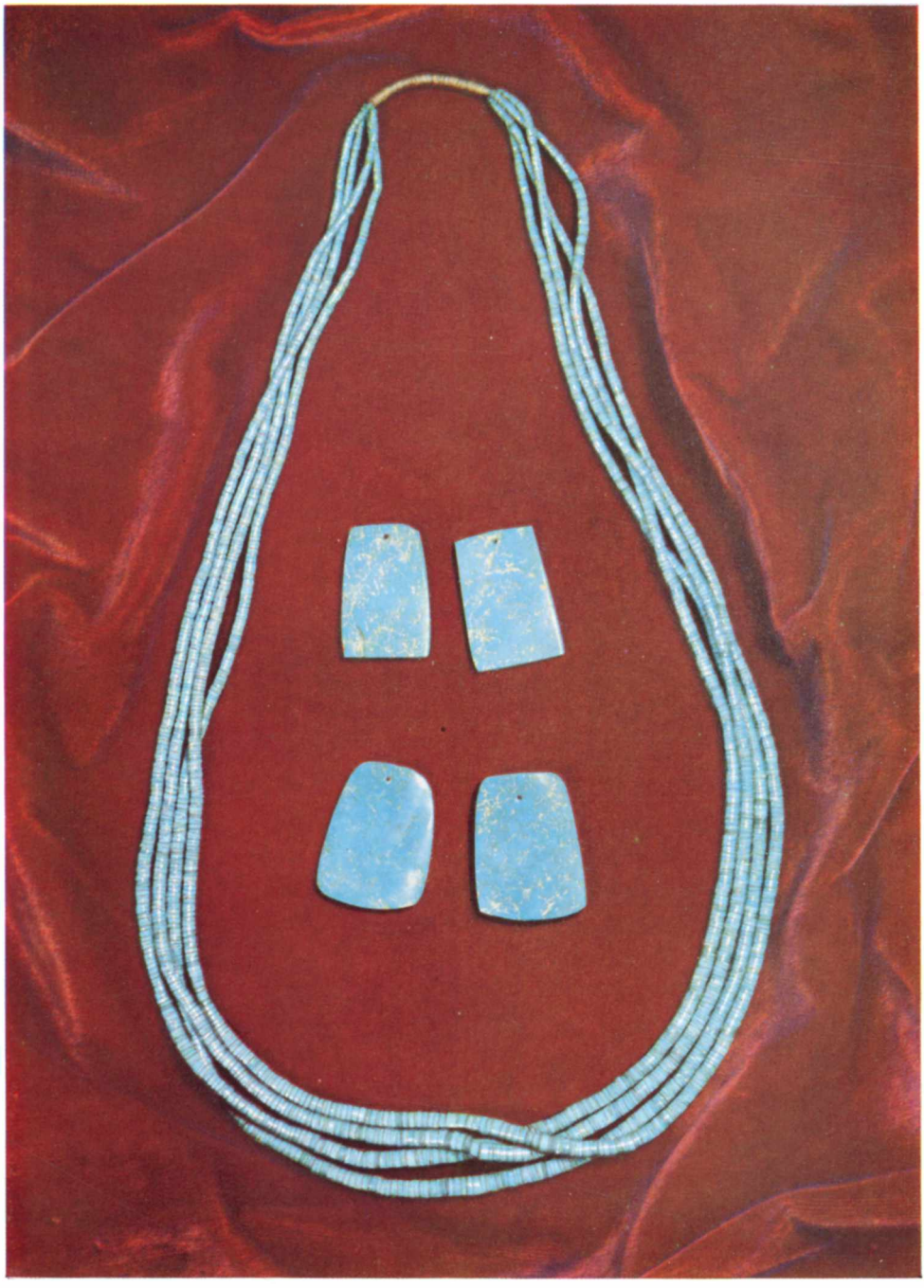


PLATE 19.—The Expedition's famous turquoise necklace and ear bobs, as displayed at the National Geographic Society. (Photograph by Volkmar Wentzel.)

to native intuition or mental telepathy, every Indian on the job had dropped his shovel and quietly gathered to watch the clearing of the specimens and their removal.

Since our masculine camp lacked a needle fine enough to pass through the smallest beads, we borrowed the lesser strings from Havens's tenor banjo and thus were able to remove the disks in their graduated sequence. From the faint trace that remained it was impossible to identify the material on which they had been threaded, but they were clearly arranged in four strings and these had been tied together. Restored as nearly as may be to its former condition this unique ornament, together with the two pairs of ear pendants, is now preserved in the Hall of the Explorers at the National Geographic Society's administration building in Washington (pl. 19). The necklace is 14 inches long as restrung; the four pendants vary in length from $1\frac{5}{8}$ to $1\frac{11}{16}$ inches and in width from $1\frac{1}{16}$ to $1\frac{1}{4}$ inches.

If another complete turquoise necklace has ever been discovered in a Pueblo ruin I fail to find published record of it. Ours is therefore treasured for its rarity as well as its own inherent beauty.

How did it happen to be where we found it, neatly coiled in a shallow depression between two flagstones? If its last owner did not hide it there for safekeeping under a film of sandy adobe, was it surreptitiously withheld by a covetous relative while preparing that last owner for hurried interment? Or was it among the loot, set aside but overlooked in the haste of flight, of one who pillaged this improvised burial chamber? These latter possibilities seem very remote, for a prehistoric thief would never have let go such a prize once he had it in hand, and Pueblo Indians are always at pains to see a loved one best attired for his journey to the next world.

A storeroom connecting with 326, Room 320 stands at the extreme southwestern corner of the older section of Pueblo Bonito (fig. 2). With others hereabout it had come, perhaps late in the history of the village, to be used as a sepulcher. Of the 10 bodies buried in it, 8 had been disturbed in ancient times; their skulls had been kicked to one side while the remainder of the skeletons were dragged about and overturned (pl. 91).

Now it is my belief that marauding enemy bands on one or more occasions attacked the surviving remnant of Pueblo Bonito's once considerable population and that such disturbance as we noted in Room 320 is evidence of their pillage.

In addition, we listed from this room the following turquoise ornaments: Six rectangular, planoconvex beads drilled transversely (fig. 12, *e, f*), 126 discoidal beads, and 7 miscellaneous pendants; also, a

handful of shell and stone beads. Since the total is obviously small for 10 Pueblo Bonito burials, we may conclude that other, more conspicuous jewels were carried away by the plunderers.

Pueblo beadmaking is essentially an exercise in patience. Each little disk is made separately—ground thin, roughly shaped, and drilled preparatory to stringing for final rounding. These successive stages are all clearly illustrated by unfinished turquoise beads in our collection.

After a piece of the mineral had been abraded to the desired thinness, and sometimes before, its edges were broken away to leave a discoidal blank, ready for the drill. In one lot of 66 such blanks (U.S.N.M. No. 335731), 27 percent have rubbed edges, thus partially

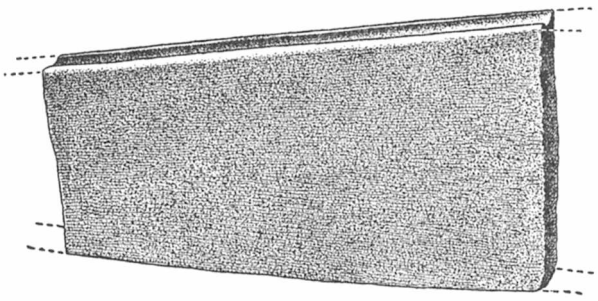


FIG. 13.—Abrader for rounding beads.

anticipating that concluding operation in which the roughly shaped, drilled, and tightly strung pieces were reduced to satisfactory diameter. The sandstone abrader reproduced in figure 13 illustrates one type used in beadmaking. It is grooved on the narrowest rather than on the broadest surface; the opposite edge and both sides are worn by the fingers of the artisan. Traces of red paint remain on both faces. With such a tool many weeks were required to shape the 2,500-odd beads in our famous necklace.

Examination of finished beads and fragments of others broken during the manufacturing process indicates that many were bored with stone-tipped drills and that drilling progressed from one side until the opposite was barely pierced, after which the disk was reversed and the incipient hole reamed out. A biconcave hole is the mark of a stone drill, smallest at the bit. In addition, the Bonitians had other, now unknown, instruments capable of drilling through stone perfectly cylindrical holes no larger than the smallest needle.

The tiniest turquoise bead noted in our collection measures 1.8 mm.

in diameter, just a trifle over one-sixteenth of an inch; its hole is about 0.75 mm. and absolutely symmetrical so far as eye and microscope can detect. Slate beads even smaller than this were made in large numbers by prehistoric peoples who dwelt in the Kayenta region and in the Gila-Salt drainage of Arizona.

Speculating on the identity of the implement with which such minute disks were pierced, archeologists have suggested a dry tubular grass stem, or a cactus spine, with fine sand as the cutting medium. I do not know whether the former has been tried, but Haury, experimenting with a simple shaft drill tipped with a thorn of the barrel cactus and rotated between his palms, employing damp sand as an abrasive, in approximately 15 minutes drilled a hole 0.94 mm. in diameter through fine-grained pelitic rock 1.47 mm. thick (Haury, 1931, pp. 86-87). An Indian more expert in beadmaking, using rock fresh from the quarry instead of a fragment culled from the sun-baked surface of a Gila Valley ruin, doubtless could have accomplished the same end in less time. But Haury has demonstrated that cactus needles make practical drill points. There are no barrel cactuses in the Chaco country, but other species native to the region bear stubborn spines.

The objects shown in figure 34 are two of six fragmentary implements, each made of fine-grained sandstone, found in Room 26, Pueblo del Arroyo. They were uncovered by a Zuñi, a skilled worker in turquoise, who immediately identified them as "files" and who proceeded to demonstrate on his own turquoise eardrops.

One cannot put much pressure on a sandstone file one-tenth inch thick. But my friend may have been right; on the other hand, he may have been influenced in his identification by the outward resemblance between these ancient implements and those which he himself employs along with pinchers, chisels, and other steel tools in these days when the spirit of mass production has penetrated even unto Zuñi. This same man uses a block of wood with a very shallow depression on the under side to hold a piece of shell, or turquoise, while reducing it to bead thickness on a sandstone tablet (pl. 20, left).

Shell beads are more numerous than turquoise at any Pueblo ruin. Despite greater distance to the source of supply and the not inconsiderable problems of transportation, large quantities of Pacific shells were imported into the Pueblo country. Being softer, shell is easier to cut and carve. One digs through rock even for the poorer varieties of turquoise! These several factors doubtless fixed the value of the two materials in prehistoric times as they do today.

From Spanish records of the sixteenth and seventeenth centuries it is manifest that well-traveled trails led to the Pueblo villages from

the south and southwest. Over these paths, across deserts and rugged mountains, came traders on foot to barter the products of their industry. If Pueblo Indians ventured south for like purposes before they acquired Spanish horses and burros I find no suggestion of it in narratives of the Conquest period. Later, however, the Pueblos did go south to trade, very likely because the long-continuing conflict between the Spaniards and the tribes of northern Mexico checked the normal supply of materials that had become essential in Pueblo secular and ceremonial life.

In 1539, as he trudged northward on an old Indian trail seeking word of the mysterious Seven Cities, Fray Marcos de Niza came finally to a fertile, well-irrigated valley inhabited by Sobaipuri Pimas. The location is thought to have been the upper Rio San Pedro, in southeastern Arizona just north of the Mexican border. Here information previously gathered among the Opatas concerning the Zuñi villages was confirmed and augmented. The Sobaipuris were so richly supplied with Zuñi turquoise—necklaces of from one to four strands, eardrops, and nose pendants—that frequent contact between the two peoples seems evident. "Cibola was as well known here," Fray Marcos notes in his journal, "as Mexico is in New Spain, or Cuzco in Peru; and they described fully the shape of the houses, the arrangement of the villages, the streets and squares, like people who had been there often" (Bandelier, 1890, p. 142).

The Franciscan's own record of what he learned along the way convinced Bandelier (1892, p. 3) that in 1539, and before, trade between Zuñi and the Sonoran tribes had originated among the latter. It was flowing in the opposite direction, from north to south, 300 years later. Just when the tide of commerce turned, and why, remain uncertain. But the turn is an established fact and Bandelier reports that "until 1859 the New Mexican Pueblos made annual trading expeditions to Guaymas and into the heart of Sonora, bartering buffalo robes, piñon, meat, and other products for iridescent conch-shells and the bright plumes of the parrot" (Bandelier, 1890, p. 177).

When Bourke visited the Hopi in 1881 he observed many of them wearing pendants of abalone. "This, they told me, they obtained from the seashore, to which they had been in the habit, at least until recently, of making pilgrimages every four or five years" (Bourke, 1884, p. 242).

That the Gulf of California was the principal source of seashells reaching the Pueblo country in earlier, as in later, times has been proved by archeological researches at diverse, widely separated sites.

It was the source of most shells we unearthed at Pueblo Bonito and which include the following genera and species:[15]

Glycymeris giganteus Reeve
Glycymeris maculatus Broderip
Glycymeris sp.
Nodipecten subnodosus Sowerby
Quodrula sp.
Proptera coloradoensis Lea (?)
Anodonta sp.
Laevicardium elatum Sowerby
Spondylus princeps Broderip (?)
Chama echinata Broderip (?)
Chama sp.
Haliotis sp.
Cerithidea sp.
Turritella leucostoma Valenciennes (?)
Strombus gracilior Sowerby
Phyllonotus nitidus Broderip
Columbella fuscata Sowerby
Columbella mercatoria Linnaeus
Nassarius ioaedes Dall
Oliva (Agaronia) testacea Lamarck
Olivella dama Mawe
Olivella sp.
Conus interruptus Broderip
Conus sp.

Olivellas are easily converted into beads. It is necessary only to grind off the spire until a thread can be run through and out the mouth (fig. 14, *a*). The smaller examples, however, often had both ends cut away (*b*) or were halved. In kivas and dwellings erected by the Late Bonitians we found both sectioned and unsectioned olivella beads but, in houses of first-type construction, only those from which the spire alone had been removed.

Among the decayed ceiling poles of Kiva R we encountered seven bead deposits, perhaps sacrificial. Largest of these (U.S.N.M. No. 336010) lay about 2½ feet above the bench in the southeast quarter and included 399 olivellas from which the apex only had been cut, 119 olivella halves or thirds, 79 oblong and figure-8 beads, 3 discoidal shell beads, 11 bracelet fragments, 1 hook-shaped shell pendant, 1 *Conus* sp. pendant; 30½ discoidal turquoise beads, 8 turquoise pendant fragments, and 6 tesserae. We have no means of knowing whether this particular deposit represents the offering of one priest or several, and this is unimportant. But it does seem significant that here, as elsewhere about the newer sections of the pueblo, we found both types of olivella beads while one type only was recovered in the older, but contemporaneously occupied, section.

Of "saucer-shaped" beads, cut from the wall of the olivella (fig. 14, *f*), we unearthed relatively few; none in dwellings of the Old Bonitians.

Among ancient Pueblo ornaments discoidal shell beads are most abundant (fig. 14, *c*). A half dozen on a string made an eardrop; a

[15] Identified by Dr. Harald A. Rehder, curator of mollusks, U. S. National Museum. Because distinguishing characteristics were frequently erased during conversion of shell fragments into ornaments, identifications are sometimes problematical.

couple of hundred, or more, went into an ordinary, single-strand necklace. Although produced in the same manner as those of turquoise, the shell beads in our collection are, on the average, somewhat larger. With living Pueblo and Navaho Indians shell beads increase in value as they decrease in size.

Although discoidal shell beads were commonly included with pilaster offerings and other oblations and although many were lost about the village, most of those we recovered came from a single room, 298. Of first-type masonry, this three-story structure had been destroyed by fire and the contents of the living quarters above fell, with collapse of the floors, into the storage chamber below. It was here, among and beneath fragments of charred timbers and adobe flooring, that we found the beads. They were gathered at the time into eight arbitrary lots; only those composing the shortest string (pl. 21, *c*) were actually together.

Least burned of all, these latter had been threaded, together with nine red claystone beads, on what appeared to be a cotton cord. Whether the strand was originally longer I do not know; neither do I know whether the beads comprising the other seven lots formed one or more necklaces at the time of the conflagration. They were found, as has been said, scattered throughout the room, and pack rats that once occupied the interstices between the burned ceiling timbers doubtless contributed to the distribution.

In addition to the ornaments just mentioned, we collected from Room 298 a number of figure-8 shell beads, four olivellas, a pendant fashioned from part of a shell bracelet (fig. 15, *q*), two burned fragments of jet pendants, three lots of stone beads, and, by way of variety, a walnut-shell pendant and 16 beads (U.S.N.M. No. 335759) made from seeds of the Rocky Mountain hackberry (*Celtis reticulata*). This tough desert plant ranges westward from Texas and Coahuila to Lower California and, in restricted areas, as far north as Colorado.

The stone beads (pl. 21, figs. *e-g*) present a puzzle to mystify the mineralogists. If the microscope be an exacting one, different materials are identifiable—lignite, oil shale, and a clay in various shades of gray. The second string includes the largest beads, some of which "resemble altered phonolitic tuffs." The first string (fig. *e*) is composed almost wholly of earthy-brown, mud-colored disks identified as of "rhyolitic tuff which has been mixed with some clay and baked." [16] Many are sintered or slightly fused on the outside, but this may be as much the result of the fire that destroyed 298 as evidence of kiln

[16] From the report of E. P. Henderson, associate curator, Division of Mineralogy and Petrology, U. S. National Museum.

baking. On the other hand, the microscope testifies to internal proof of the folding and molding of plastic materials.

If our mineralogists be correct, these manufactured beads are unique, so far as I know, in the Pueblo area. Externally nothing but an unusual color sets them apart. All are discoidal; sides retain striations of the abrading tablet; peripheries were shaped by the customary finishing process. Their borings vary in diameter, some being perfectly cylindrical, while others are more or less asymmetrical and biconcave—marks of a stone drillhead.[17]

In the middle of the third necklace (fig. *g*) are 32 more or less cylindrical beads, dark brown in color and of undetermined material. Discoidal beads of lignite and various shales complete the string.

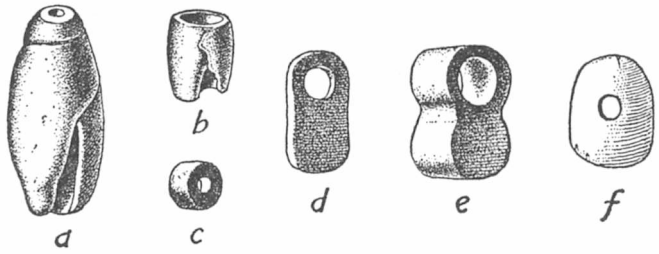


FIG. 14.—Types of shell beads. (Drawn by Irvin E. Alleman.)

Besides these three lots and those next to be considered, we collected only 117 stone beads in the course of seven seasons at Pueblo Bonito. A few were surface finds; a few came from Kiva B, of third-period construction. The remainder, perhaps 100 in all, were collected from six Old Bonito dwellings and during the digging of our West Court trench.

Shell beads were combined with shale to form a necklace for one of the persons buried in Room 330. Since the beads were found all about the skull it seems likely the ornament had been laid upon the head at the time of interment. Rethreaded (the original arrangement is unknown), they constitute a string 22 feet 8 inches long—enough to make up a necklace of 7 or 8 strands. Approximately three-fourths of the total are shale beads averaging 3.5 mm. in diameter and 26 to the inch; the remainder are shell disks of comparable size, interspersed with 62 univalves from the Gulf of California (*Nassarius ioaedes*

[17] J. C. McGregor reports molded clay beads from Winona Village, a twelfth-century settlement near Flagstaff, Ariz. Mus. of Northern Arizona, Bull. 12, p. 31, 1937.

Dall, spires ground off, outer lip perforated for stringing) and some 50-odd figure-8 beads from 2.8 to 4.0 mm. long.

If this assortment made up a single necklace it is noteworthy for several reasons: It is the only one in our collection composed of both stone and shell; it includes the only examples of *Nassarius* found during the course of our Chaco Canyon explorations; it contains our smallest figure-8 beads and, considered as a whole, our smallest stone beads. These latter remind one of the diminutive stone beads for which the Hohokam of southern Arizona were so justly famous and, indeed, a Gila Valley Indian may well have made those we unearthed in Room 330.

The figure-8 beads are miniature examples of a type much favored at Pueblo Bonito. A variant of the oblong bead (fig. 14, *d*), the figure-8 (*e*) when arranged as a necklace would simulate a double string of discoidal beads. The side notch, which gave the type its peculiar form, was the final task in the shaping process and followed after the oblong pieces had been otherwise finished and tightly strung. Because their greater length would naturally induce end-spreading when worn about the neck, beads in this category, both notched and unnotched, are frequently wedge-shaped—thinner at the drilled end. Fancy occasionally urged further elaboration—two of the figure-8 beads in the pilaster 3 offering, Kiva N, have the lower lobe squared at the end and marked, respectively, by single and crossed saw cuts (U.S.N.M. No. 335995).

Normal figure-8 beads from Pueblo Bonito vary in length from 3.6 to 10.7 mm.; in thickness, from 2.0 to 7.2 mm. The averages are about 8 and 3 mm., respectively. Most of those we recovered were offerings deposited in kiva pilasters or in house walls at time of construction. Relatively few were found in dwellings of the Old Bonitians; over 90 percent came from kivas showing third-type masonry.

Scattered among the wreckage in Room 329 were parts of a figure-8 necklace so decayed that its shell beads stuck together in groups of 3 to 10. Examining these sections led me to believe that the larger, more boldly notched beads had been assembled to hang upon the owner's chest while those less prominently marked, including oblong beads, encircled his neck (U.S.N.M. No. 335684).

Casual search of the literature at hand suggests that the figure-8 bead is an ornament peculiar to the Pueblo III period. Where the type originated and how widely it was distributed throughout the Southwest, are yet to be determined. It has been reported from at least two ruins in Arizona, from Chaco Canyon and the Mimbres area, in New Mexico. It has been variously designated and its material identified

as stone, bone, and shell.[18] Although many of our figure-8 beads resemble either bone or stone those actually tested proved to be shell.

About the chest and shoulders of a male skeleton (No. 23) in Room 330 we found a pair of shell eardrops, one of which is shown in figure 15, *o*, and a necklace composed of discoidal and cylindrical shell beads, pendant beads of *Chama*, and apex-cut olivellas (pl. 21, *b*). Many of the latter have one or more tiny quartz pellets forced under the lip to keep the strung shells properly aligned. This appears to have been a common local practice. Occasionally bits of shell or turquoise or even small discoidal beads replaced the pellets.

The cylindrical beads on the necklace just described vary in diameter from 4.0 to 5.3 mm.; in length, from 5.8 to 10.7 mm. All others in our collection were included with pilaster offerings; rarely does one exceed the dimensions just given.

The "pendant beads" mentioned are irregular in shape and size and vary in color from creamy white to pink. All are provisionally identified as of *Chama echinata* Broderip, from the Gulf of California. Previous drillings show several to be reworked fragments of larger ornaments. A partially bored hole in the lower pendant is set with tiny turquoise beads, and it is reasonable to believe that some of the older cord holes had also been plugged.

Many of the cylindrical and irregularly discoidal beads on this same necklace appear likewise to be made from *Chama*. No other ornaments fashioned from this particular species of shell were found in the old part of Pueblo Bonito, but beads, pendants, and unworked fragments were fairly common in the newer sections, especially as sacrifices in kiva pilasters. Toothlike pendant beads occur most frequently; next, discoidal beads, including the largest in our collection (fig. 16). One such, from a pilaster in Kiva P, measures 12.7 mm. in diameter by 7.9 mm. (U.S.N.M. No. 336000).

Pendants.—One may not readily distinguish between ear pendants and those designed to be worn alone upon a neck cord or threaded at

[18] Kidder and Guernsey (1919, p. 151) found "three two-lobed beads of white stone" in a cliff dwelling in the Marsh Pass region, northeastern Arizona; Roberts (1931, pp. 162, 167), excavating superimposed ruins north of St. Johns, found in a Pueblo III structure the only complete necklace of figure-8 shell beads yet reported and noted the absence of like beads in the underlying pit house; Pepper (1920) repeatedly refers both to stone and shell beads "in the shape of a figure 8" he unearthed at Pueblo Bonito; Bradfield (1931, p. 62), while investigating the Mimbres culture in Cameron Creek valley, Grant County, N. Mex., exhumed an infant burial accompanied by "sixteen 'padlock' shaped bone beads"; Mr. and Mrs. Cosgrove (1932, p. 64), recovered 11 "double-lobe shell and bone beads" at Swarts Ruin but remark that they are of infrequent occurrence in the Mimbres Valley.

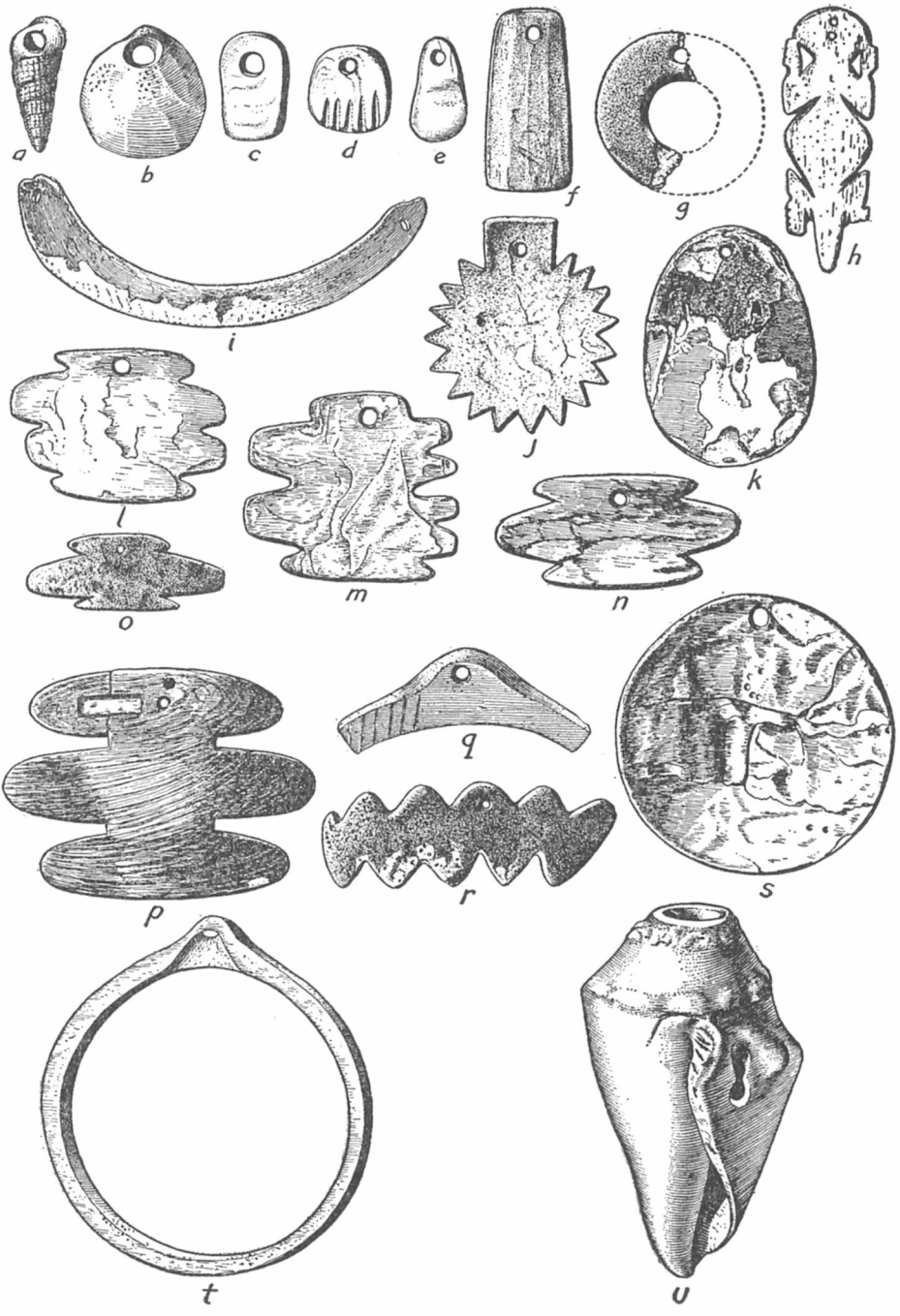


FIG. 15.—Variations in shell pendants.

intervals on a string of shell beads. Some examples were paired when found and thus, presumably, are eardrops; others, like the pendant beads previously described, were no doubt attached to necklaces. There is no reason, of course, why the average pendant could not have served both purposes, according to the whim of its owner.

A number of characteristic shell pendants from the Pueblo Bonito collection are illustrated in figure 15. Figure 15, *o*, is one of a pair found, with the necklace described above (pl. 21, *b*), in Room 330 above the shoulders of Skeleton 23, a male. The second shows a cut across one lobe where a piece had been inset transversely to cover a

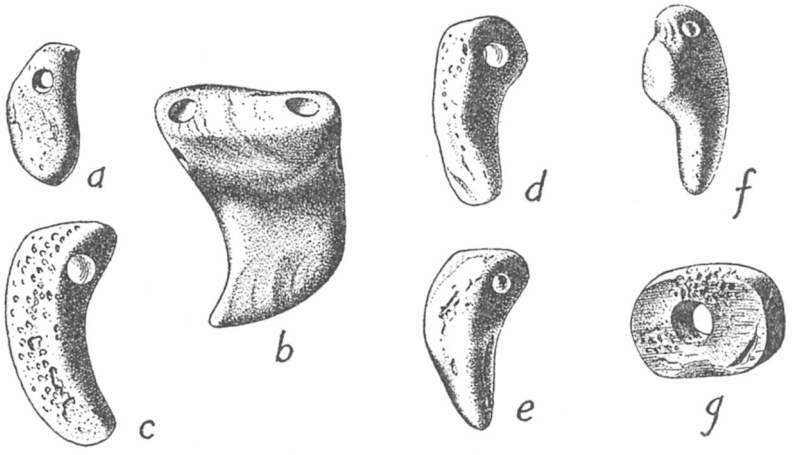


FIG. 16—Ornaments made of *Chama* shell.

break. Figure *k*, also from Room 330, is one of two (*Haliotis* sp.) picked up among the scattered bones of several children. A third pair from the same burial chamber is represented by figure *j* while figure *s* portrays one of two fine abalone disks from Room 323.

The two abalone pendants illustrated as figure 15, *l, m*, our only specimens having more than three lobes, were found among fallen masonry just outside the northeast wall of Room 186 and are part of an offering formerly embedded, it is believed, over one of the first-story ventilators. On that at the right, the two extra notches plainly result from an effort at balance following breakage of the major lobes.

Another pair of abalone eardrops (U.S.N.M. No. 336000), sacrificed to the gods, was sealed in one of the two pilasters we exposed in Kiva P.

A few additional examples are: Figure 15, *p*, depicts a fine abalone pendant, one lobe of which had been broken and repaired with an

inset of the same material; the old cord hole, near the upper edge, was plugged with a rounded bit of turquoise and replaced by a larger one. In the companion pendant (U.S.N.M. No. 335709), the original suspension-cord hole was likewise closed with turquoise and a new one drilled at the middle of the lentoid bar. That shown in figure *n*, of like form, is cut from a pinkish shell (believed to be *Spondylus princeps* Brod.), whose range is from the Gulf of California to Panama. Worn and polished by long use, the specimen (*Strombus gracilior* Sowerby) figured in *u* is the heaviest (1.4 ounces) of our shell ornaments. Our lone shell effigy (fig. *h*) may represent almost any 4-legged creature, from a lizard to a mountain lion.

Of unidentifiable shell, the fragment shown in figure 15, *g*, illustrates a type of ornament which, despite its obvious fragility, appears to have been quite popular. We found comparable fragments, generally included with offerings in kiva pilasters, carved from turquoise, jet, and claystone. Some of these, however, have ground ends that clearly identify them as peripheral segments of discoidal or ringlike mosaics.

Small *Glycymeris* shells were converted into pendants simply by drilling a hole through the hinge. One, from Room 241, is illustrated in figure 15, *b;* another of like size came from Room 227-I. Four larger examples (U.S.N.M. No. 336031; average width 2.4 cm.) were picked up among the jumble of human bones and burial furniture in Room 329. None of the six is ornamented in any way.

From the foregoing list and descriptions it is clear that most of the shell ornaments in our Pueblo Bonito collection were made from Pacific coast species obtained, quite likely, from the Gulf of California. Of those identified, I am informed only four species could have come from east of the Rocky Mountains; of these, three are fresh-water clams well known in Texas and Arkansas, but one of the three, *Anodonta* sp., is said to occur also in northern California. No fragments of clamshells were recovered from dwellings of the Old Bonitians. *Columbella mercatoria* Linné, whose range is from North Carolina to the Gulf of Mexico, is represented by a single, unworked specimen (U.S.N.M. No. 335691), found during the digging of our West Court exploratory trench.

Turquoise pendants and eardrops, unlike those of shell, exhibit but little variety of form. With few exceptions those we collected are more or less keystone-shaped and drilled at the narrower end for suspension. Length ranges from $\frac{3}{16}$ to $2\frac{3}{4}$ inches; width, from $\frac{1}{8}$ to $2\frac{5}{8}$; thickness, from less than $\frac{1}{16}$ to $\frac{1}{4}$ inch. In each case the maximum dimensions here given are those of a once-magnificent ornament,

found burned and broken in Room 41, Pueblo del Arroyo. More typical examples, all from Room 326, Pueblo Bonito, are shown in plate 22. (See table of size and provenience, Appendix A, for explanation of letters referred to on plates 22, 24, 36, 52, 79, and 83.)

Of these Room 326 pendants, the first were found on the skeletons of women. Figures *f* and *h* lay at the neck of burials 8 and 9, respectively; *g* lay on the left chest of Skeleton 12. The other six were picked up individually about the room, but they are so evenly matched, both in size and color, that I have not hesitated to pair them.

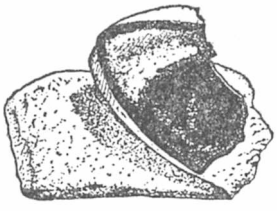


FIG. 17.—Turquoise partly cut from its matrix.

Averaging a trifle under 6 in the scale of hardness (Pogue, 1915, p. 24), or just a little harder than glass, turquoise, nevertheless, is readily worked by primitive peoples and with the crudest of implements. The Pueblos had no metal tools until after the advent of the Spaniards; sand and sandstone

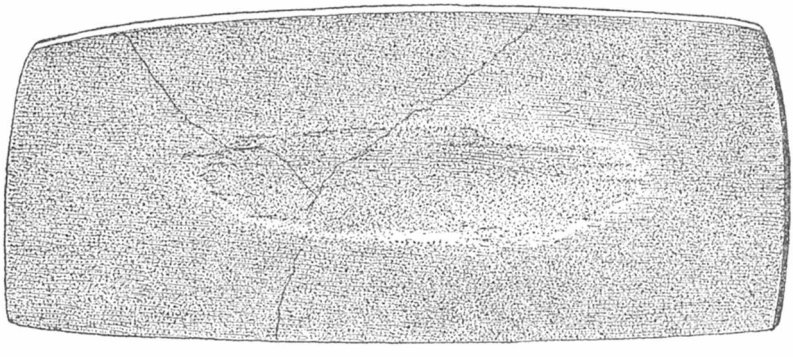


FIG. 18.—Abrader tablet for shell and turquoise ornaments.

were their substitutes for steel. With thin sandstone saws they separated a piece of turquoise from its matrix (fig. 17); by patient rubbing on a fine-grained sandstone tablet (fig. 18), the selected piece was reduced to the size and shape desired. The cord hole was bored with a simple shaft drill or, possibly, with a pump drill such as Pueblo lapidaries employ today. The velvet smoothness that followed years of contact with the human skin only added to the soft beauty of a perfect turquoise ornament.

Although frequently worn in pairs as eardrops, the smaller pendants were sometimes interspersed in a necklace of discoidal beads. One such necklace, including eight pendants from three-sixteenths to three-

eights of an inch long, formed a bracelet of three coils on the left wrist of an elderly female (No. 12) buried in Room 326 (pl. 22, *e*).[19] Perhaps it was this type of bracelet that Indians of northwestern Mexico had in mind when, describing the Pueblo country and its inhabitants to Melchior Diaz early in 1540, they said the women "wear their hair on each side done up in a sort of twist, which leaves the ears outside, in which they hang many turquoises, as well as on their necks and on the wrists of their arms" (Winship, 1896, p. 549). The fabulously rich Burial 14, Room 33, apparently was bedecked with a necklace wrapped around each wrist, that on the left including 2,384 discoidal turquoise beads and 194 pendants (Pepper, 1909, p. 224).



FIG. 19.—An unusual turquoise ornament. (Drawn by Irvin E. Alleman.)

As has been said, turquoise pendants are usually thin and keystone-shaped. From this generalization two interesting exceptions may be noted: A little, pale-blue ornament (fig. 19), drilled lengthwise through the barrel and transversely through the surmounting lobe, part of which was found in pilaster 1 and the remainder in pilaster 6, Kiva I; and a teardrop pendant of greenish shale, three-eighths of an inch in maximum diameter by thirteen-sixteenths of an inch long, from Room 323 (U.S.N.M. No. 335741). A fragment of a large polished object, of the same green shale and half an inch thick (U.S.N.M. No. 335733), was recovered from the nearby dwelling, Room 326; also, beads and thin pieces squared for mosaics were occasionally noted elsewhere. It is quite possible that this dark, oily-green stone passed for turquoise since our Bonitians did not entirely scorn the off-color varieties. Or perhaps a visiting trader turned a shady deal!

That turquoise-conscious Indians are sometimes as gullible as Whites is evident from a transaction I surreptitiously watched during working hours at Pueblo Bonito. One of our Zuñi workers whom everyone regarded as mentally subnormal finally persuaded a dubious Navaho to buy as genuine turquoise a slender pendant made from a tooth I had seen broken from part of a woman's blue celluloid comb, retrieved from the trash pile behind the old Wetherill home.

The bird figured on page 296 (fig. 92) is carved from pale greenish turquoise. Although found with the disturbed burials in Room 329, it may be regarded not as a personal ornament but as an object associated with some unknown ritual. The drilling through the breast is

[19] Excavating the old Zuñi village of Hawikuh, Hodge (1921, p. 15) noted that turquoise ornaments generally occurred at the left ear or wrist of burials; rarely at the right.

at such an angle that, suspended from a cord, the bird hangs back down and almost horizontally—a most unlikely position for a heavy pendant worn on the chest. It is more reasonable to believe the drilling a means for binding the figure to a staff or other support. Pepper (1905b, p. 194) includes five comparable examples with the wealth of ceremonial objects he unearthed in Room 38. From the illustration given, his birds differ from ours chiefly in their smaller size and in their head position which, in each instance, is high with beak thrust forward.

Our second turquoise effigy, in this case of rich blue stone, is a "tadpole," oval in shape, 11.6 mm. long, drilled laterally, with two knobs for eyes. It may once have been an amulet or an ornament for necklace or wristlet, but we found it in the pilaster 5 offering, Kiva R.

With scraps from the lapidary's workbench, beads and small turquoise pendants were usually included in the propitiatory offerings built into secular and ceremonial structures. Many were lost about the village and still others in kivas and living quarters, whence sooner or later they were removed with floor sweepings to the nearest rubbish pile. However, with few exceptions, the finest examples we recovered came from those rooms in the older section utilized for burial purposes. We may be certain they either belonged to the deceased or were funeral gifts from sorrowing relatives. It seems equally obvious that, from the conditions under which they were found, these choice turquoise ornaments are those overlooked by prehistoric grave robbers.

Lignite is considered by Zuñi Indians as precious as turquoise and is even referred to as "black turquoise" (Hodge, 1921, p. 21). Lignite occurs in Chaco Canyon's bituminous coal beds as laminate masses varying in color from brown to gray to jet black. Unworked lignite fragments look dull and unpromising but those that are jet black, carved and polished to mirror smoothness, become jewels very pleasing to look upon.

Among the jet ornaments we recovered, pendants are most numerous. Not all are of tabular form (fig. 20). Perhaps lignite, being relatively soft and easy to carve, tempted the Bonitians to experiment with new ideas. Only two of those illustrated could conceivably be classed as beads (figs. *a, g*). Figures *k-m* show three unfinished pendants, one with incipient drilling.

Cord holes in jet ornaments, instead of being straight through, are often paired and drilled at an angle to meet below the surface, at the back or on one edge.

In the 2-foot fill (principally debris of reconstruction) separating the original floor of Room 348 from the last, a lignite pendant or

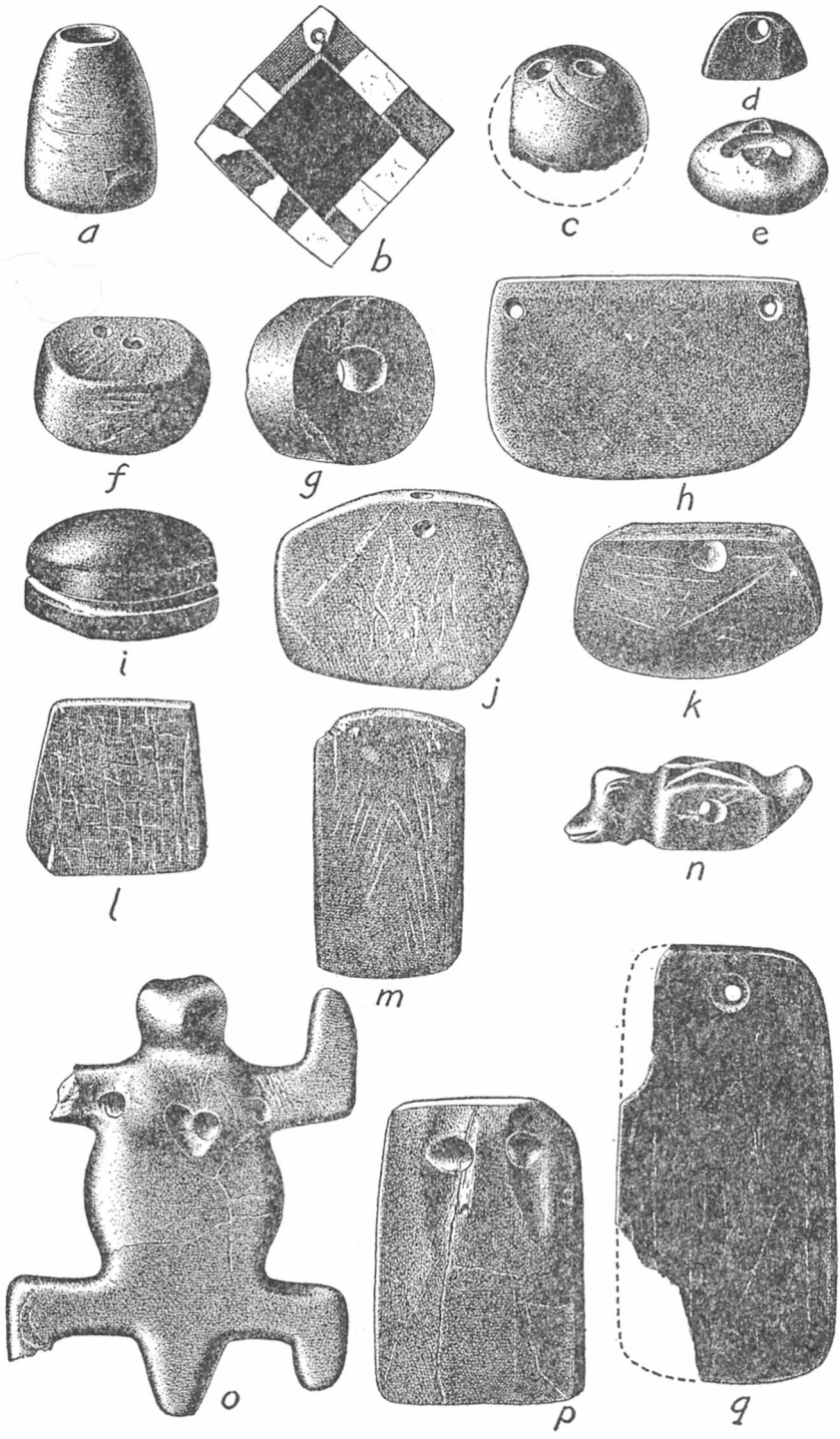
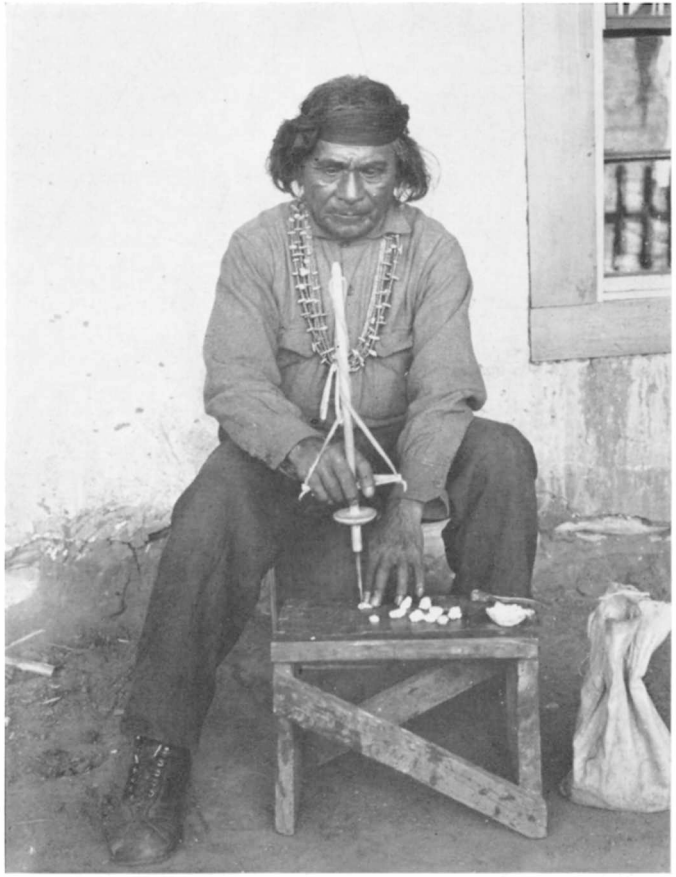
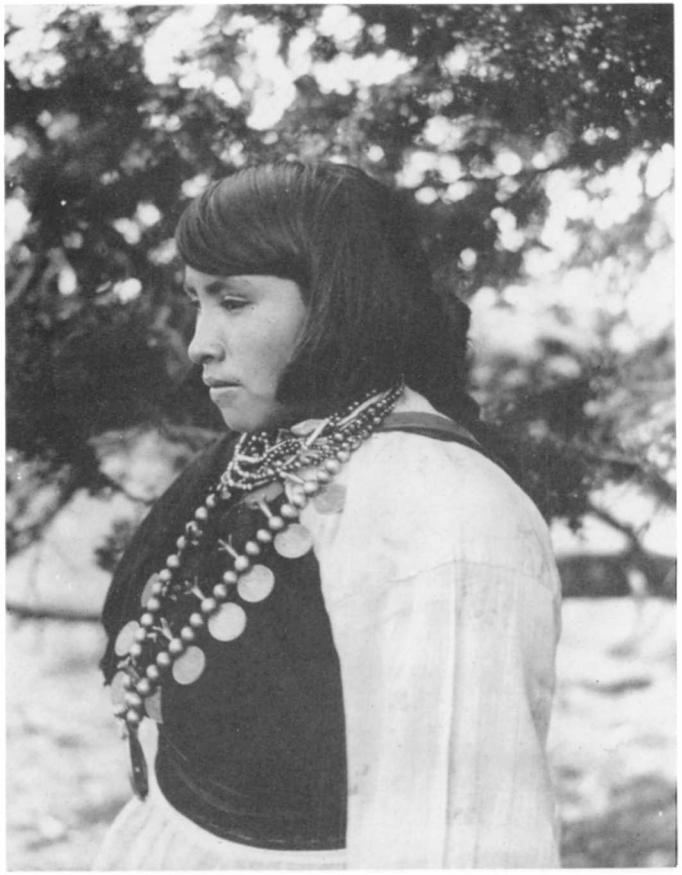


FIG. 20.—Ornaments carved from jet.



Zuñi man drilling turquoise with pump drill. (Photograph by O. C. Havens, 1924.)



A young Zuñi matron wearing a Navaho silver necklace that includes 12 half dollars. (Photograph by Charles Martin, 1920.)

PLATE 20

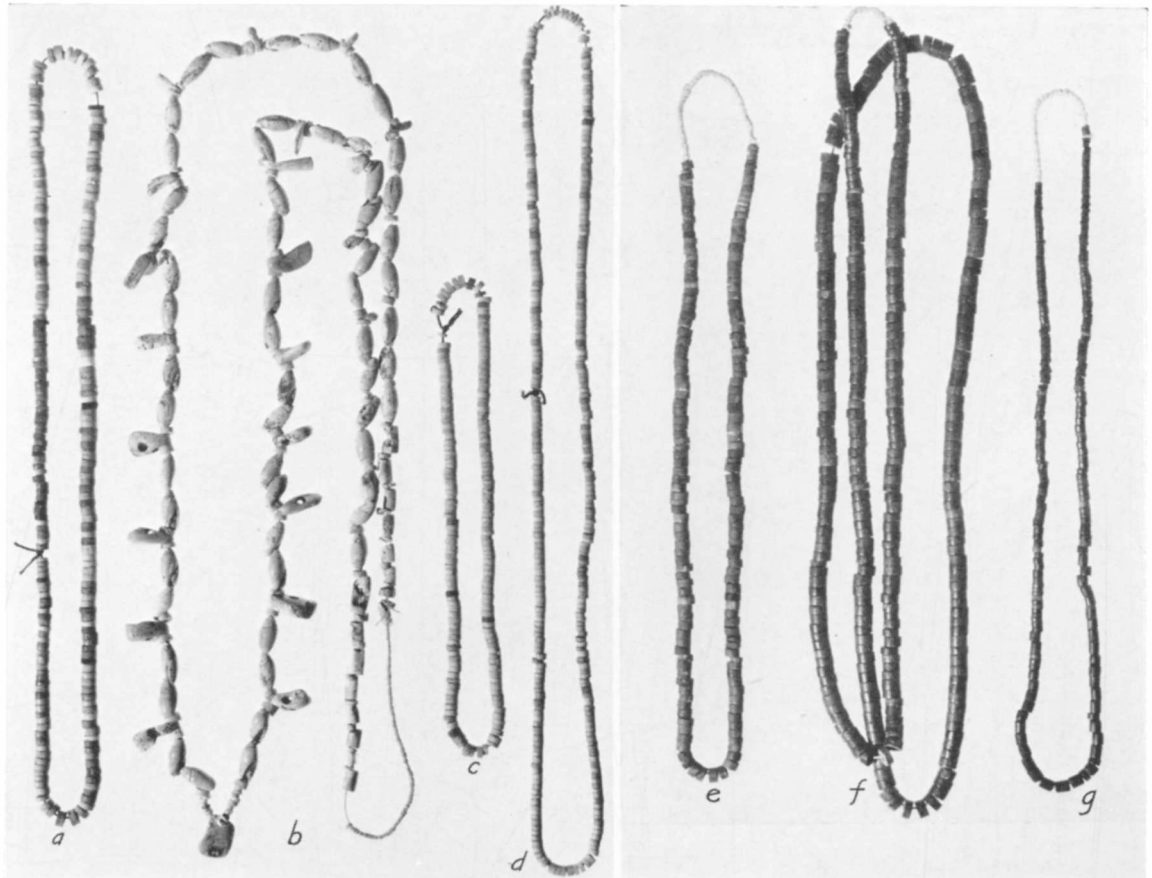


PLATE 21.—Shell, stone, and clay beads, restrung.

eardrop (fig. 20, *b*) came to light. In its countersunk border turquoise pieces had once been fitted. If these were also present in the fill some were missed and of those recovered several fit less snugly than our artist has represented. Nevertheless, the drawing gives the general idea, and the reader's imagination will readily picture the pleasing contrast between jet black and turquoise blue.

Two jet effigies (figs. *n, o*) may also be accepted as ornaments. The smaller was unearthed during the digging of our West Court trench; the larger, in the south recess of a partially razed subfloor kiva within Room 336. From the place of finding, it might logically be assumed that this second figure had some connection with rituals once performed in the abandoned chamber. But ceremonial objects are rarely left lying about; the kiva wall had been razed to within nine inches of its floor; there were no other artifacts among the debris. Could this fragile carving, with its paired holes through the breast for suspension, have been a personal, priestly sacrifice when the kiva was replaced by another?

Thin squared and rectangular bits of polished jet were often used in mosaic work. It so happens, however, that our only detached pieces, 28 by actual count, were among a quantity of shell, turquoise, and red claystone tesserae scattered about the floor of Kiva Q. Neither jet ornaments nor unworked fragments of lignite were recognized in any pilaster or other sacrificial deposit.

Claystone, or red shale, is often called "clinker" by unromantic geologists just because it is a clay turned red through burning of underlying coal beds. It varies considerably in texture, but the finer grades take on a smooth, velvety finish. Claystone of this latter quality was utilized by the Bonitians not only in mosaics but also for pendants and pendant beads; less frequently, for discoidal beads and finger rings. As variations from the more common rectangular and ovoid forms, we figure one claystone pendant with lobate ends, like the favorite form of shell pendant, and a central depression in which a jet or turquoise disk may have been fitted; also, three lesser ornaments probably worn on necklaces (fig. 21).

Calcite and selenite were but little used as material for ornaments. Or perhaps we should say the Bonitians tried these two minerals and found them wanting. Both lack those qualities of color or luster prized by primitive peoples. Rarity alone is no measure of desirability. Of the many fragments of selenite retrieved during the course of our explorations only 11 had been shaped in any degree, and of these 5 only had been drilled for suspension. Three are shown in figure 22.

Mica, as a medium for personal embellishment, awakened even less interest than selenite. Of the half dozen fragments recovered, two only have been shaped and drilled for possible use as ornaments. The nearest known source of mica is in Rio Arriba County, 120 miles to the east, and this may be the source also of the unworked cubes of galena (U.S.N.M. No. 335566) that we found in several rooms.

There may be nothing significant in it, but the result of our inquiry

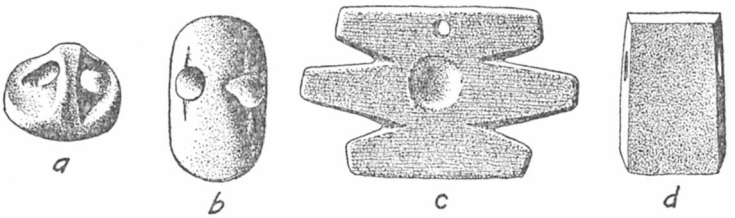


FIG. 21.—Ornaments of red claystone.

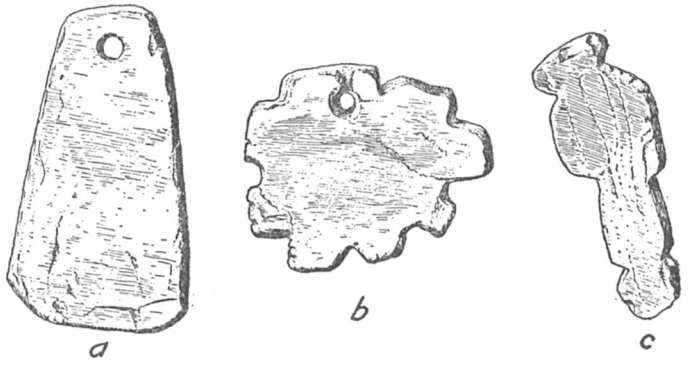


FIG. 22.—Pendants carved from selenite.

into the distribution of these several minerals between the older and later sections of Pueblo Bonito is here recorded: Of 7 cataloged lots (one or more pieces) of galena, 3 were from rooms of first-type construction; of 7 lots of mica, all came from third- and fourth-type rooms; of 35 lots of selenite and calcite, both worked and unworked, 5 lots only were recovered from first-type dwellings; of 41 lots of red claystone artifacts, worked and unworked fragments, 10 are listed from rooms of first-type construction; of 31 lots of azurite and malachite pellets, mostly unworked, 13 came from first-type structures; of 9 hematite artifacts and fragments, 4 are cataloged from dwellings of the Old Bonitians.

Several other ornaments, fashioned from minerals foreign to Chaco

Canyon, may be noted: A sphere of fluorite (fig. 23, *c*) practically duplicating in shape and size the jet ball represented in figure 20, *c*; the blunt tip of a slender fluorite ornament 7.2 mm. in diameter (U.S.N.M. No. 335756); a hematite effigy of some canyon insect, found on the surface within the walls of Room 35 (fig. 23, *b*); the likeness of an acorn produced, after a few moments' work with abrader and drill, from an azurite pellet whose natural shape gave its finder the idea (fig. 23, *a*). Azurite and malachite pellets were found throughout the ruin but very few had been modified in any way. A rather sizable garnet (U.S.N.M. No. 336036), unworked, came from Room 330.

Half a walnut (*Juglans* sp.), converted into a pendant merely by drilling two holes to meet below the convex surface near the apex (fig. 23, *d, d'*), was picked up in Room 298 along with the hackberry

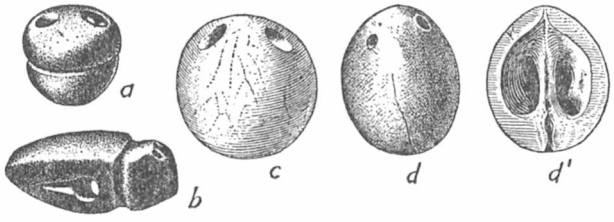


FIG. 23.—Miscellaneous ornaments.

seed, shell, and stone beads already described. Another walnut shell, rubbed smooth on the outside and the base ground off, yet not identifiable as an ornament, was recovered in the passageway (Room 250) connecting Rooms 251 and 256 (U.S.N.M. No. 335378). Unworked fragments of walnut shells (*Juglans major* or *J. rupestris*) were collected also in Rooms 246, 296, and 323. Three of these five chambers were built and occupied by the Old Bonitians.

Because the shells have been more or less mutilated from the botanical point of view, identification as to species is not always practical. Two native walnuts are recognized in the Southwest, neither being found in Chaco Canyon today. One is a shrub (*J. rupestris*) growing along streams in western Texas and southeastern New Mexico; the other is a tree (*J. major*) whose range is given by Wooton and Standley (1915, p. 162) as the mountainous section of southwestern New Mexico, southeastern Arizona, and southward. But Rehder (1927, p. 128) extends the range into Colorado.

During his excavations in Pueblo Bonito, Pepper likewise found a number of walnut shells, both worked and unworked. One of these

had been "covered with gum and inlaid with turquoise" (Pepper, 1920, p. 205). Morris unearthed several at Aztec Ruin and thought them more likely to have been worn as charms than as mere ornaments (Morris, 1919a, p. 98). The five walnut shells on a string found in an infant's grave in Canyon del Muerto, (Morris, 1925, p. 298) may have hung from the baby's cradle to ward off evil spirits or just to entertain him with their rattling. Some years ago in the Colorado State Museum, Denver, I saw single walnut shells suspended from paired bone beads 2 or 3 inches long, forming an attractive ornament.

Two pendants fashioned from black-on-red potsherds, one of which is only partially drilled (fig. 24), may have been designed to satisfy the imitative instinct of children. The square one comes from refuse

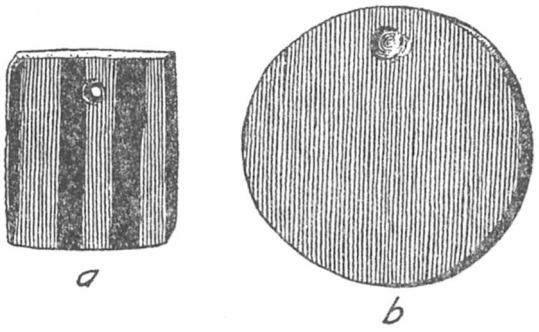


FIG. 24.—Potsherd pendants.

in Kiva H; the discoidal, from Room 282—both third-period structures on the east side of the village. I rather suspect certain Bonitian mothers, in devising trinkets for their offspring, experienced fully as much secret amusement as did the wife of one of our Navaho workmen who, from day to day, bedecked her small son with a varying assortment of spools, pearl buttons, huge wooden beads, etc., and pretended not to notice the surprise his visits always created in our camp (pl. 59, left).

Mosaics.—The numbers of tesserae found in kivas, dwellings, and rubbish piles suggest that mosaic work was much in vogue at Pueblo Bonito. We unearthed no complete example, however, and the only base for inlay actually recovered is the jet pendant from Room 348, subfloor. In Kiva R we noted decomposed shell, cut in the form of a human lower leg, as a backing for fitted pieces of turquoise; of these, only six were present, including one notched to represent toes (U.S.N.M. No. 335752). Among the artifacts from Room 330 is a thin rectangle of sky-blue turquoise still adhering to a square of

abalone shell which may, in itself, be a peripheral segment of a large mosaic gorget.

From Room 33 Pepper (1909, pp. 227-230) reports two foot-shaped turquoise ornaments accompanying Skeleton 14 and two shell pendants of like form near a cylindrical basket incrusted with turquoise and shell. Since this latter surely was never intended for daily household use, it is manifest the Bonitians employed mosaic not only for the embellishment of objects of personal adornment but of ceremonial paraphernalia as well.

For their inlays the lapidaries of Pueblo Bonito utilized shell, jet, red claystone, and turquoise. Of these, turquoise ranked first according to our observations; claystone, second. While the vast majority of prepared pieces are quadrangular, thin, and flat-sided, some were shaped to fit a convex surface. We know, for example, that shell gorgets, jet finger rings, and bone scrapers occasionally were inlaid.

Among the tesserae before me several are planoconvex in cross section including some curved laterally as though to border a disk 2 inches or more in diameter. The longest is a jet piece 4 mm. wide by 2.8 cm. from end to end; it is a segment from a circle 7.1 cm, in diameter—a trifle over $2\frac{3}{4}$ inches. One claystone piece measures 6 by 20.3 mm.; another is 15.5 mm. square. Three planoconvex circle segments measure, respectively, 3 by 20, 3.5 by 20.2, and 6 by 17.5 mm. A claystone rectangle 7.5 by 17 mm. and only 1 mm. thick is concavo-convex as though ground to meet the curve, say, of an abalone disk. There are squares and rectangles also of glossy mussel shell, the largest measuring 8.5 by 20 mm. From these figures it is clear that some Bonitian mosaics were large enough to attract attention in any gathering.

Mosaic ornaments have long been prized by Indians of the Southwest. A number, with wood or shell backplates, were unearthed by Fewkes (1904, pp. 85-87) during excavation of Chevlon and Chaves Pass ruins, near Winslow, Ariz. At the somewhat older Aztec Ruin, northwestern New Mexico, Morris (1919a, p. 102) observed some 20 mosaic-incrusted shell disks on the chest of a single skeleton. From pre-Spanish graves at Hawikuh, Hodge (1921) recovered part of a shell gorget and several wooden combs and ear tablets, each decorated with mosaic work.

Data gathered during the course of his investigations led Hodge to conclude that wood, as a backing for mosaic, was introduced at Hawikuh in late prehistoric time. This supports the observations of other students, namely, that wood gradually replaced shell. Although their men continued to wear mosaic-covered shell gorgets, the favorite

ear ornaments of Hopi and Zuñi women in the sixteenth century and, indeed, until a generation ago, were wooden tablets to which bits of turquoise had been attached with pinyon gum.[20]

Rings and bracelets.—No ornaments in our collection prove the esthetic sense of the Bonitians more convicingly than the jet finger rings illustrated in figure 25. (See also pl. 22.) When one recalls how fragile jet really is and how crude the tools available for carving it, and then notes the uniform thinness and symmetry of these four rings, one's admiration for the skill of Pueblo Bonito artisans is measurably increased. The four vary in thickness from 2.0 to 2.7 mm.; in width, from 10.5 to 18.0 mm.; in inner diameter, from 14.6 to 16.7 mm. Thus the rings provide a passing index to the stature of those who wore them. For example, the widest of the four has the smallest diameter,

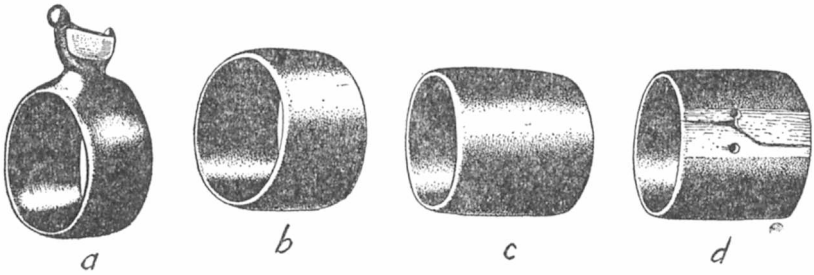


FIG. 25.—Finger rings of jet.

and this is just one-sixteenth inch less than that of a ring worn by my secretary who stands 5 feet 3 inches and weighs 135 pounds.

The first three rings were found among the disarticulated skeletons in Room 330; the fourth, in Kiva 2-D. This latter specimen had been broken and later repaired by binding a splint (now missing) to a purposely thinned zone bordering the fracture. But the ring that naturally attracts most attention is the first, with its silhouetted little bird whose inset wings are sky-blue turquoise. A daintier, more exquisite jewel was never made by Pueblo Indians! The fragment of another jet ring with turquoise inlay was found in Room 348.

Our Bonitians also carved finger rings from bone (fig. 26), shell, limestone, red shale, and onyx. When broken, as many of them eventually were, the prehistoric technique of pottery repair was brought into play; that is, holes for sinew or fiber lashings were

[20] Hough (1897, p. 40) identifies this resin as that of *Pinus monophylla* Torr. and Frem. rather than as *P. edulis*. At Pueblo Bonito, the National Geographic Society recovered three flattened balls of resin, unidentifiable as to species, in the adjoining rooms, 225 and 226 (U.S.N.M. No. 335382).

drilled on both sides of the break. Narrowest of all in our collection are fragments of two shell rings: 4.0 and 5.0 mm., respectively.

The bracelet shown in figure 15, *t,* was cut from a Gulf of California shell, *Glycymeris giganteus* Reeve. As always, the hinge is drilled for suspension, thus evidencing occasional use as a pendant. Similar ornaments are especially characteristic of those prehistoric cultures that once flourished in the Little Colorado and Salt River Valleys, Arizona.

Apparently no effort was made to mend a broken bracelet, but the fragments had ritualistic value, being included in most pilaster and other offerings. Three superb *Glycymeris* bracelets, as white as when first carved, and part of a fourth were among the sacrifices placed in one valve of a cockleshell (*Laevicardium elatum* Sowerby) and sealed in a subfloor repository in Kiva D (U.S.N.M. No. 335955). Figure 15, *i,* illustrates a simple gorget made from the ventral margin of, presumably, another cockle.

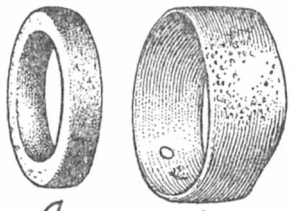


FIG. 26.—Bone rings.

Bone "beads."—Besides the rings our only bone artifacts that conceivably may be regarded as ornaments are 53 tubular "beads" varying in length from three-eighths of an inch to $3\frac{3}{4}$ inches. None is ornamented. All, apparently, are made from radii, ulnae, and femora of birds, including the turkey.

The series in figure 27 illustrates the method of manufacture and the finished product. Freed from its articulations, the hollow shaft was used in whole or in part; the cut ends were ground smooth and, in time, the sides became more or less polished. First of the five, the ulna of a golden eagle, is scarred by stone knife marks as though it had served as a cutting block after a bead had been detached; the last has been partially sectioned into three.

Of the 53, 10 represent casual finds during trenching operations while 19 came from kivas and 24 from dwelling rooms of which 11 were built during the third period of constructional activity. Only one bone bead was found in a fourth-period room; only six in houses of the Old Bonitians. All occurred in rubbish and, with two exceptions, singly.

Both exceptions are from Kiva X, a smallish chamber on the middle west side of the West Court. Here, lying close together in the fill, were three bone beads averaging 7.0 mm. in diameter by 16 mm. long. The second lot, presumably of turkey bone, numbers five. Their

diameter varies from 12.2 to 15.1 mm.; length, from 9.2 to 14.0 mm. In neither case was the original arrangement evident. A section of reed, tightly fitted into a bone tube 4.2 cm. long, came from Room 296 (U.S.N.M. No. 335197).

Sections of bone such as these, irrespective of length, have generally been classified as beads because of their polished ends and sides. No one of our Pueblo Bonito examples was found under circumstances suggesting its original use. But quite comparable specimens, strung end to end to form necklaces, accompanied burials at Aztec Ruin and at Hawikuh; others lay at the wrists of skeletons as though

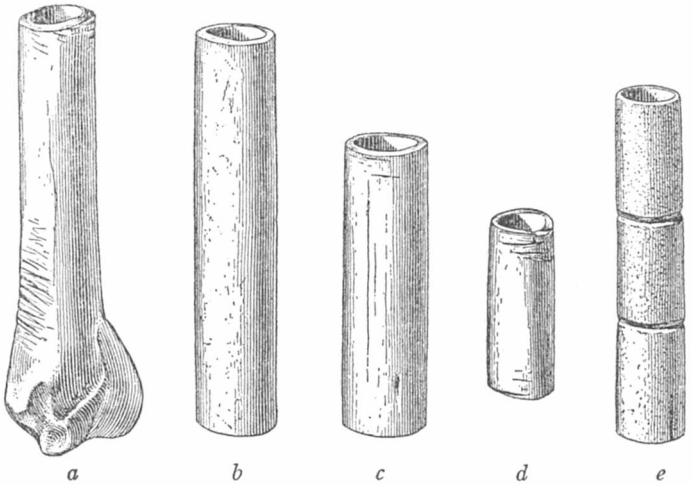


FIG. 27.—How bone beads were made.

once bound to a leather or fiber bowguard (Morris, 1919a, p. 42; Hodge, 1920, pp. 126, 134). That like sections of bird bone played a further, as yet undetermined, function in Pueblo life is evidenced by the fact that lots of 10 to 200 or more occurred both in rooms and with interments at Aztec and at Pecos (Morris, 1924, p. 153; Kidder, 1932, p. 260).

Three pairs of cut bird bones in the Colorado State Museum, Denver, probably were designed as ornaments. The pairs vary in length from 2 to 3 inches; each pair hangs side by side, but not snugly, on a yucca cord with a walnut-shell pendant below. (Colo. State Mus. Nos. 0815-0817.)

While supplementing my original notes on these three, I was informed that the Colorado collection includes four other specimens, presumably necklaces, composed of bone beads strung end to end and alternating with walnut shells (Nos. 0811-0814). Some of the latter

are missing, but one specimen (No. 0811), apparently complete, is made up of eight bone beads and eight walnuts. As a variation from the usual practice, the walnut shells of No. 0812 were each threaded independently and suspended from the necklace cord between bone beads. All seven specimens were collected in unidentified cave ruins of the Mesa Verde district in the winter of 1888-89 by a party composed of Charles McLoyd, L. C. Patrick, J. H. Graham, and Alfred Wetherill.[21]

Copper bells.—We found 21 copper bells and bell fragments in Pueblo Bonito, 6 in Pueblo del Arroyo, and of the total only half a dozen came from kivas. We have no reason to suppose ownership

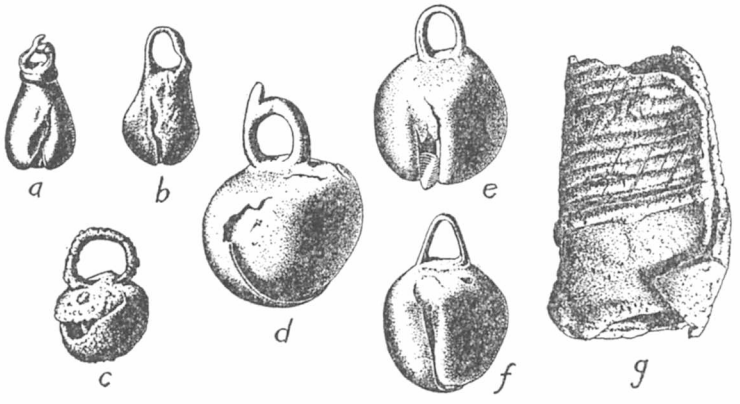


FIG. 28.—Copper bells and fragment.

was restricted to the priesthood; no reason to believe the bells were in any way connected with rituals.

Of our Pueblo Bonito specimens one was a surface find, one came from the West Court trench, two from dwellings of the Old Bonitians (Rooms 6a, 329). Four bells, including three unearthed during removal of debris previously thrown out of Rooms 55 and 57, are attributed to fourth-period houses; the remaining 13 to third-period rooms and kivas. Since 81 percent were recovered from newer sections of the village, it is quite possible these copper bells did not reach Pueblo Bonito until sometime after A.D. 1050, the approximate date when the Late Bonitians began their first intensive rebuilding program.

Our six best-preserved examples are illustrated in figure 28. Each was made of thin copper (0.39 to 0.50 mm.). In each the slit in the resonator was cut as the final operation in the manufacturing process;

[21] Information generously furnished by Victor F. Lotrich, curator of archeology and ethnology, Colorado State Museum, in November 1941.

cracks at the ends of the slits prove the cutting was done when the metal was cold. In the three larger examples (*d-f*), strips of metal one-eighth inch wide were actually removed and the resulting gaps lessened by pinching the lips together. These three, and two of the smaller, have pebbles for clappers; one specimen only (*b*) contains a copper pellet. Examining the series as a whole, we find that five are pear-shaped, as *a* and *b*, with the apex more or less flat and ringed about; a majority are globular.

The outer surfaces, while not perfectly smooth and regular, exhibit no hammer marks and no mold seams. In every instance the suspension ring appears to have been made separately and then brazed or fused to the body.

Two fragments, one of which has been somewhat flattened by hammering (*g*) are from larger, thicker bells with wire coiling simulated between ring and raised shoulder band. Bells in this technique have been recovered from various sites in Mexico, Yucatan, Honduras, and Panama.

Spanish explorers and missionaries to the Southwest sometimes distributed metal bells, presumably made in Spain. At Cochití, notes Luxán (Hammond and Rey, 1929, p. 82), the Espejo expedition of 1582-83 traded sleigh bells and small iron articles for buffalo hides. Fray Estevan de Perea, reporting upon a visit to the Hopi pueblos in 1629, remarks that the priests gave the Indians "some trinkets which they had brought—such as hawks' bells, beads, hatchets and knives" (Bloom, 1933, p. 232). But the copper bells we found in Pueblo Bonito exhibit individual variations that identify them as of native manufacture; they antedate coming of the Spaniards by at least four centuries.

Echoing the thoughts of our teachers we first assumed these bells had reached Chaco Canyon through intertribal trade, along with parrot feathers, seashells, and other products of the southlands. However, as the present study was getting under way, eight of our specimens were analyzed for Peabody Museum by Prof. W. C. Root, who concluded they were cast in New Mexico, Arizona, or Chihuahua and from local ores.[22]

[22] At the request of Dr. Alfred M. Tozzer, of Harvard University, the U. S. National Museum in 1928 submitted for analysis 16 copper bells from prehistoric ruins in Mexico, Arizona, and New Mexico. These were returned under date of February 8, 1929, together with excerpts from Professor Root's report; parts of the same report subsequently were incorporated in Root's analysis of the Snaketown bells and published as Appendix II in "Excavations at Snaketown," by Gladwin et al., 1937, pt. 1, pp. 276-277. In a chapter on minerals and metals, same volume, pages 163-167, Haury dates the Snaketown bells between A.D. 900

During the years that followed, the present writer puzzled repeatedly over Professor Root's conclusions and remained unconvinced. Southwestern copper deposits were well known but none gave evidence, so far as could be learned, of having been worked in pre-Spanish times. Copper artifacts other than bells had rarely, if ever, been reported from southwestern ruins; there was no proof that metalworking was practiced by any southwestern tribe before 1540. Finally, as these paragraphs were being revised in the summer of 1938, the Chaco Canyon specimens forwarded to Harvard 10 years earlier, with 12 others of like form and 7 ore samples, were transmitted to the National Bureau of Standards for spectrochemical analysis.[23]

The specimens considered, identified by their U. S. National Museum catalog numbers, are as follows:[24]

No.	Specimen	Locality	U.S.N.M. No.
1	Bell	Bay Islands, Honduras	373236
2	"	" " "	373237
3	"	Tenango, Mexico	99044
4	"	Orizaba, Veracruz	97782
5	"	Casa Grande, Ariz.	254495
6	"	Upper San Francisco River, N. Mex.	98211
7	"	Tulerosa Canyon, N. Mex.	170547
8	"	Tonto Basin, Ariz.	173068
9	"	4-Mile Ruin, Ariz.	177804
10	"	Pueblo Bonito, N. Mex.	335581
11	"	" " " "	335583

(Continued)

and 1100, a period corresponding to the occupancy of Pueblo Bonito. He believes the globular or pear-shaped bells older than the larger, more specialized examples. Both Root and Haury believe the bells they examined were cast by the cire-perdue process. In this a clay core, modeled to the desired form, is covered by wax and the latter, in turn, by more clay; when the clay is baked the wax melts and may be replaced by molten metal.

[23] The National Geographic Society and the U. S. National Mueum gratefully acknowledge their obligation to Dr. Lyman J. Briggs, then Director of the National Bureau of Standards, to Dr. William F. Meggers, chief of the spectroscopy section, and to B. F. Scribner for cooperation in this study. Their reports are on file at the National Museum. The writer is personally indebted to Dr. Meggers for reviewing this section.

[24] 373236 and 373237, differing in type, are illustrated by Strong, Smithsonian Misc. Coll., vol. 92, No. 14, pl. 9, *d*, and pl. 10, *f*, respectively; 254495 is illustrated by Fewkes, 28th Ann. Rep. Bur. Amer. Ethnol., fig. 51, p. 148; 173068 and 170547 are illustrated by Hough, U. S. Nat. Mus. Bull. 87, p. 37, figs. 78 and 79; 177804 is figured by Fewkes, Ann. Rep. Smithsonian Inst. for 1897, pl. 3, p. 605; 99042 and 99043 are ascribed by collector W. W. Blake to the Tlapanecas Indians.

No.	Specimen	Locality	U.S.N.M. No.
12	Bell	Pueblo Bonito, N. Mex.	335587
13	"	" " " "	335582
14	"	" " " "	335586
15	"	Pueblo del Arroyo, N. Mex.	334764
16	"	" " " " "	334766
17	"	" " " " "	334767
18	"	State of Guerrero, Mexico	99043
19	"	" " " "	99042
20	Ore	Fort Bayard, N. Mex.	10183
21	"	Santa Rita, N. Mex.	33371
22	"	Bisbee, Ariz.	86510
23	"	Cananea, Sonora	88198
24	"	Inguaran, Michoacán	19550
25	"	Jalacingo, Veracruz	57277
26	"	Tuxtla Gutiérrez, Chiapas	90770

The nature and extent of the analyses are described in these words:

The arc spectra of cleaned portions of the specimens were photographed in the region 2470-3300 A (spectrogram Nos. B-403, 404, and 405) using carbon electrodes, and in the region 2800-5000 A (spectrogram Nos. W-138ab, 139ab, and 140ab) using copper electrodes.

The spectra were examined for the sensitive lines of: Ag, Al, As, Au, B, Ba, Be, Bi, Ca, Cb, Cd, Ce, Co, Cr, Cu, Fe, Ga, Ge, Hf, Hg, In, Ir, K, Li, Mg, Mn, Mo, Na, Ni, Os, Pb, Pd, Pt, Rh, Ru, Sb, Sc, Si, Sn, Sr, Ta, Th, Ti, Tl, U, V, W, Y, Zn, and Zr.

Subsequently Dr. Meggers interpreted the results and drew certain conclusions from them, in a letter addressed to the writer:

Since discussing this report with you . . . I have given the matter much personal attention. First, I examined the report for possible correlations, but not finding any of great importance, I next reexamined the spectrograms for the purpose of checking or extending the report. The new analysis which I made quite independently is practically identical with the old one made by my assistants, but I have tabulated my results more compactly to facilitate their comparison.

* * * * * *

It is obvious that the bells numbered 99042 and 99043 are identical in chemical composition. Also 334766 and 334767 are practically the same, and two ores 10183 and 33371 are closely similar. But beyond these comparisons there appear to be no further resemblances, and no connections at all between bells and native ores. In making such comparisons one should not lay much weight on the common contaminating elements (alkalis, alkaline earths, silicon, iron, etc.), because these are almost everywhere and may have come from handling. However, the occurrence in copper of such elements as zinc, gallium, indium, tin, lead, arsenic, antimony, and bismuth is always significant; they are either characteristic of the ores or were later alloyed with the metal. It is just these elements which distinguish the different artifacts and ores. For example, most of the bells contain appreciable to fairly large amounts of arsenic and antimony, but no trace of arsenic or antimony was detected in any of the ores examined. Chemical identity of

99042 and 99043 has been pointed out, but 99044 is distinctly different, lacking tin and indium which are strong in the former. Arsenic also distinguishes 334764 from 334766 and 334767, while both tin and arsenic give 373236 a chemical composition markedly different from that of 373237. High lead content distinguishes 97782 from all the others.

There can be no doubt about the reality of these differences even though our spectrochemical estimates are only semiquantitative. Without comparison standards we do not guarantee absolute values within a factor of 10, but relative values are more accurately estimated, and only relative values are important in these comparisons. The detection of more differences than of resemblances between these artifacts and ores probably means that a larger variety of samples must be tested before a correlation may be expected. Perhaps it should be determined also if native copper has a characteristic composition or varies from sample to sample. It is noted that two ores (10183, 33371) from New Mexico are essentially the same chemical composition but the Mexican ores are all different. Unless we find some ores or native copper rich in arsenic, antimony, tin and lead, it will be difficult to account for the prominence of these elements in some of the bells unless it is assumed that they were deliberately added as alloying constituents in molten metal.

Dr. Meggers's tabulation is given on page 114.[25]

Silver is present in all the bells and all the ores examined. Zinc is present in three of the Mexican ores but in none of the bells, including four from Mexico. Tin, occurring in two Mexican ores and three Mexican bells, is lacking in our specimens from southwestern mines and ruins. Antimony appears in most of the bells but in none of the ores; lead is present in most bells and in five of the seven ores. Indium is found in only one southwestern bell, that from Tonto Basin; gallium, present in all 19 bells, occurs in the single Arizona ore sample

[25] The elements in italics are regarded as most significant:

Zn	zinc	*In*	indium
V	vanadium	*Ga*	gallium
Ti	titanium	Fe	iron
Sr	strontium	Cu	copper
Sn	tin	Cr	chromium
Si	silicon	Co	cobalt
Sb	antimony	Cd	cadmium
Pb	lead	Ca	calcium
Ni	nickel	*Bi*	bismuth
Mo	molybdenum	Ba	barium
Mn	manganese	Au	gold
Mg	magnesium	*As*	arsenic
Li	lithium	Al	aluminum
K	potassium	Ag	silver

Quantitative key:

S = strong, > 1.0 percent
M = moderate, > 0.1 percent
W = weak, > 0.01 percent
T = trace, > 0.001 percent

	Zn	V	Ti	Sr	*Sn*	Si	*Sb*	*Pb*	Ni	Mo	Mn	Mg	Li	K	*In*	*Ga*	Fe	Cu	Cr	Co	Cd	Ca	*Bi*	Ba	Au	*As*	Al	Ag
															BELLS													
1			T—	T	M—	W	W—	T	W—		T	T	T—			W	W	S+	T			W	W—	W—		M	W—	W—
2						T	T	T	T		W	T	T—			W	W	S+				T				T	T	W
3						T					T	T—				T	T	S+				T				M	T	W—
4					M	W	M—	S	W			W—			W—	T	T	S+		T		W—	W	T		M	W—	W
5						T—	M—	T	T		W—		T			W	W	S+	T			W—				W	T	W
6						T	T—	W—			T	T				T	T	S+				W—				T	T	W
7			T—	T		W	T	W—			T	W—				T—	W—	S+	T—			W—		W			T	W
8			T—			W—	T	W—	T		W—	W			T	W—	W	S+	T—			W—		T			W	W
9						T	T	T			T	T—				T	T	S+	T—							T		W
10						T	T	T			W—	T—				T	W—	S+	T								T	W
11						T					T	T—				T	W—	S+				T				M—	T—	W
12						W	T	T				T				T—	T	S+				T				T	T	W
13						W—					T—	T				T	T	S+				T					W—	W—
14			T	T		W	T	W—	T		T	T				W—	W—	S+	T—			M—		T—		T	W	W—
15				T		T					T—					W—	T	S+				W		T		M—	T	W
16			T	T		W—	T	T	T		T	W—				T	T	S+	T—			M		W—			W	W
17				T		W	T	T	T		T	W—				T	T	S+	T—			W—		T			W	W
18			T—		S—	W—	W—	T	T		T—	T			M	W—	W—	S+				W	T	T—		W	W	W—
19			T—		S—	W—	W—	T	T		T—	T			M	W—	W—	S+				W	T	T—		W	W	W
															ORES													
20						M—		T		T—		T					T	S+	T			T		T—			W	T
21			T—	W—		M		T		T—		T—		T			T	S+	T			T		W			W	T
22		T	T	T		M		T—	T		W	W	T			T	W	S+				W		T			M	W—
23					W—	M—		W—			T—	T					T	S+	T—			W—		T—	T		W—	T
24	M	T—	T	T	W—	M—		W—	T	T	T	W	W			T	W—	S+	T		T	W		W—			W	W
25	W					M			T		W	W	T		T	W—	M	S+		T		M—		T			W	T
26	T—	T	W	W		M			T	T	W	W		W—	T	W—	M	S+	W—	T		M		W			M	T

and in three of those from Mexico. Arsenic appears in two-thirds of the bells but, like antimony and bismuth, is lacking in all seven ores. Our data, therefore, fail to show any connection between copper bells from divers sites and ore samples from the nearest mines represented in the mineralogical collections of the U. S. National Museum. If artifacts from Arizona and New Mexico ruins were made of local copper one might logically expect a closer similarity between the spectrograms of, say, bells 98211 and 170547 and ores 10183 and 33371. And the Bisbee ore might show at least a trace of the arsenic noted in the bell from Casa Grande. Obviously, as Dr. Meggers points out in his letter, we need to know more about copper ores and whether the elements in them may vary quantitatively in samples from the same deposit. Until such information is available for comparative study the origin of the copper bells found in our southwestern ruins cannot positively be determined. So far as we are aware, the prehistoric Indians of New Mexico and Arizona had no knowledge of metallurgy.

The clay bells with clay pellets unearthed by Fewkes at Awatobi and by Hough at nearby Kawaiokuh may be pre-Spanish, as Fewkes believed, or local imitations of those introduced by Perea in 1629 (Fewkes, 1898, p. 629; Hough, 1903, p. 342).

Paints.—However lavish Bonitian men and women may have been in their use of jewelry, there came times when necklaces, bracelets, and rings were supplemented, or even replaced, by mineral paints. Especially on ceremonial occasions paints were utilized for drawing symbolic designs both on participants and on their paraphernalia. Oxides of iron provided red, yellow, and brown; carbonate of copper, the green and blue; gypsum, the white. Since their chief use was ritualistic, pigments have been considered at greater length in our chapter on objects of religious connotation. But red paint was also an essential feature of the daily toilet and therefore a requisite in primitive dress. Modestly applied to cheek and forehead, it heightened flesh tints and thus braced the ego; used extravagantly, it afforded protection from sunburn.

Time and again on Arizona trails I have passed Navaho men and women with faces as brilliant as the Vermilion Cliffs at sunset. Occasionally such a one stopped briefly to watch our Chaco Canyon excavations. But our Navaho workmen seemed less covetous than the Zuñi of the fragments they unearthed. The Zuñi begged every scrap of red paint exposed but were generally satisfied with pieces not desired for our collections. Invariably they would interrupt work long

enough to rub the fragment on a potsherd or bit of sandstone, wet the rubbings with spittle, and daub the mixture on forehead, nose, and cheeks. I was given to understand that when they are home they usually mix face paints with a little grease or the oil of melon and squash seeds. Generous use of rouge, practiced by desert peoples the world over, doubtless was an established custom at Pueblo Bonito no less than at Zuñi and other present-day pueblos in Arizona and New Mexico.

I realize that our data do scant justice to the dress and objects of personal adornment worn by the inhabitants of Pueblo Bonito. Because time had destroyed most perishable materials, the material evidence we sought was mostly lacking. Nevertheless, if we keep before us the fragments of cloth, blankets, and sandals actually recovered and bear in mind what contemporary Pueblos in cliff dwellings were wearing; if we recall the degree to which cliffdweller garments duplicated Pueblo dress at the time of the Conquest and later, we cannot go far astray in picturing the articles of clothing worn by our Bonitians—rectangular pieces of cotton goods tied together and worn as knee-length shirts or dresses, cotton blankets, rabbit-skin or turkey-feather robes, dressed skins, sandals of braided yucca leaves or woven *Apocynum* fibers. And with their wealth in jewels, with trails bringing trade from far valleys, it is certain they lacked nothing the eleventh-century Southwest offered in the way of body covering.

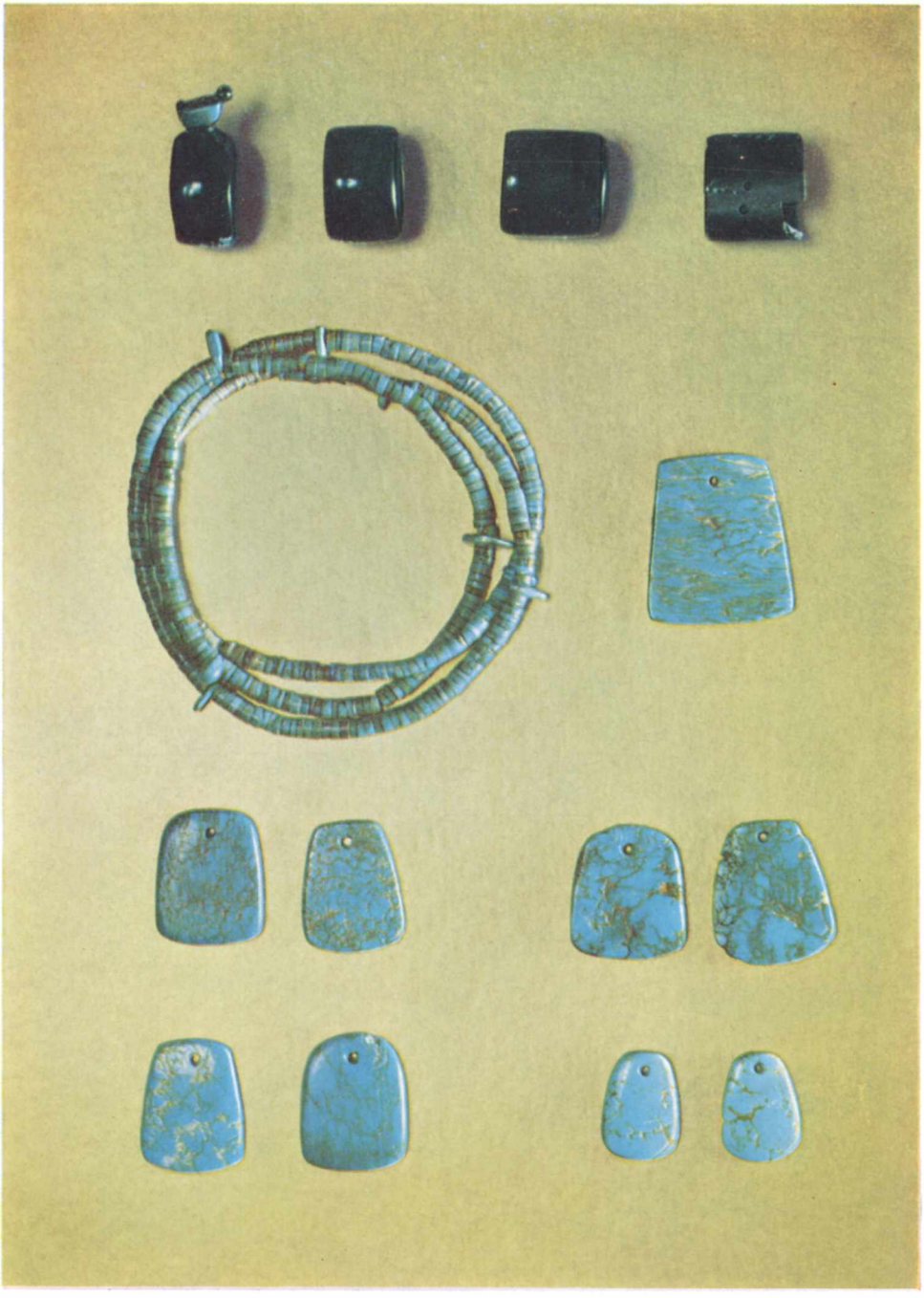
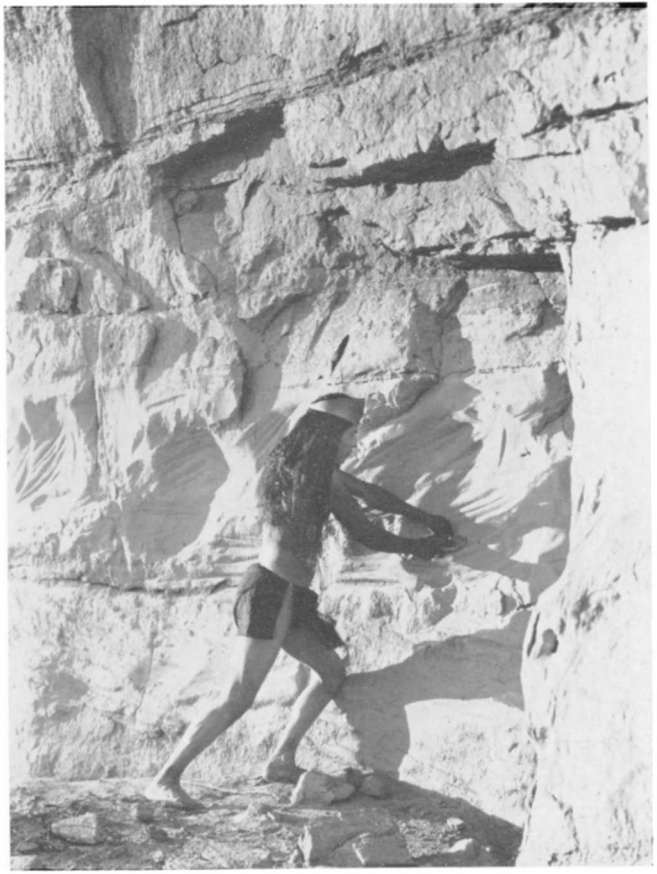


PLATE 22.—Jet finger rings, turquoise pendants, and a necklace last worn as a bracelet. (Photograph by Willard R. Culver.)



Cliff back of Pueblo Bonito where stone axes and bone awls were sharpened. (Photograph by O. C. Havens, 1925.)



Blind Zuñi man using a stone hammer to pound a wedge in his ax. (Photograph by O. C. Havens, 1923.)

PLATE 23

IV. HOUSEHOLD TOOLS AND UTENSILS

The Bonitians were a stone-age people. Occasionally they may have seen a copper knife in the hands of an itinerant peddler from the highlands of Mexico, but they had none of their own manufacture. Indeed, it was not until the second quarter of the seventeenth century, when Spanish colonists seemed permanently settled in the upper Rio Grande Valley and the Franciscans had established missions from Pecos on the east to Awatobi in the west, that the several Pueblo tribes became at all familiar with metal. And it was years thereafter before iron and steel were available to them in such quantity as partially to supersede the simple stone tools of their forefathers—hammers, axes, knives, and projectile points.

Stone tools were still common among the Pueblos, especially those of the west, as late as 1881 and were only then being displaced by American steel (Bourke, 1884, p. 251). A large portion of the stone implements Stevenson obtained in New Mexico and Arizona in 1879 had previously been gathered from abandoned villages. "The old ruins are searched," he wrote (1883, p. 329), "and from them, and the debris about them, stone pestles, mortars, hammers, hatchets, rubbing stones, scrapers, picks, spear and arrow heads, and polishing stones are collected by the inhabitants of nearly all the pueblos, and are kept and used by them."

At Bonito as in later, even post-Spanish, Pueblo towns there were implements peculiar to the household and others designed for use primarily in the fields. Some were used chiefly by men; others, by women. Some closely resemble, in form and function, twentieth-century tools. But there are other implements the purpose of which we may only guess. All were fashioned from the only suitable materials available—bone, wood, and stone.

IMPLEMENTS OF STONE

Hammers, simplest of all aboriginal tools, came into use with the very dawn of the human race. Any tough stone that might be grasped in the hand sufficed for a hammer, but its surface was invariably fractured with another stone to produce jagged faces and thus increase its effectiveness. When these rough edges were worn away, the hammer was discarded. On one of our numerous trips to Zuñi I saw an old gentleman, totally blind, driving a wedge into an ax handle with a rock from his doorstep (pl. 23, right). To him there was nothing novel in this, for he had been pounding things with simi-

lar stones since early boyhood. And the ancestors of this ancient, having no knowledge of metals, were doubtless more expert than he in improvising tools from the materials at hand.

As their fathers did before them, the artisans of Pueblo Bonito employed hammerstones for breaking or abrading rocks. With stone hammers they struck off chunks of flint that might be carried home and made into arrowheads and knives. By patient pounding, by the slow attrition that comes with repeated blows of stone on stone, they shaped axheads from water-worn cobbles, transformed sandstone blocks into mills for grinding maize, and dressed the slabs used in house construction. In primitive hands the stone hammer and the abrader answered all those diverse needs for which the modern craftsman requires an assortment of chisels, mauls, and other steel implements.

Bonitian hammers (pl. 24, *a*) are mostly of quartzite, silicified wood, and flint because these are the toughest rocks to be found in northwestern New Mexico. They vary in weight from a few ounces to a pound and a half. No other artifact was so frequently encountered during our explorations. Pepper tabulates 688 hammerstones unearthed by the Hyde Expedition; my own field notes mention the finding of 653, and we may have seen and ignored half as many more while trenching rubbish heaps and tracing deeply buried, partly razed walls.

That the time required in making stone implements by aboriginal methods is really much less than the uninitiated might suppose has been amply demonstrated in the laboratories of the Smithsonian Institution by Gill, Holmes, McGuire, and others. DeLancy Gill, for example, with a jasper hammer and a sandstone abrader as his only tools, in 21 hours fashioned from a quartzite cobble a most excellent ax measuring $4\frac{5}{8}$ by $3\frac{5}{8}$ by $1\frac{5}{8}$ inches. Like the aborigines whose work he so successfully imitated, Gill found that the effectiveness of a stone hammer was materially reduced when its faceted surface became smooth through use; that it was easier to make a new hammer than to refracture an old one. This observation undoubtedly explains the abundance of discarded hammerstones at every Pueblo ruin.

Abraders were to the Bonitians what planes, rasps, and carborundum wheels are to twentieth-century farmers. They were the tools with which other tools were made, the chief reliance of the woodworker. Abrasive stones were never standardized; we find them in all manner of shapes and sizes. Some are merely casual fragments, used once and tossed aside. Others are so carefully made, so trim and neatly squared, as obviously to have been designed for special purposes.

Throughout the sandy Chaco district sandstone is present in unlimited quantities and in various degrees of fineness. The coarser varieties were utilized for shaping and smoothing artifacts of stone, for dressing wooden tablets, and for rubbing knots off ceiling beams. Sandstone of much finer texture was employed for fragile materials and more delicate tasks, as when shells and turquoise were fashioned into objects of personal adornment. That the abrasive properties of Chaco Canyon sandstone are still appreciated was clearly demonstrated one day when I chanced to see one of our Navaho workmen pick up a spall and use it to take the rough edge off a broken incisor.

When a Bonitian had an ax to grind he rubbed it up and down on the cliff back of the village (pl. 23, left) or on any other handy surface. Perhaps half of the remaining doorsills in Pueblo Bonito are scored by the sharpening of stone axes, whatever the housewives may have had to say about it. On detached blocks here and there and occasionally on house walls one notes where bone awls were pointed, where digging sticks were re-edged, and where various other implements were whetted for the task in hand.

The abrasive stones we recovered from rooms and rubbish heaps may be divided into two fairly equal classes: "active" and "passive." Active abraders—the designation is literal—are those held in the hand and used after the manner of a file, while a passive abrader is one which remained stationary as the object being altered was moved back and forth upon it. Naturally the type employed was more or less determined by the size and shape of the object to be made and the ease with which it could be managed. Whether the abrader was rubbed on the artifact or the artifact on the abrader, it was the cutting properties of sand that produced the desired result.

The three illustrated in figure 29 are typical examples of active abraders. Although commonly described as "arrowshaft smoothers," their best-known function, they were also employed at Pueblo Bonito for smoothing willow shoots for ceilings in houses of second-type construction, for rounding spindle shafts and similar slender objects of wood. Among several somewhat related specimens is one with 10 concave faces (fig. 30), the result of friction through which a bow, a digging stick, a paho, or artifact of comparable diameter was brought to its final form. We may list also with the active abraders spalls with worn edges, sandstone saws, delicate filelike tools, and pointed implements, both flat and rounded. From Room 318 came a series of five conical abraders, varying from half an inch to an inch in diameter at the butt and from $1\frac{3}{4}$ to $4\frac{1}{2}$ inches in length. Together, they suggest a definite set of tools (pl. 25, *a-e*).

In figure 31 is shown a section severed from a thin sandstone tablet.

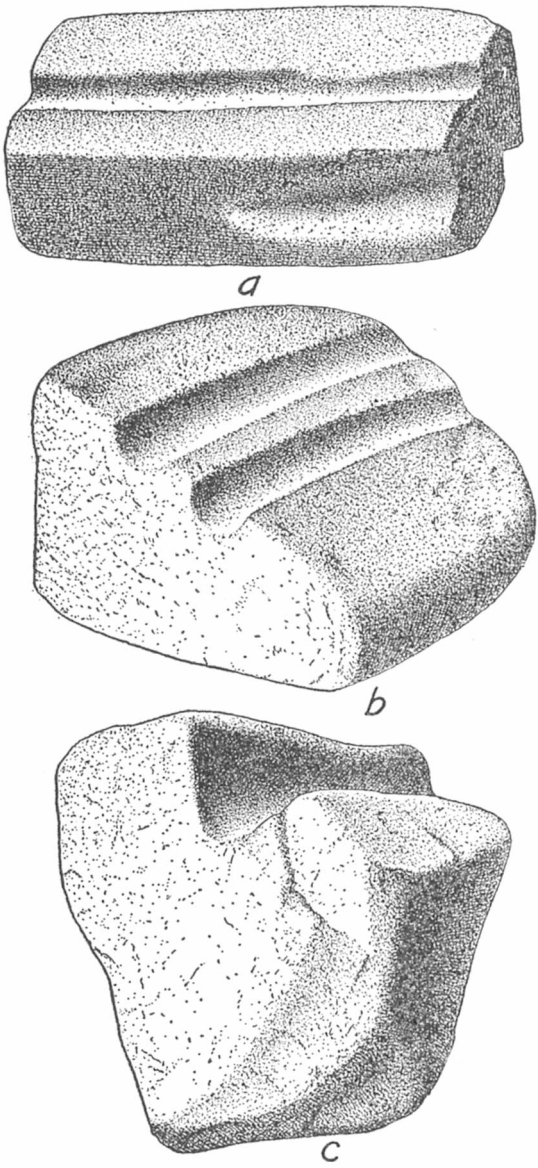


FIG. 29.—Active abraders.

This specimen illustrates clearly the manner in which stone was used to cut stone. An edged abrader was moved patiently back and forth upon the tablet until the resultant groove was deep enough to permit breaking off of the unwanted portion. But the latter, in this particular instance, was itself utilized since its cut edge has been worn to a degree not adequately represented in the drawing.

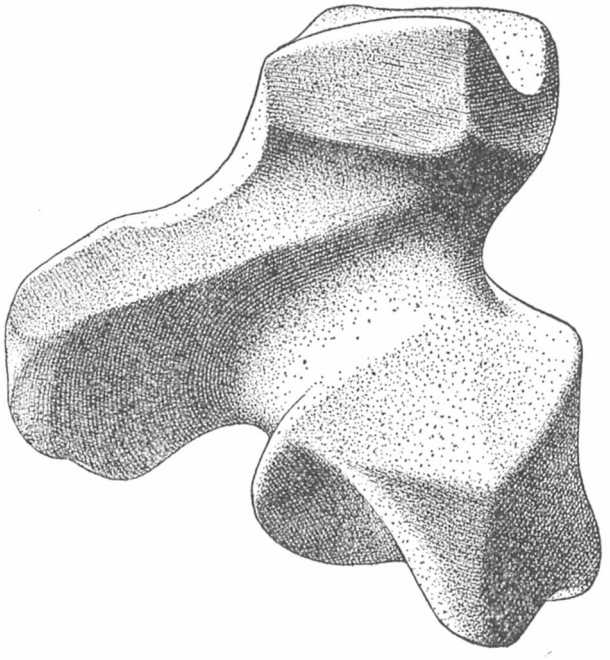


FIG. 30.—A multiple-grooved abrader.

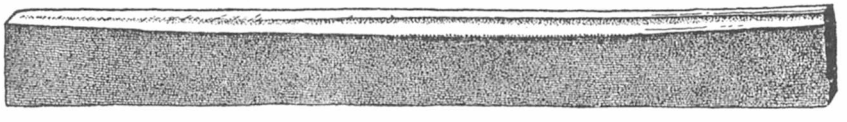


FIG. 31.—Portion of stone tablet severed by sawing.

In contrast to the more or less chance fragments comprising this first group, "passive" abraders—those remaining in fixed position as objects were rubbed upon them—may be anything from the cliff back of the village to a half-pound lap stone. While an irregular block might suffice for pointing a bone awl (fig. 32), most passive abraders are rectangular, and it is noted that the care exercised in shaping them, and their thinness, vary directly with the texture of the stone. Some are polished to velvet smoothness (fig. 33, *b*), some are worn

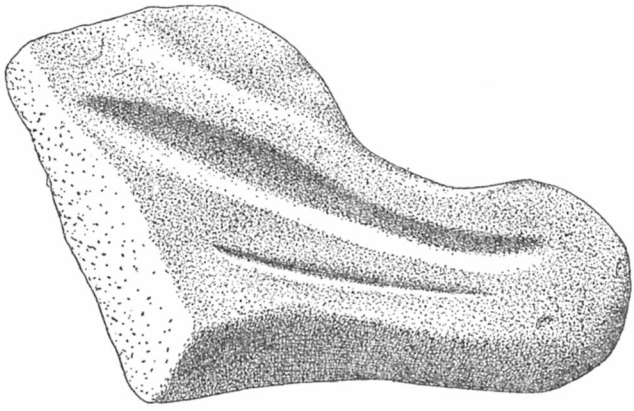


FIG. 32.—Fragment of sandstone on which awls were sharpened.

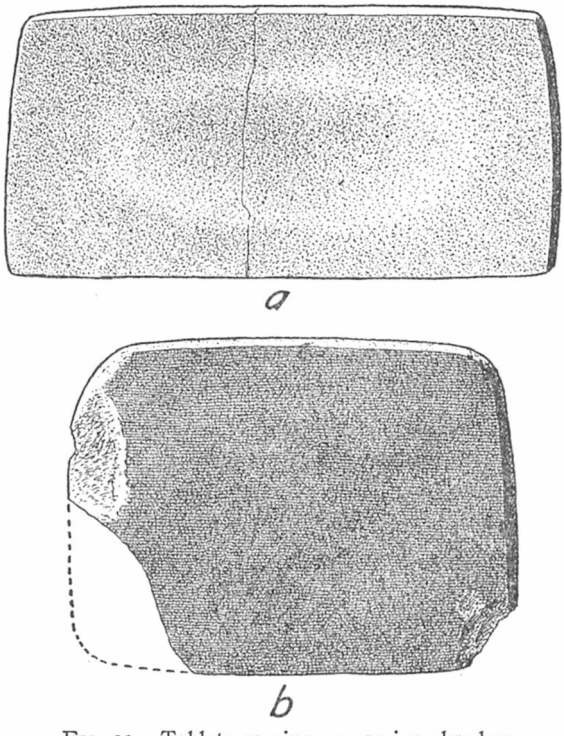


FIG. 33.—Tablets serving as passive abraders.

unevenly like a novice's whetstone, and some show median, longitudinal attrition (fig. 33, *a*). I believe these latter, always of fine-grained sandstone, were used in the manufacture of ornaments, a surmise strengthened by the fact that, in several instances, the grinding surface retains traces of some unidentifiable white substance, perhaps the calcareous matter of which shells are formed or the sericitized granitic rock in which New Mexico turquoise usually occurs.

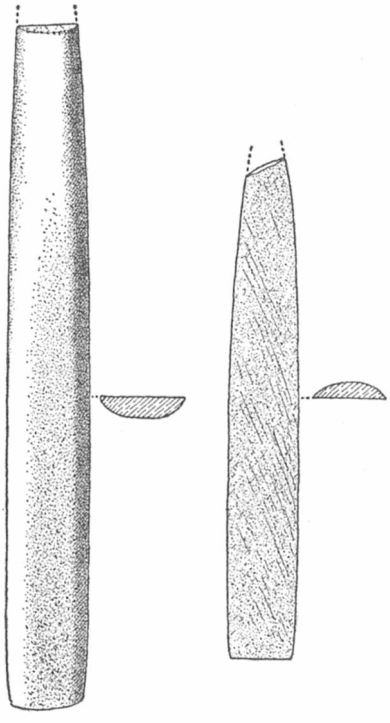


FIG. 34.—Sandstone "files."

The filelike tools mentioned among our "active" abraders merit an additional word. Six were found in Room 26, Pueblo del Arroyo. All are broken, but this is not surprising considering the fact that they average only a tenth of an inch thick at the broader end (fig. 34). Four are planoconvex in cross section, while the other two are flat, with edges beveled on one side. A single comparable specimen was recovered at Pueblo Bonito, in Room 328, and this also is flat on both sides (U.S.N.M. No. 335628).

It is certain that these little instruments served as abraders, yet for what particular purpose I cannot say. One of our Zuñi, an expert

worker of turquoise, described them as files for making beads and proceeded to demonstrate while I held my breath lest he break the fragile thing. But this same man, like other Zuñi lapidaries I have watched, ground his own turquoise beads and pendants in the old proven way—individually on a sandstone tablet. So his explanation of our filelike implements, however plausible, is doubtless to be taken with a grain of salt.

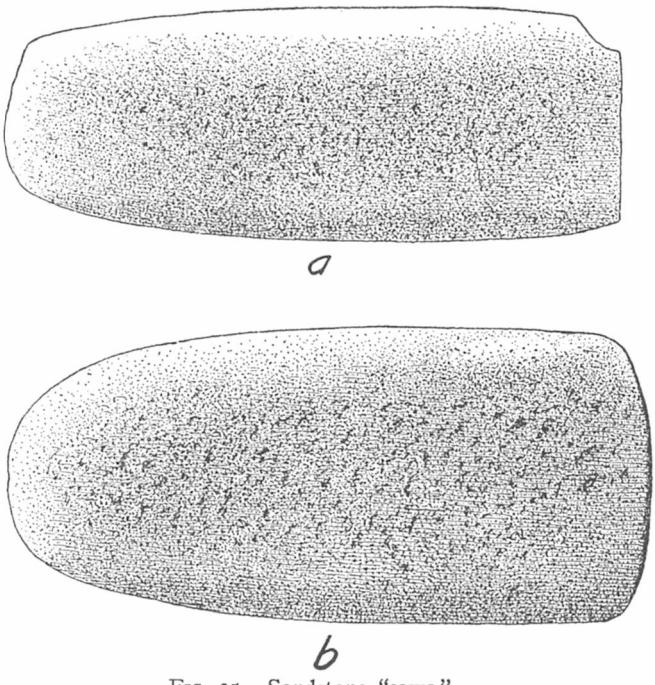


FIG. 35.—Sandstone "saws."

Sandstone saws (fig. 35).—This term will serve to describe an even dozen knifelike implements made of clayey sandstone. The two illustrated, the only complete ones in the lot, are double-edged, while nine of those remaining are sharpened on one edge only. All indicate an original length of at least twice the width, with thickness varying from one-sixteenth to one-eighth of an inch. Six were found in rooms of third- and fourth-type masonry, while only one came from the older part of Pueblo Bonito.

As saws, these fragile blades were used to sever stone, bone, and other materials. Their edges are beveled equally from both sides, and some are noticeably dulled. One fragment retains traces of a cal-

careous substance as if it had been employed not only for cutting pieces of shell but also as a block on which to polish them. Grooves in cut bone correspond with the V-edges of these sandstone saws.

Two other fragments originally included in this series are found, on reexamination, to be parts of small tablets. They were made of the same clayey sandstone; they are equally thin, but their edges are less knifelike and their faces are slightly concave owing to longitudinal attrition.

Rubbing and smoothing stones, so-called (pl. 25, lower), are commonly thought to have been utilized for smoothing earthen floors and newly plastered walls. They would have answered these purposes admirably, but none of our examples shows the transverse striations that must have resulted had it been so employed. The Pueblo woman's hand is her trowel in all plastering operations today.

Often made from water-worn cobbles, smoothing stones are oval, discoidal, or rectangular in shape and of a size easily held by one's outstretched fingers. Most of our series show wear on both sides, the faces being flat or slightly convex. All are of sandstone, usually fine-grained, except three foreign to the Chaco area—one of grayish-brown vesicular lava and two of a dark, igneous rock mineralogists call gabbro. One in the series has served as an improvised palette and another is stained red all over, thus evidencing a final use in powdering ocher.

Being of convenient size, rubbing stones were frequently substituted for other household implements, especially hammers and mullers. This is proved by their battered edges and by the shallow, circular depressions not uncommonly noted on doorslabs and old metates. Two of those illustrated (pl. 25, figs. *j* and *k*) are from storeroom 300B; 51 rubbing stones, manos, and re-used mano fragments partly enclosed a pile of potter's clay at the south end of Room 212.

Pottery polishers, the water-worn pebbles with which Pueblo women traditionally gloss the surfaces of earthenware vessels prior to ornamentation and firing, were little used at Pueblo Bonito. Although numbers of unworked pebbles and small cobbles were unearthed, our collection includes only 11 showing perceptible wear and four of these served also as hammerstones. Only one came from the old section of the village; none was found in Pueblo del Arroyo. And yet some of the oldest as well as some of the latest pottery we exhumed was clearly stone-polished.

Sandstone tablets were found in all parts of the ruin. Some, shaped and roughly dressed with stone hammers from slabs an inch or so thick, were designed as storeroom doors (pl. 26, B), others, of smaller

size, covered ventilators and like wall openings. Sandstone slabs were found in position over the ventilator ducts in Kivas J, K, and N; reworked door fragments sealed subfloor repositories in Kivas D and R. Tablets 2 to 10 inches long and of varying texture, used primarily as passive abraders, may be identified by the marks of abrasion. But there are others, rough or smoothly finished, for which we find no satisfactory explanation.

Five very unusual sandstone tablets were found in Room 23, Pueblo del Arroyo. Nothing equal to them either in size or workmanship was disclosed at Pueblo Bonito. Indeed, the only ones at all comparable are the four illustrated in plate 27, *a-d,* and these are only about half as large as the five from Pueblo del Arroyo. The first of the four, of cream-colored marlaceous shale foreign to Chaco Canyon,[26] was recovered from Kiva Q; the others, from Room 326. The fourth, *d,* was among the burial furniture of two middle-aged females, Nos. 8 and 9 (pl. 95, upper), but this fact provides no hint as to its purpose.

Work slabs (?).—Three examples will suffice to represent a relatively small group, neither metates nor tablets, whose real function we do not know but which I am designating "work slabs" under the belief that each was utilized in some domestic task. The specimens are all of fine-grained sandstone; some have taken on a near-polish. Had they been used in the preparation of clay for pottery manufacture —an old metate, a flat rock, or a board answers this purpose among living Pueblos—the marks of crushing implements and scratches from tempering materials would be evident.

One of our three examples has, indeed, been slightly worn the full width on each side by friction of a muller (U.S.N.M. No. 335897). It is a slab of chocolate-colored sandstone, 16 by $7\frac{1}{4}$ by $1\frac{1}{4}$ inches, whose natural cleavage planes required little alteration; both faces bear traces of a black pigment. A second specimen (No. 335898), $11\frac{5}{8}$ by $9\frac{3}{4}$ by $1\frac{11}{16}$ inches, with neatly worked edges and rounded corners, was so embedded that its one smoothed face lay flush with the floor in the middle east half of Room 291; it had no apparent connection with a nearby series of dismantled mealing bins. In Room 268 a like slab was similarly embedded in the floor, against the north wall and adjoining an oval fireplace.

The third example (No. 335899), of limy sandstone as smooth as velvet, is equally puzzling. It measures $16\frac{1}{2}$ by $10\frac{5}{8}$ by $1\frac{1}{8}$ inches, has

[26] Identified by Dr. J. B. Reeside, Jr., of the U. S. Geological Survey, as possibly from the Greenriver formation between Grand Junction, Colo., and Price, Utah; less likely, from the Todilto formation which overlies the Chinle red beds north of Thoreau, N. Mex.

rounded edges, and is polished on both sides. Longitudinally it is slightly concavoconvex; neither face is scored by abrading implements. When found the slab was leaning against the wall as an improvised step to the hatchway that formed the only exit from subterranean, rubbish-filled Room 255. Like the other two it shows no evidence of use over a fire and thus cannot be a baking stone such as one may see in modern Zuñi and Hopi homes.

Jar covers.—Not long after fired pottery came into general use throughout the San Juan area, the jar cover followed as a natural accompaniment. A sandstone slab, reduced with stone hammers to the size desired, answered as lid for a storage pot buried under the floor or set next to the wall of a granary, but a jar used daily at mealtime required a cover more pleasing to the eye. Among the undescribed objects from a Pueblo I pit house in Chaco Canyon is the larger portion of a sandstone disk, a quarter of an inch thick by $4\frac{7}{8}$ inches in diameter, whose two faces and chipped edge have been partly smoothed by abrasion (Judd, 1924a, p. 411. U.S.N.M. No. 324830). Small-mouthed vessels at Pueblo Bonito were customarily covered by equally thin but completely smoothed disks (pl. 24, *b*). We found none actually in position but noted several instances where pitchers placed as burial offerings had toppled to one side, dislodging their covers.

Disks were most numerous in rooms whose contents included cylindrical-necked pitchers and cylindrical vases. We retained 123 for the national collections. These are entirely representative and show every possible variation from those rudely shaped by percussion to those abraded to almost machine-made exactness both in diameter and thickness. All but three are sandstone: two are of slate (the reworked fragments of larger disks), and one is of lignite—the periphery is rubbed but both faces show the natural plane of cleavage. Only 13 are more than 5 inches in diameter. Five have been used as chance palettes on which to prepare red, yellow, or white pigment; three served as passive abraders whereon materials were ground by a broadly circular motion. A few covers are rather squarish; nine are plainly reworked fragments of tablets such as those shown in plate 27, *a-d*. Eleven were recovered from kivas. Twelve specimens, all of fine-grained sandstone but varying in size and circularity, measure $1\frac{1}{2}$ inches or less in diameter and thus should have been listed under another category.

As to provenience, whereas 62.6 percent of our series came from Late Bonitian buildings (57 percent from third-period structures alone), Hyde's tabulation of those Pepper unearthed, taking "disks"

and "jar covers" together, shows 69.8 percent from Old Bonitian houses and only 30.2 percent from later dwellings and kivas (Pepper, 1920, pp. 363-365). Seventy-five covers (ibid., p. 125, gives the number as 121) were in Room 28 and closely associated with an unusual assemblage of pottery that included both early and late types.

In addition to the foregoing, we encountered a few improvisations. Among these was the bottom of a corrugated pot that, with a minimum of chipping on the periphery, was converted into a satisfactory jar cover $3\frac{1}{8}$ inches in diameter (U.S.N.M. No. 336106). And in Room 326 we found a stopper of unfired clay, $3\frac{1}{4}$ inches in diameter by $1\frac{1}{8}$ inches thick (No. 336082). Its upper surface is slightly convex and somewhat irregular as if pressed by the heel of the hand; the under side bears angular imprints of some hard, fragmentary substance such as turquoise matrix.

In a region where the casual tourist sees only sand and sandstone, the men of Pueblo Bonito found nodules of chalcedony, chert, jasper, and obsidian. Flakes struck from these were carried back to the village and fashioned into knives and arrowheads with stone hammers and bone chipping tools.

Cherty concretions infrequently occur in the massive sandstones bordering Chaco Canyon; occasional outcroppings of flint may be noted on the mesas above; petrified logs are exposed now and then in the blue clays of the Ojo Alamo section, to the northward. My Navaho workmen said that weathered pieces of obsidian could be gathered along the Continental Divide, some 40 miles east of Pueblo Bonito; they professed not to know the source of chalcedony which geologists assure me should appear, in concretionary form, almost anywhere in the Chaco district. The light-gray, fine-grained quartzite from which a few of our chipped specimens were made doubtless came from the Animas River valley. It is abundant there and was commonly utilized by the inhabitants of Aztec (Morris, 1919a, p. 34).

Knives.—The most effective cutting tools known to the Bonitians were chipped from obsidian, flint, and similar glassy rocks. While any feather-edge flake might serve a passing need, the real Pueblo knife was a leaf-shaped blade or one resembling an oversized arrowhead. With the possible exception of the two largest, specimens *a-h* shown on plate 28 were doubtless hafted for use. Flint knives in their original wooden handles are uncommon but by no means rare in the Pueblo area. Morris (1919a, fig. 17, p. 31) figures three from Aztec Ruin; Pepper (1920, p. 326) found one in Room 107B at Pueblo Bonito.

Describing the Indian method of skinning buffalo as practiced on the Great Plains in 1541, Castañeda says they used "a flint as large

as a finger, tied in a little stick, with as much ease as if working with a good iron tool" (Winship, 1896, p. 528). Stone knives and arrow-points were in daily use as late as 1871 by the Apache, Paiute, and other nomadic tribes of the Southwest (Hoffman, 1896, pp. 281-283).

Because it is easily chipped into a keen-edged cutting tool, obsidian was a favorite material of all Indians having access to it. The obsidian blade shown in figure *h* of plate 28, the finest in our collection, comes from Pueblo del Arroyo. The large fragment, *c,* of brown silicified limestone, had been used as a saw until its edges were measurably dulled. Although containing fewer fossils than the two blades described below, it probably came from the same place.

The other three knives, plate 28, figures *i-k,* are remarkable for several reasons. Part of an offering concealed in the north wall of Kiva Q, they far excel in skill of execution all other blades known to me from the main Pueblo area. Indeed, if worth were measured by thinness and mastery of the art of chipping, rather than by length alone, I doubt that their better has been found elsewhere in the United States. The three were flaked in the same technique, and they are undoubtedly the product of a single individual. They are vastly superior to the other chipped implements from Pueblo Bonito, and the materials used are foreign to Chaco Canyon.

As illustrated, the first two are of silicified, earthy limestone, dark brown in color and containing minute fossil shells of Ostracoda. I was hopeful these latter might suffice to identify the source of the rock but they do not. The ostracod is a microscopic creature that lives mostly in fresh water. Limestones frequently contain fossil Ostracoda but not all limestones are silicified. My geological and paleontological colleagues [27] tell me the best-known deposit of silicified limestone bearing fossils of the type represented in our two specimens is the Maravillas chert of the Marathon Basin, near Abilene, Tex. However, in color at least, our two blades agree more closely with another formation, the Montoya limestone of the El Paso area. But these formations are both Ordovician, and it is generally conceded that the tiny shells in our specimens look much later, perhaps as late as the Tertiary period. Even so, southwestern Texas seemed the most likely place of origin for our two cherty knives until I chanced to recall one from Utah.

In 1876 Dr. Edward Palmer investigated several "mounds"—pre-

[27] For their cooperation in seeking to solve this problem, the writer acknowledges his indebtedness to Josiah Bridge, P. B. King, Edwin Kirk, J. B. Reeside, Jr., and the late E. O. Ulrich, of the U. S. Geological Survey; and to G. A. Cooper, of the U. S. National Museum.

sumably the remains of P. II adobe houses—in Santa Clara Valley, near St. George, in the extreme southwestern corner of Utah. Among the artifacts he recovered, still carefully preserved in the U. S. National Museum, is an unusually fine blade 10⅜ inches long. It was figured by Wilson (1899, fig. 88, p. 896) but inadequately described. Strangely enough, that knife is chipped in the same superior technique as the two from Kiva Q; it is of the same mottled brown, cherty limestone and of exactly the same thickness, three-sixteenths of an inch. Ostracods are present, but they are small and occasional. Such a rock might occur, I am told, in more than one Tertiary formation on the mountaintops of southwestern Utah. The air-line distance to Pueblo Bonito is almost the same as that from El Paso, but, as an additional obstacle, there would be the Rio Colorado to cross.

There are other, problematical sources nearer Chaco Canyon: west from Mount Taylor, in New Mexico, and, again, extending southward from the Chuska Mountains, in eastern Arizona, exposures of unsilicified limestone (Todilto formation) containing Ostracoda like ours overlie the red Wingate sandstone. Now it is possible an intrusive dike of igneous rock—and such dikes are present in the Chuska area—would silicify the limestone for a short distance roundabout and thus produce just such material as that from which our two blades were fashioned. Since both districts lie within a couple of days' foot journey from Pueblo Bonito, there remains the possibility that some wandering Bonitian, or a visitor, happened upon a limited quantity of the material and selected the blocks from which our two specimens were chipped. However, even while grasping at this straw, we are reminded that the quality of the chipping excels that of all other knives in the collection if not, indeed, that of all others from the Pueblo area in general.

Our third blade from the Kiva Q deposit is of grayish, semitranslucent quartzite, flinty in appearance but with no distinctive characteristic. Thus there is no likelihood of tracing it to its place of origin. The rock is lighter in color than the Animas River quartzites, but it permitted the same flaking technique as the two limestone blades.

In every abandoned room where floor sweepings and other debris of occupation had been thrown we uncovered spalls of flint, jasper, and obsidian—rejectage from the manufacturing of blades and projectile points. Of these numerous fragments less than two dozen had been turned to account. Four were notched like saws (fig. 36), while the others were chipped on one or more edges to serve as scrapers or knives. In archeological circles, flakes chipped from both sides are

identified as knives; those chipped from one side only, as scrapers.[28]

Scrapers are flakes of hard, flinty rock, chipped along one or more edges and designed for fleshing hides, shaping wooden objects, etc. There are two principal types, named from the area of specialization: End scrapers and side scrapers. Both are almost worldwide in distribution; both have been in use since the lower Paleolithic period. Thus, by themselves, scrapers can tell very little of time or culture.

From its blunted end, the first type is often designated "snub-nosed" or "duck-billed." It was an indispensable tool of tribes that followed

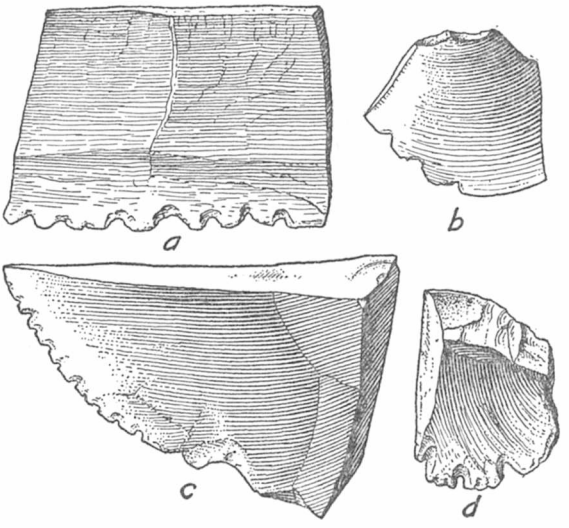


FIG. 36.—Flint spalls used as saws.

the buffalo up and down the Great Plains. End scrapers chipped from bottle glass, collected in Nebraska about 1870, duplicate in shape and size those of chalcedony and jasper found in Colorado deposits geologically dated as at least 15,000 years old.

Stone scrapers of both types are surprisingly rare in the western Pueblo country. We recovered only five during our seven seasons' excavation. Three of these are side scrapers and, although chipped to an edge from one side only, are thin enough to have served as knives. The other two are end scrapers recovered, respectively, from Kiva J, Pueblo del Arroyo (U.S.N.M. No. 334796), and the west refuse mound at Pueblo Bonito. The second example (fig. 37) was a surface

[28] For the latest, most penetrating analysis of chipped implements from the Pueblo area, see Kidder, 1932, pp. 13-44.

find in 1929 by Mrs. Hilding F. Palmer, wife of the then custodian of Chaco National Monument.

In contrast with our meager findings, Kidder (1932, p. 15) lists 185 end scrapers and 291 side scrapers from Pecos, situated on the western margin of the buffalo country. I am not prepared to argue that the number of chipped scrapers from a given Pueblo III ruin is any index to contact between that settlement and Plains tribes in pre-Spanish times, but the possibility merits archeological scrutiny.

Drills are tools for boring holes. Holes for suspension cords were bored in beads and pendants; broken earthenware vessels were repaired with yucca fiber threaded through drilled holes. Lacking metal, the Bonitians made drill points of stone, chiefly flint and chalcedony. We may have overlooked several, but even so it is strange that our Pueblo Bonito collection contains only five examples. One of these is an altered arrowhead; another looks like an arrowpoint in profile but is really too thick along the spine.



FIG. 37.—An end scraper. (Drawn by Irvin E. Alleman.)

Broad-stemmed drills were doubtless held between thumb and index finger and turned gimlet-fashion, but the others were mounted in the end of a stick to be twirled between the palms. Examples so mounted have been found repeatedly in Arizona and Colorado cliff dwellings.

Although steel has since replaced the stone drill points they commonly used 60 years ago, Zuñi lapidaries still employ the pump drill for boring holes in shell and turquoise beads (pl. 20, left). The pump drill, like the bow drill, is a compound instrument usually associated with northern Indians and the Eskimo. However, Martin (1934, pp. 94-97) figures and describes a bow-drill set found in 1890 in a cliff dwelling in Grand Gulch, southeastern Utah. After 60 years the set remains unique for the Pueblo country.

Milling stones.—Maize cultivation was the foundation upon which Pueblo society was erected, and milling stones were essential to the full utilization of maize. Although wheat has come more recently to form an important item in Pueblo diet, maize remains the favorite. It has provided the principal food supply of all sedentary tribes dwelling in the Southwest since Basket Maker times, and almost without exception these diverse peoples have ground their maize meal between two specialized milling stones. One of these, the metate (from the Aztec *metlatl*), remains stationary; upon it, maize kernels are crushed with a movable handstone, the muller or *mano*.

There seems but little doubt that the original concept of these primi-

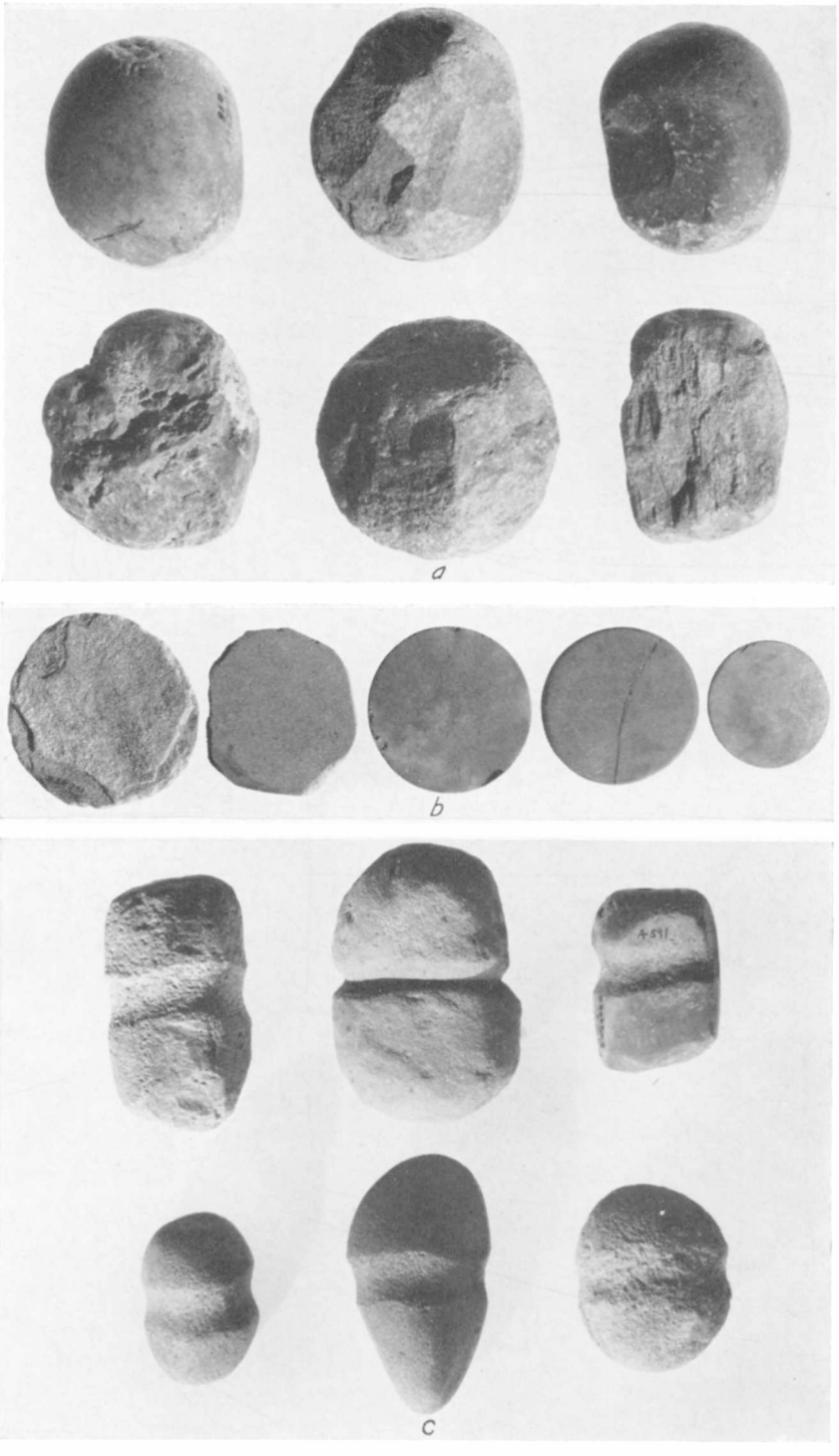


PLATE 24.—*a*, Hammerstones; *b*, sandstone jar covers; *c*, club heads.

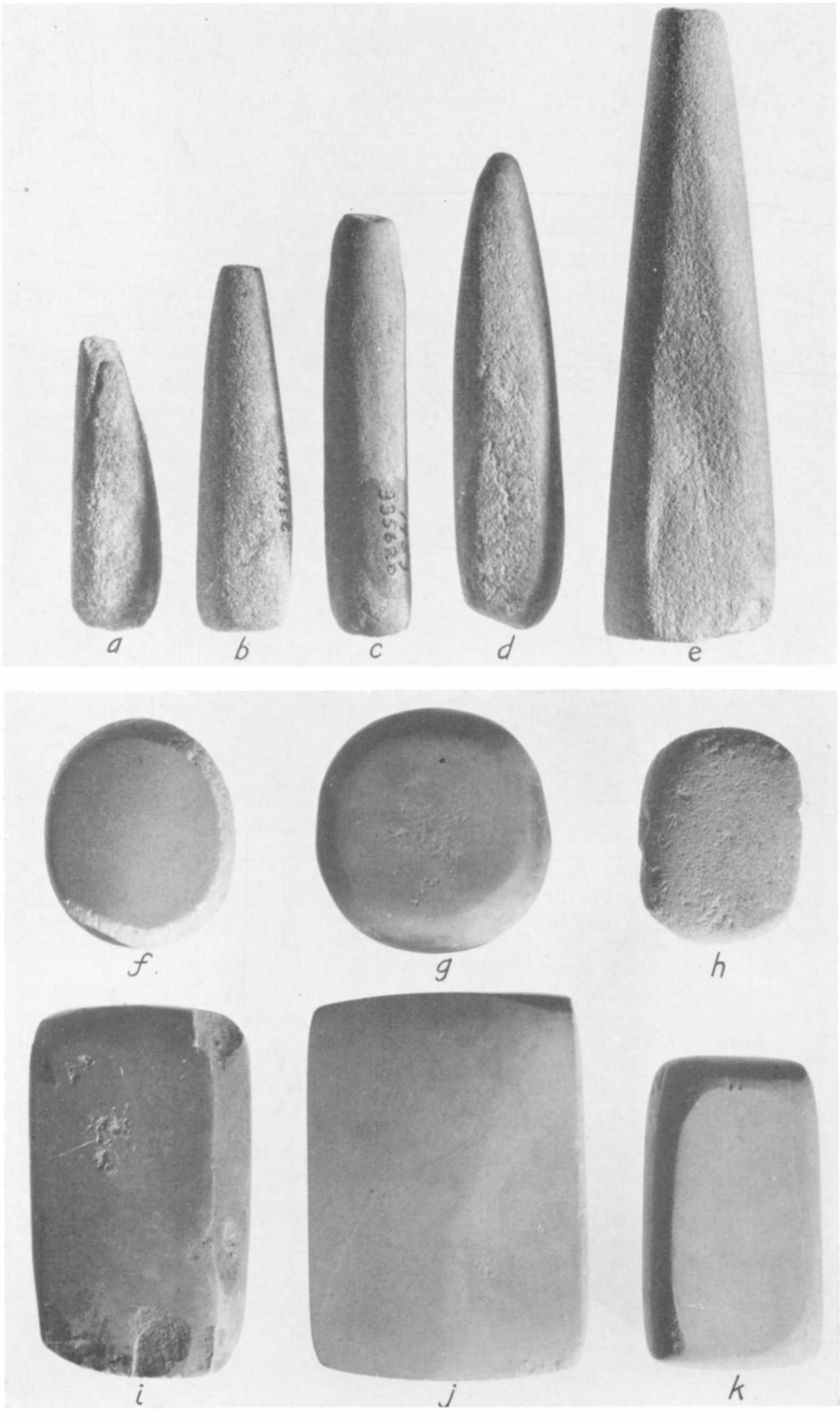


PLATE 25.—*Upper:* A set of sandstone abraders from Room 318. *Lower:* Rubbing and smoothing tools of sandstone.

tive stone mills germinated in Central America or Mexico and spread north and south with the distribution of maize. Mexican and Central American metates, carved usually from basalt, ordinarily possess three legs that elevate the grinding surface to a height and angle convenient for a kneeling woman. They can be moved about the house at will and often are transported appreciable distances. Pueblo metates, on the other hand, are commonly of sandstone and always legless. In their earliest known form they lay flat upon the floor while in use; later the end at which the miller knelt was often propped up a few inches for comfort while grinding. Still later, perhaps during the first half of the eleventh century, a housewife here and there fixed her mill permanently in position, at an angle of 20° to 30°, and walled it about with sandstone slabs on edge. Out of this occasional practice grew the Pueblo custom of arranging binned metates of varying texture side by side in series of two, three, or more. Three provide a satisfactory sequence and is the number most frequently employed today. The first, or coarsest, may be of vesicular lava; the others, of medium- and fine-grained sandstone. Maize crushed upon the first is passed to the next for grinding and then to the third, where it is reduced to the desired degree of fineness (pl. 29, lower).

The efficiency of these multiple milling stones, and the young women who operated them, greatly impressed Coronado during his first few days among the Zuñi. From Hawikuh he wrote the viceroy on August 3, 1540: "They have the very best arrangement and machinery for grinding that was ever seen. One of these Indian women here will grind as much as four of the Mexicans" (Winship, 1896, p. 559).

In Tigua villages, according to Castañeda (ibid., p. 522), maize was ground on three stones in a room that was set aside for the purpose and which the women were at pains to keep clean. They even removed their moccasins and covered their hair before entering. At one of the towns our chronicler looked in upon a grinding party preparing cornmeal for some ceremony—a gay party where the girls sang in rhythm with their grinding while a man sat at the door and played a flute accompaniment.

We do not know precisely where or when the compound milling bin originated, but we have evidence of at least two in Pueblo Bonito. Both were in houses of third-period construction; both had been dismantled. The first series, which included 10 metate bins and occupied almost the entire middle length of Room 90, has been described by Pepper (1920, pp. 295-296). Slabs on edge had framed each mill and its accompanying basin into which the ground meal fell. In each case the meal basin had been paved with sandstone slabs; in each case this

flooring lay 2 to 3 inches below the forward edge of the metate slope. Three metates, two of which clearly had fallen from the room above, were found upon or near the bins; one of the three is described as "flat."

Our second example appeared in Room 291, a dwelling with central fireplace. Here two adjoining meal basins, flag-paved 4 inches below the room floor, indicated the former presence of as many stone mills. The first basin, 16 inches wide by 21 inches long, abutted the northeast wall less than 4 feet from the north corner; the second basin, in the same axis as the first, measured 12 by 16 inches. Their respective lengths, 21 inches and 16 inches, approximate the widths of the two metates that once sloped upward from the basins toward the northwest end of the house. Both mills had left concave imprints, and since the first is perceptibly higher than the second we infer the metate that made it was thinner and broader than its companion. A slab fragment on edge had supported the forward end of the second mill and marked the near side of its associated basin. Both bins had been dismantled when their metates were removed; we detected no evidence of former enclosing slabs at their upper or raised ends (pl. 29, upper).

In line with the two described above and against the southwest wall, a slab on end marks the back of a third meal basin, 11 by 19 inches. Between it and the room's west corner are the remains of two more, likewise slab-paved, upon the original room floor 4 inches below the second and final one. Because this latter was much broken, metate seatings here are not so clearly indicated as in the two cases first cited. Nevertheless it seems certain that when Room 291 was inhabited it boasted five binned metates, in banks of two and three, respectively. These and their enclosing slabs were removed for use elsewhere when the dwelling was abandoned; subsequently, and characteristically, nearby residents utilized the empty room as a convenient receptacle for household rubbish. Of 1,023 potsherds tabulated from this debris, 5.4 percent represent the four principal varieties of Old Bonitian pottery; 71 percent, as many Late Bonitian wares.

Adjoining 291 on the northeast is Room 72, a narrow closet built to utilize otherwise waste space when Kiva 75 replaced 76. In Room 72 the Hyde Expedition found 20 metates, including several unfinished ones, leaning against the walls or fallen flat upon the floor.[29] Next beyond 72 is Room 20, which adjoins 90, the milling room to which we have already referred. The doorways connecting these four had all

[29] Pepper, 1920, pp. 257-258. Pepper's unpublished negative No. 247 shows that at least six of the mills belong in our "tabular" classification.

been blocked, presumably because first-story Rooms 20 and 90 were no longer suitable as living quarters after Kiva 75 was constructed in front of them. If the time of that construction was A.D. 1061, the cutting date of a beam that carried the south wall of Rooms 290-291 across the arc of Kiva L, then Room 90 probably was built 15 or 20 years earlier. Its 10 slab-walled milling bins may have been installed at the same time or a decade later.

In Old Bonitian dwellings we found no binned metate; no special milling room. Here, as throughout the village generally, the daily grinding appears to have been done on single, casually placed mills. These were all of the troughed variety; that is, the upper surface bore a longitudinal groove or trough in which the mano moved to grind the meal. That groove was closed at the elevated end, where the operator knelt, and open at the lower end.

All Bonitian metates are troughed, but minor differences separate them into two principal groups. One group is thin, tabular, and symmetrical as a rule, with wide margins to the shallow grinding area (pl. 30, left); the second, at least 3 inches thick, is more or less massive in appearance (pl. 30, right). Both groups include mills finished with little or no change in the original block of sandstone except the mano groove and others reduced to the desired size and shape by much spalling and rubbing. We brought to Washington for the national collections only one example of each kind, but my choice for the second type is not quite a proper one since its closed end had been battered away and the trough extended full length—the lone example of its kind at Pueblo Bonito. Pittings left by the stone hammer suggest this change probably took place when the mill was last resurfaced.

It is well known that Pueblo milling stones must be "sharpened" from time to time in order to maintain their cutting properties. Just how frequently is the one factor in question. Bartlett (1933, p. 4) says Hopi matrons of a generation ago roughened their grinding stones every 5 days. At such a rate, and with corn to be crushed and powdered daily, deep troughs would soon develop even in the thickest, toughest mill. By the same token, those of the tabular variety would last a matter of months only, rather than years.

Because all Bonitian metates are troughed, I did not recognize soon enough the possibility of a cultural lag. And I have not yet found a satisfactory adjective to differentiate between the two groups. In the field we referred to the first as "tabular" but were never able to improve upon "thick-troughed" for the second. "Massive" would have fitted a majority but not all. Tabularity is perhaps the most tangible point of distinction. We regard as "tabular" those metates made from

laminate sandstone split along its cleavage lines into slabs averaging about 2 inches thick and retaining a border of 3 to 6 or more inches on three sides of the mano trough. All others are "massive" even though they bulk less than tabular mills.

Of 87 unbroken metates exposed during our investigations at Pueblo Bonito, 53 were found in rooms of third- and fourth-type masonry, and approximately 80 percent of these were of the thicker variety. Many had been discarded, but others clearly had fallen from second-story dwellings. Twenty-five came from Old Bonitian Rooms 296, 306, 307, 307-I, 323, and 326, of which the last four had degenerated into dump grounds. Fifteen of this number belong to our "massive" group, three are "tabular," and seven remain unclassified. Where mills are reported in my excavation notes, the type, unfortunately, is not always indicated. None of those we uncovered was propped up on stones or otherwise fixed in position.

We have no record of a local mill with over-all grinding surface requiring a muller as long as, or longer than, the metate's width. But such a one was found in Room 5, Pueblo del Arroyo—a foreign, flat-faced metate 8 inches wide by 19 inches long, neatly set in adobe in a slab-walled bin 17 inches wide.

Pepper (1920, p. 90) describes from Room 20 fragments of a tabular metate with a scroll design pecked on its broad margin. We found nothing comparable, but we did observe several interesting examples of re-use. For instance, pieces of thin metates were frequently incorporated in the slab lining of fireplaces; like fragments helped line some of the seven storage bins on the original floor of Room 307. A perfectly good tabular mill 25 inches long, 21 inches wide, and about 2 inches thick was inverted to provide a new sill for the reconstructed south door of Room 227. Another, trough up and 8 inches from the north wall, was embedded in the floor of Room 300B to seal the hatchway connecting with the closet below. Part of a thick-troughed metate was utilized as a step for the east door in Old Bonitian Room 320 (pl. 92, lower). Others were found in the fill of Kivas F and L; another, more ponderous example blocked the stepped passage leading down into Room 273. A large tabular mill lay face down on the floor of Kiva V; a smaller one of the same kind was recovered from the sandy accumulation in Kiva W.

Since mills of each type were found in both early and late dwellings, how may we know which belonged primarily to the older inhabitants; which to the later? We have the evidence presented by lesser ruins throughout the Chaco region and the testimony of coworkers elsewhere. Only "massive" metates were uncovered during our study of

nearby small-house sites wherein architecture and ceramics closely agree with those in the later portions of Pueblo Bonito; only "tabular" mills were present in Pueblo I pit dwellings shortly antedating the oldest section of our famous ruin (Judd, 1924a, pp. 402, 411; unpublished N.G.S. data). At a Late Basket Maker site 9 miles east of Pueblo Bonito the typical milling stone was tabular, but, unlike ours, it generally remained untrimmed around the edges (Roberts, 1929, pp. 132-133). Where no possibility of intrusion exists, therefore, we find only the one type of metate associated with the earlier Chaco Canyon habitations; the other, with the latest known structures. Both Morris and Roberts report comparatively thin, troughed metates the characteristic form at Early Pueblo villages in southwestern Colorado (Morris, 1919b, p. 200; Roberts, 1930, p. 148). These extramural observations thus strengthen our conviction that the thin, tabular, open-troughed mill of Pueblo Bonito was a cultural trait of the older, more conservative element in the community. More recently, Bartlett (1933, p. 26) and Dutton (1938, p. 67), without distinguishing between "thick" and "thin" examples, trace troughed metates from B.M. III to P. III times and place the troughless, full-width-grinding-surface variety (their "flat slab" type) from P. III to modern villages. Five troughless mills were found in Leyit Kin, a small-house Chaco ruin described as predominantly P. II. Brew (1946, p. 147) reports three metates of the same type, each in its slab-walled bin, from a P. II ruin on Alkali Ridge, southeastern Utah.

Thick or thin, Bonitian metates are made of sandstone, the one readily available rock in Chaco Canyon. For the most part, and irrespective of type, they are of a size one person could carry, but in the rubbish of Room 251 we found five troughed mills each of which weighed at least 150 pounds. They were massive and difficult to move. Two other, even more ponderous examples, one with three and the other with four mano channels, appear among those from Room 17, as figured and described by Pepper.[30] Such unwieldy blocks necessarily rested flat upon the floor when in use.

[30] 1920, pp. 84-85; fig. 29. The illustration shows three outworn tabular mills, two of them "in such a position that they would catch the meal from one of the larger metates." This latter boasts three troughs, each of less than average width.

In my opinion, Room 17 and the two or three next on the south, whose common west wall partly overhung Kiva Q and had slumped into the latter when its ceiling collapsed, were set apart for the preparation of clay used in pottery manufacture and perhaps for others purposes. A pile of potter's clay, with accompanying mullers, lay at the south end of Room 212. The "cornmeal" Pepper noted on one of the large, multiple-troughed mills in Room 17 is more likely to have

The *manos,* or handstones, employed in conjunction with Bonitian metates were commonly used on one side only (pl. 27, *e-g*). Of the 12 specimens brought to Washington only one, an East Court surface find, is triangular in cross section as a result of wear on three sides. My field notes include no reference to others of like form among the 424 mullers we unearthed but left at the ruin.

Through friction, the grinding surfaces of each pair of milling stones soon came to coincide, and as the metate trough deepened the mano naturally continued in negative agreement. Thus, manos used on our "massive" metates are generally shorter and with a more pronounced longitudinal convexity than those intended for the shallow, tabular mills of the Old Bonitians. Also, Late mullers are often thinner along one edge while those employed on tabular metates are flat-faced and with but little curvature at the ends.

When new the rectangular mano blocks were often 2 or 3 inches thick, with cupped finger grips on the front and rear edges as a convenience in handling. They were discarded only when worn too thin for grasping with the fingers. In an emergency a muller, like almost every other object, could meet a need for which it was not primarily designed. So we find occasional mullers stained all over from the grinding of red ocher; others that had been pressed into service as palettes for red, green, or yellow paint.

Like fragments of tabular metates, manos now and then found their way into house construction as building stones and as lining for fireplaces and storage pits. We could detect no reasonable purpose, however, for the 10-inch mano embedded on edge in the floor of Room 316 with 1½ inches exposed, paralleling the northeast wall at a distance of 3½ feet and standing 2 feet 5 inches from the northwest wall.

The metate illustrated on plate 26, A, probably was not designed for household use. It retains the hammerstone bruises that first delimited its mano channel; its sides and edges have been carefully smoothed. Unearthed in the court west of Room 165, it closely resembles one figured by Pepper (1920, p. 60, fig. 18, *b*) as of possible ceremonial use. Its intended function may, indeed, have been preparation of the

been white sandstone such as he exposed in Room 27 and which our Zuñi workmen say came from a cavity under an upper ledge in the south canyon wall, opposite Pueblo Bonito.

On the east side of Kiva Q, among building stones fallen from above, we unearthed 23 metates and metate fragments. Both types are represented but it is noted that those of tabular form were all outworn; that the massive ones generally have secondary channels cut in the grinding trough by rubbing stones or re-used mano fragments (pl. 31, upper).

cornmeal (in which bits of shell and turquoise are ground) offered in prayer on the occasion of every Pueblo ritual, although today such meal is prepared by the women of the household on ordinary milling stones.

That this specimen represents a local type is indicated by the fact that we found fragments of several others during the course of our investigations. The rectangular depression at its upper end is reminiscent of the larger, cruder "Utah type" metate (Judd, 1926, p. 145) with its shallow basin from which meal presumably was advanced for further grinding. The feature is unusual on milling stones from Arizona and New Mexico.

Mortars and pestles, indispensable utensils among the acorn-eating tribes of California, were rarely used in Pueblo kitchens. At Pueblo Bonito we recovered only one specimen that even resembles a mortar, and it is merely half a sandstone concretion hollowed out and smoothed around the rim (U.S.N.M. No. 335923). Ours was a surface find, but Pepper (1920) describes two comparable examples from Rooms 10 and 38; a third, "made of an irregularly shaped piece of sandstone," from Room 27, and a barrel-shaped, elaborately painted sandstone mortar from Room 80.

IMPLEMENTS OF BONE

From the bones of animals killed for food Bonitian women made tools to facilitate their household tasks. Awls, for example, were employed for patching clothing and in the manufacture of coiled baskets. There were punches for sharpening flint knives, chisel-like implements of unknown use, and scrapers for fleshing hides.

Bone tools are easily made: a flint flake, sandstone, sometimes a stone hammer—nothing else is needed. By sawing part way through with the flake and then applying pressure, it is possible to section a bone or to shorten it as desired.[31]

A common practice at Pueblo Bonito was to saw deer metapodials lengthwise so they could be split into halves or even quarters (pl. 32, *d, e*). However, in the case of an elk tibia, figure *d,* splitting was attempted by means of a wedge—and unsuccessfully, as may be seen from the result. The wedge mark shows on the lower edge, below the heavy shadow. In other instances a hammerstone was employed to spall away the unwanted part. Irrespective of method, with the desired portion in hand, edges were smoothed, protuberances were removed,

[31] For aboriginal methods of bone working, see Hodge, 1920, pp. 72-78; Kidder, 1932, pp. 196-200.

and the implement otherwise was brought to its final form by the abrasive action of sandstone. The cliff back of Bonito is furrowed by the sharpening of bone awls (pl. 23, left); similar grooves are often seen on doorsills, on convenient stones in house walls. Rubbing on or with sandstone was chiefly the means by which bone implements were shaped and sharpened.

Awls are the most common of bone tools. Those in our collection exhibit no attempt at standardization but, on the contrary, differ greatly in size, shape, and the amount of labor expended upon them. Properly pointed, almost any bone answered for an awl, even fortuitous splinters (pl. 33).

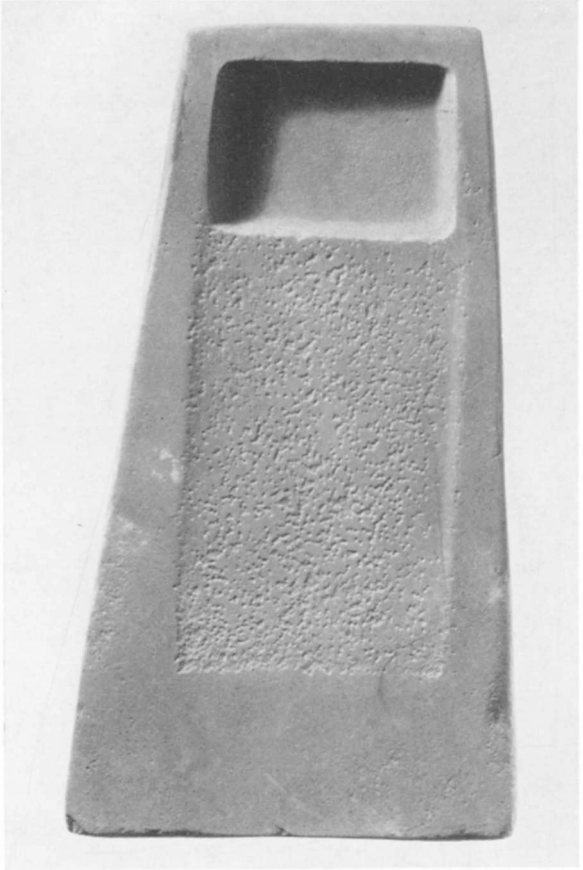
With fragments eliminated, 417 bone awls were available for the present study. Only 42 are listed as avian, and some of these may actually be from the hollow leg bones of rabbits or other small animals. It is difficult to identify bones that have been altered; doubly so when both articular surfaces are wanting. Of the 42 bird bones converted to awls, only 16 have been identified, and 14 of these are wild turkey (*Meleagris gallopavo*). The tibiotarsus was utilized in seven instances, two of which retain the unmodified proximal end as a grip. The ulna was employed in three cases; the radius and tarsometatarsus, in two each. Awls made from the ulna of a golden eagle (*Aquila chryaëtos*) and the tibiotarsus of a ferruginous rough-legged hawk (*Buteo regalis*), figures *h* and *i*, respectively, suggest these birds of prey were not held so sacred (on account of their feathers) that their bones could not, upon occasion, be applied to mundane needs.

Among 375 awls made from mammal bones perhaps 70 percent are too changed for positive identification. The remainder includes the following eight species, listed in descending order of their occurrence:

Mule deer, *Odocoileus hemionus*
Jack rabbit, *Lepus californicus*
Cottontail, *Sylvilagus auduboni*
Dog or coyote, *Canis familiaris* or *C. lestes*
Elk, *Cervus canadensis*
Bobcat, *Lynx*
Mountain sheep, *Ovis canadensis*
Badger, *Taxidea taxus*

The last two are represented by single specimens. Bones of the mule deer predominate. Although pronghorn-antelope bones occur in local rubbish piles, none has been recognized among the implements before us.

The strength and straightness of deer leg bones quite understandably won for them first choice among awlmakers. Our collection



A, Specialized metate, with newly pitted grinding surface and grist basin above.



B, Sandstone door showing slight use as a passive abrader.

PLATE 26

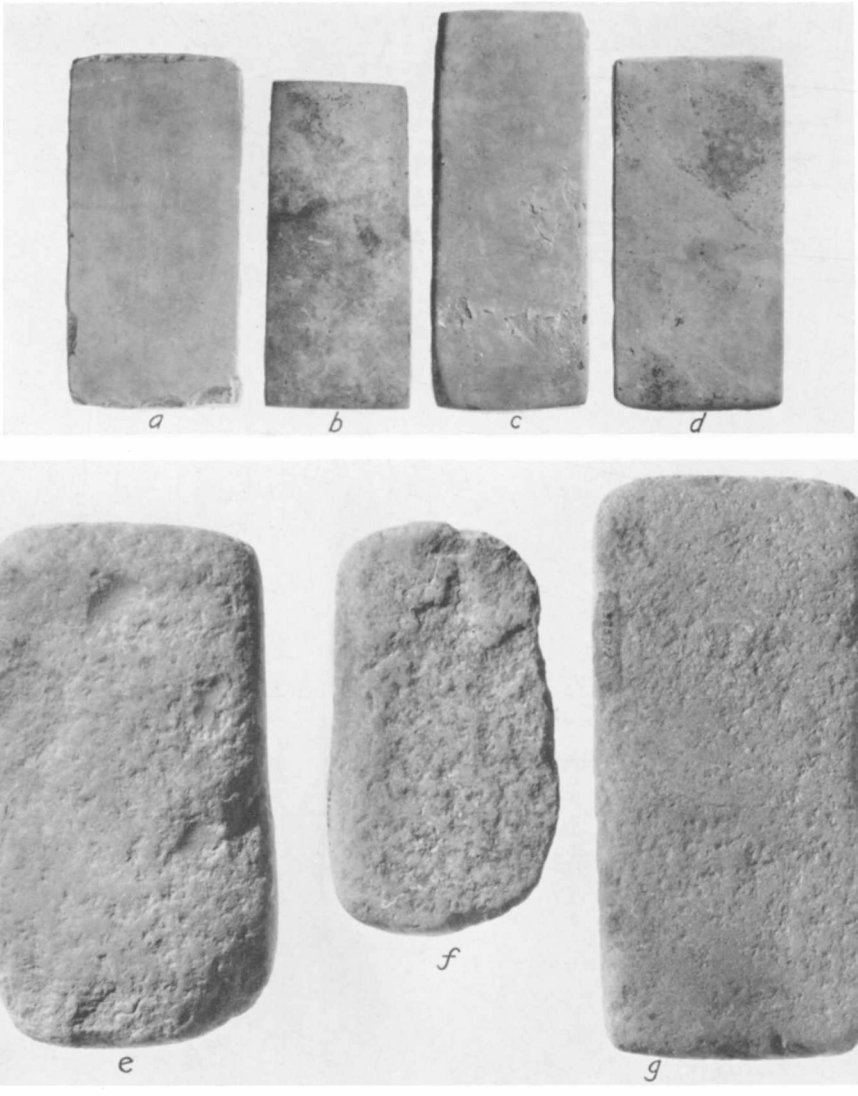
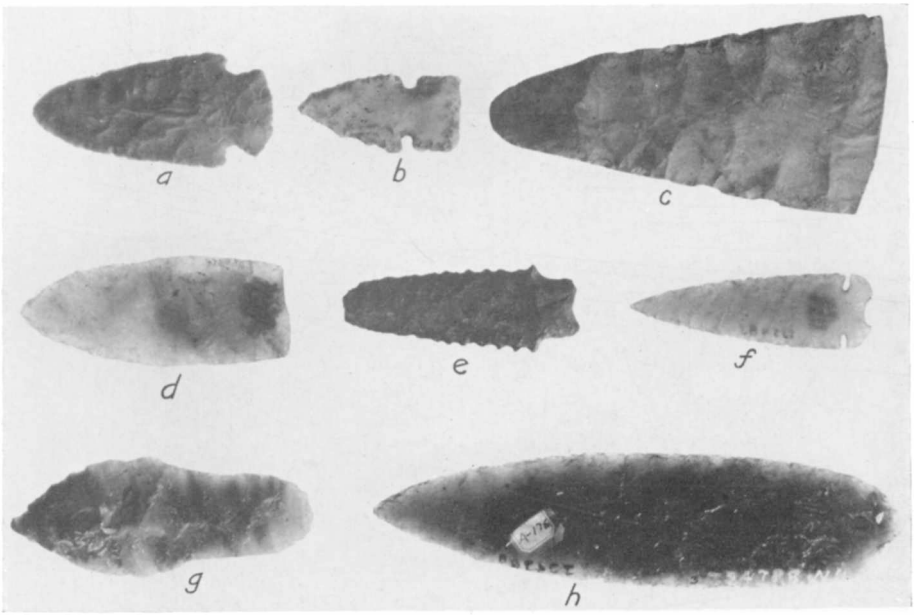


PLATE 27.—*a-d*, Tablets of fine-grained sandstone; *e-g*, hand stones used for grinding corn on metates. The back, or unworn, side only is shown.



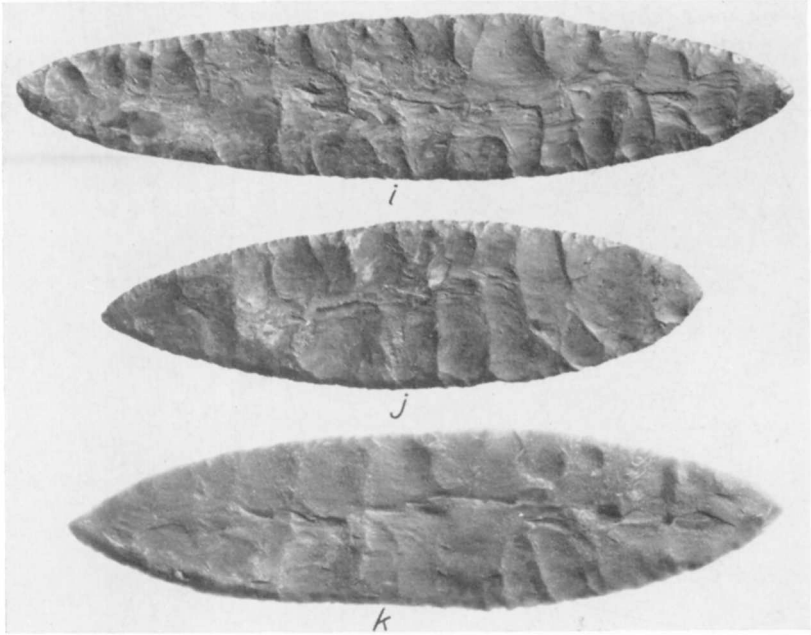


PLATE 28.—*a-h,* Knives chipped from various rocks; *i-k,* three blades from a sealed repository in Kiva Q.

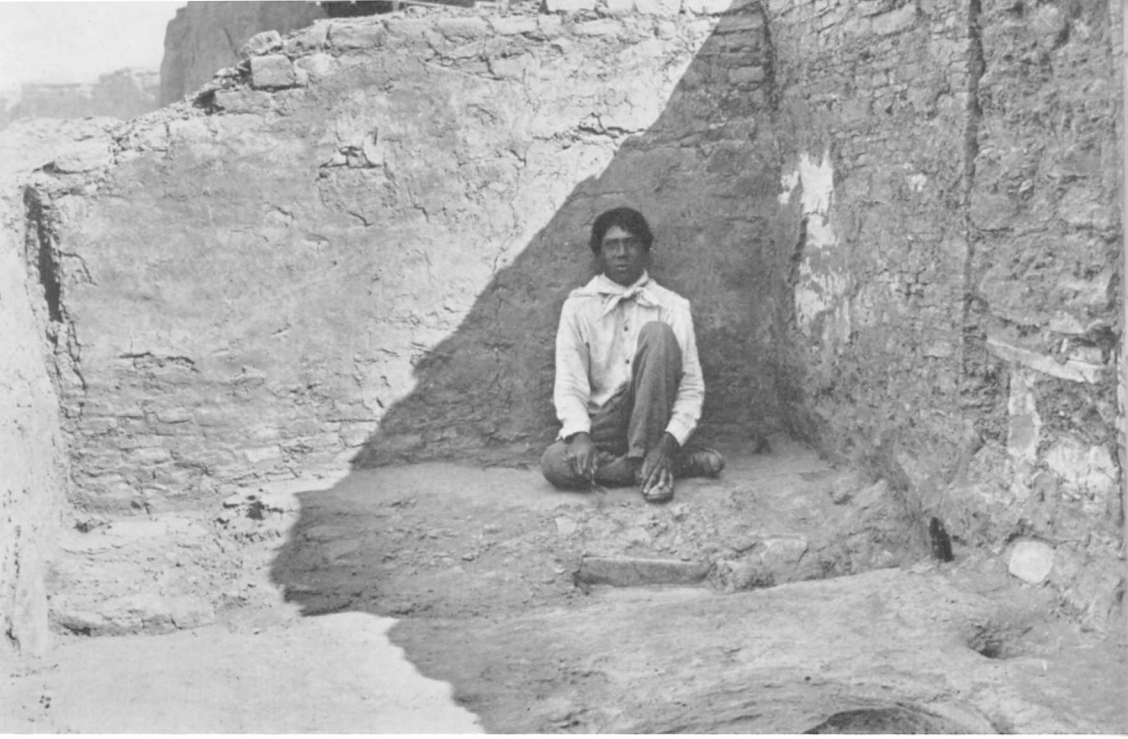
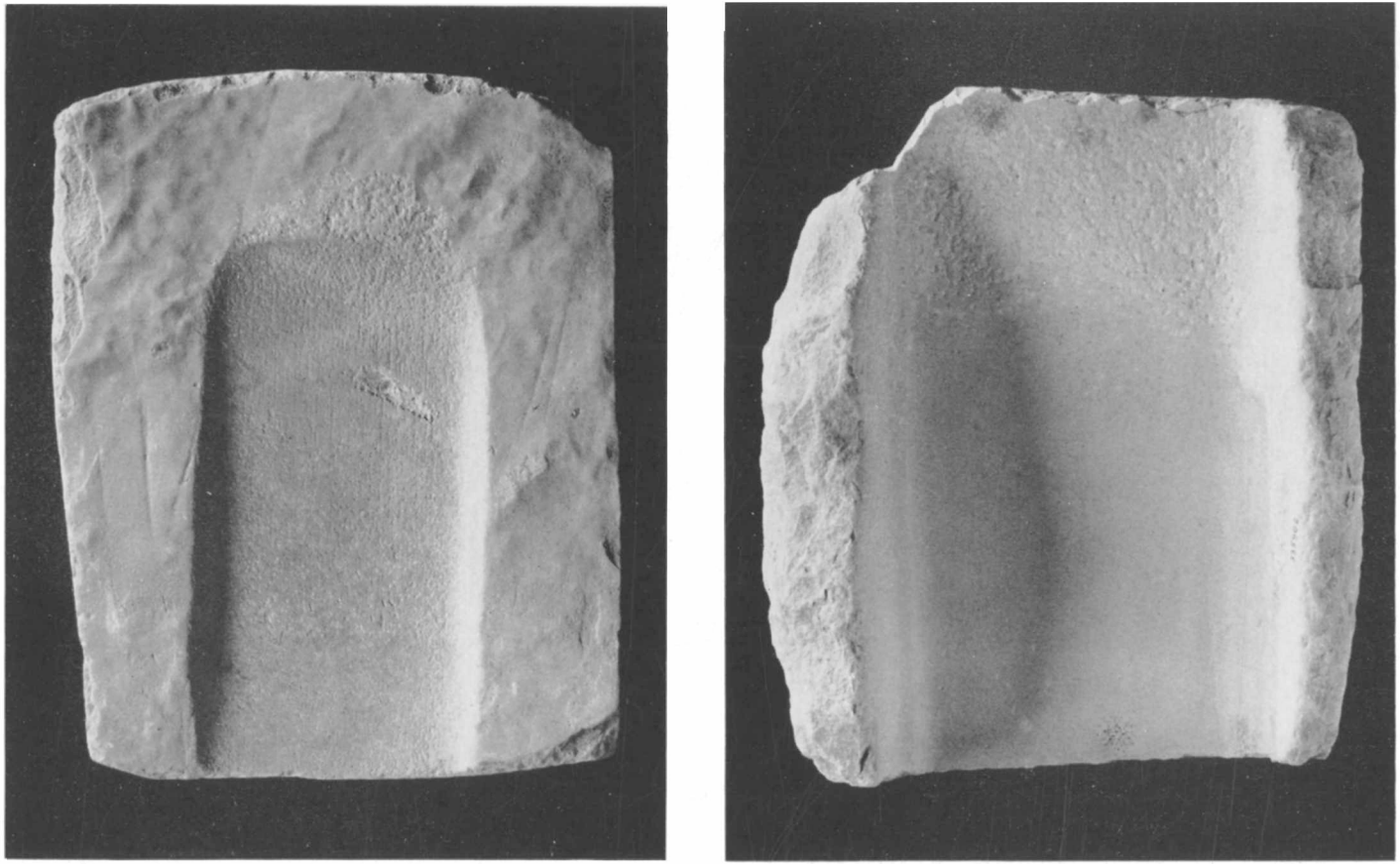


PLATE 29

Upper: Dismantled mealing bins in Room 291. (Photograph by Neil M. Judd, 1923.)

Lower: Zuñi girls grinding the family's daily ration of corn meal. (Photograph by Charles Martin, 1920.)





A B

Types of milling stones used by the Old Bonitians (A) and by the Late Bonitians. In the latter (B), the normally closed upper end has been removed by pecking.

PLATE 30

PLATE 31

Upper: Outworn metates found on the east side of Kiva Q and presumably fallen from work rooms partly overhanging the kiva. (Photograph by Neil M. Judd, 1924.)

Lower: Before and after its ceiling collapsed, Room 323 had served as a neighborhood dump. (Photograph by O. C. Havens, 1924.)

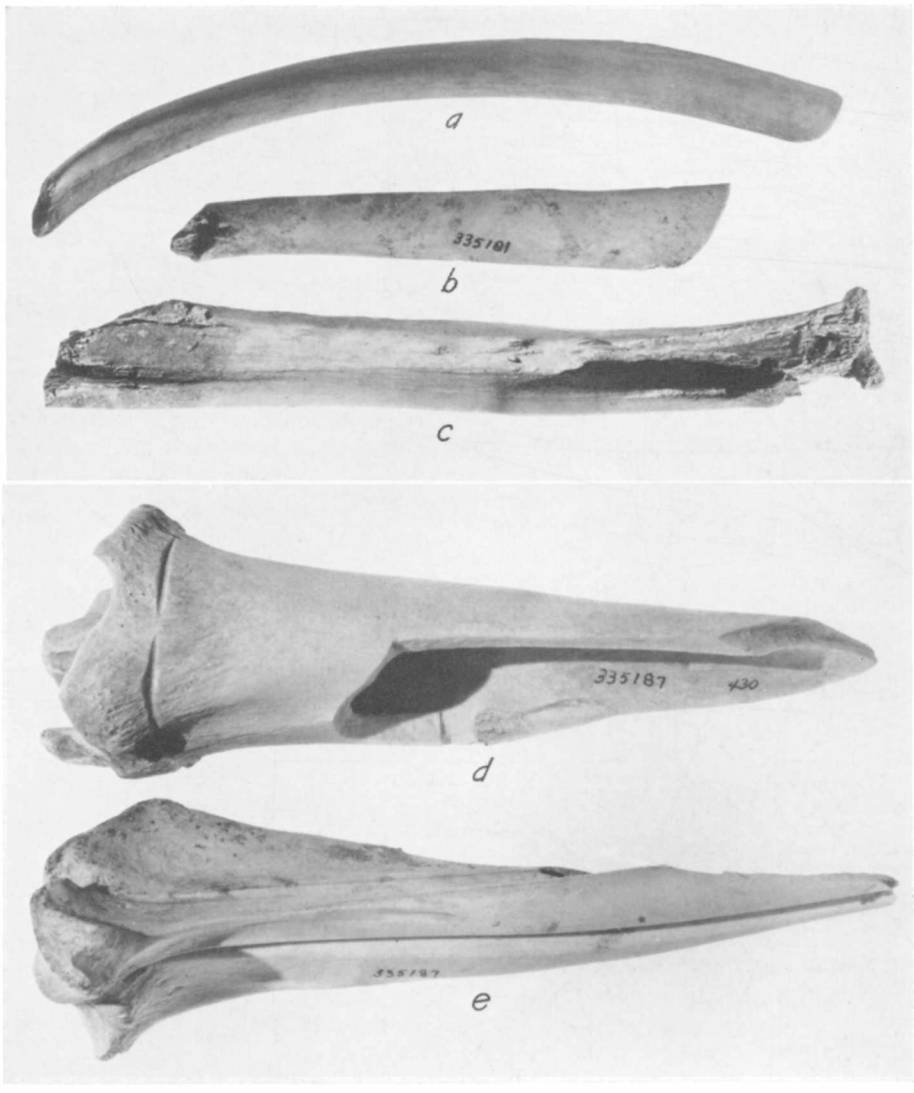


PLATE 32.—Bone end scrapers and drawknife (*a-c*). With flint and sandstone saws, wanted portions of deer bones are separated and the rest discarded (*d-e*).

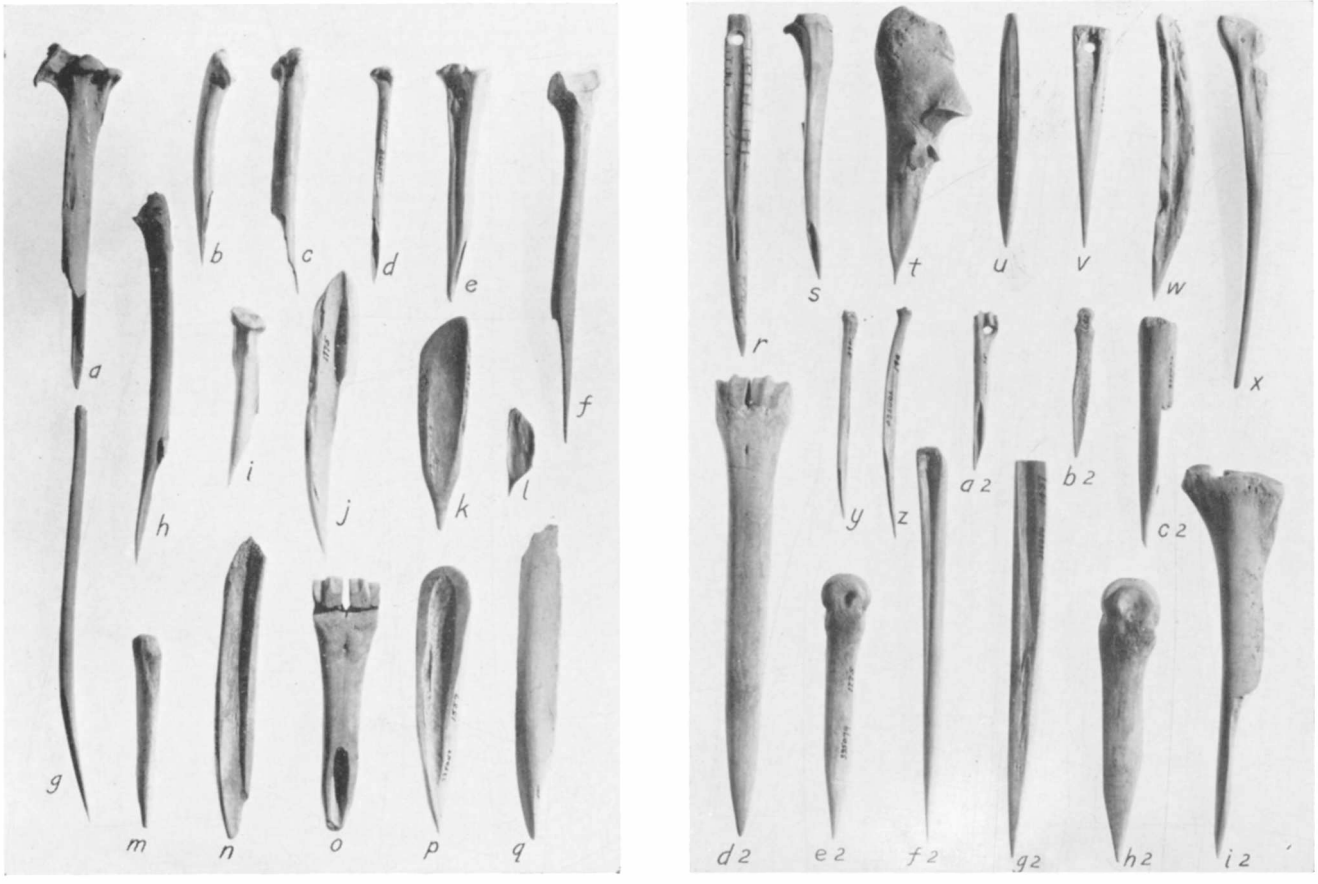


PLATE 33.—Bone awls and awl-like tools made from bird and mammal bones.

includes 83 awls made from metapodials that retain at least part of one articulation and 134 others probably from the same bones. Of the former, 51 preserve part of the distal joint as a handle—the entire end in 6 instances, half of it in 44 cases, and less than half in 1 only. Where metapodials were quartered it is the proximal end, if any, that survives in recognizable degree. Bones of young animals were utilized impartially; in several instances the epiphysis has become detached since the implement was last used. Deer radii were employed for two awls and, if I judge correctly from shape, curve, and weight, for nine others that lack articulations.

Second, numerically, are awls made from rabbit bones. The tibia is identifiable in 18 cases, the radius in 7, the humerus in 5, and the ulna in 3. Bones of the jack rabbit prevail slightly over those of the cottontail. Since rabbits are easier to kill than deer, rabbit leg bones probably were utilized in larger proportion than our figures indicate, but, being hollow, they were easily broken and as quickly discarded.

From our awl collection we may derive a number of facts and figures. There are long awls and short awls; thick and thin awls; awls made in a moment from the first bone within reach and awls that required days of patient rubbing and polishing. Many even today are needle-sharp; many are dulled through use and neglect.

The series is predominantly Late Bonitian for, of the 417 specimens on which these observations are based, only 40 are regarded as most likely of Old Bonitian origin. Thirty of these were recovered from dumps in which Old Bonitian rubbish prevailed; three from Old Bonitian dwellings, and seven under circumstances that mark them as probably Old Bonitian. In contrast, 200 came from dominantly Late Bonitian trash, 82 from Late Bonitian houses and kivas, while 13 are considered probably Late Bonitian. Forty-five were found in dumps where Old and Late Bonitian rubbish was approximately equal; 37, exposed during trenching and clearing operations, remain doubtful. Thus over 70 percent of our awls are presumably Late Bonitian; only 9.5 percent Old Bonitian.

Of our 40 Old Bonitian awls only one is of bird bone, the distal end of a turkey ulna broken in such a way that a couple of strokes against sandstone sufficed to smooth the tip's edges (pl. 33, fig. *c*). It was found beneath the floor of Room 151 in what was probably part of the original Old Bonitian village dump. The other six doubtful specimens, all mammal bone, came from the West Court exploratory trench.

This paucity of bird-bone awls was not restricted to one part of the pueblo. It is a phenomenon we noted repeatedly in the course of our investigations. For instance, of 13 awls in the partial fill of Room 226,

only 1 was of bird bone. Of 14 specimens from Room 290, another trash pile dominantly Late Bonitian, 3 were of bird bones. Of 32 awls from our stratigraphic trench through the east refuse mound, chiefly Late Bonitian in origin, only 1 was of bird bone and that a mere splinter, perhaps from a turkey's tibiotarsus.

Fifteen awls were recovered from Old Bonitian debris of occupation in Room 323. One has been identified as the baculum of a badger, sharpened at the proximal end. Two deer metapodials preserve part of the head as a handle, while seven, varying in length from $2\frac{3}{4}$ to $5\frac{7}{16}$ inches, retain half the distal joint. One is made from a deer's radius (pl. 33, i_2); four lack any trace of an articular surface. Two of these latter are drilled, one being the notched example illustrated as figure *r*; one is a spatulate awl (fig. *p*); and the fourth, a mere splinter.

Strangely enough, our burial rooms were practically devoid of awls either as grave offerings or discards. Only two were found in Room 320; three only, in 330. Ten came from Room 326 and all appear to be deer bones: one, the proximal end of a radius; one, the head of an ulna; two, a half and a quarter, respectively, from the proximal end of split canon bones; three, metapodials retaining half the distal joint, and three from which both articulations were severed. Two of these latter (U.S.N.M. No. 335051) are drilled three-eighths and five-eighths of an inch, respectively, from the butt. One of the three distal-end awls is notched or shouldered about a quarter inch from the tip (pl. 34, fig. *q*). The notch ends slope in opposite directions—one, up and forward; the other, down and to the rear.

A similar specimen was uncovered in our stratigraphic trench through the east refuse mound. In this case, however, the shoulders are symmetrical and the tip rounded, presumably in consequence of a habitual wrist twist of the owner while punching splint holes in basketry. A majority of our deer-bone awls have been ground to a more or less conical point but no others exhibit the balanced shoulders and the cylindrical tip of this one.

Kiva B was half filled with floor sweepings and debris of occupation. From this 23 bone awls were recovered, 18 of them mammalian. Five were found in the subfloor chamber west of the fireplace, but there is nothing distinctive about them. Two are splinters; one preserves the distal joint of a deer's canon bone; one is the short, rounded pin shown as figure *f*, plate 34; and the fifth, the flat-sided, conical-based fragment described on page 145.

Two awls came from Kiva C, a relatively late structure in the southeastern quarter of the village. One is made from the tibia of a cottontail; the other probably from a deer radius (U.S.N.M. No.

335064). This latter, slightly curving, thin, and neatly finished, had been stuck for safekeeping between the paired ceiling poles resting upon pilaster 5 and was burned and broken when fire consumed the timbers.

A single awl found in the west bench recess, Kiva L, is $4\frac{1}{8}$ inches long, sharply pointed, and probably from the quartered proximal end of a canon bone (U.S.N.M. No. 335075).

We have four awls made from lateral metapodials or splint bones (pl. 33, fig. b_2). This peculiar and seemingly useless bone is naturally awl-shaped; the average one can be pointed with a half dozen strokes against sandstone and thus readied for immediate service. It seems strange, therefore, that splint bones were not deliberately saved despite their small size and fragility.[32] Ulnae likewise can be converted into awls with very little effort. We have 16 such: 3 of jack rabbit; 4, dog or coyote; 9, mule deer.

Out of this study two observations seem paramount: the relative paucity of bird-bone awls and the fact that, despite preference for the straighter ones, almost any bone or fragment sufficed for awl making. Despite variations in weight, length, and quality of workmanship I detect among our bone awls no distinctive qualities on which to justify either cultural or time groupings. They are just awls and they were made out of whatever suitable material was available. Fifty specimens are nothing but splinters, more or less accidental splinters, from bones broken by pressure or percussion. Three are pieces of deer mandibles; five, rib fragments. There is at least one made from the distal end of a bobcat's humerus (U.S.N.M. No. 335019); at least one from the distal end of a bobcat's femur (No. 335079); another from the head of a dog or coyote femur (No. 335068).

Awls may differ in length as in the proportion of bone removed. Among those made from deer metapodials, for example, and retaining at least part of the articulation, the longest measures $8\frac{15}{16}$ inches (No. 335086); the shortest, $1\frac{13}{16}$ (No. 335056). This latter, the *reductio ad absurdum* of awls, shows wear on the butt although not to an extent suggesting that use and periodic resharpening alone could have worn it down from a length, say, of 9 inches. It is one of three awls recovered from Late Bonitian rubbish in Room 333, while the longest, a possible dagger, came from the great West Court trench.

Three awls have random lines finely incised upon the convex surface

[32] Our old Zuñi camp man said his people formerly tied three splint bones together for a comb. He may have meant a hair ornament. The example we illustrate is slightly scored below the joint.

but without an attempt at design (pl. 33, h_2). Two others are notched on the edge or face. One of these bears 10 conspicuous notches along one edge, 11 along the other (fig. *r*). On a second example (No. 335053), edge notches at the left of the tip change to short, incised lines that continue up the crest of the convex side to end at upper right.

Twelve specimens are drilled at the butt end. Their length varies from $2\frac{1}{4}$ to $7\frac{1}{2}$ inches, averaging $4\frac{5}{8}$. Some are rounded, some are flat; some are thick and some are thin. The diameter of the drilling varies but not necessarily in proportion to the breadth of the shaft. One is drilled laterally through half the distal joint of a deer metacarpus. Only one in the lot might properly be described as a needle (pl. 34, fig. *a*). It is of split mammal bone, $2\frac{3}{4}$ inches long by $\frac{5}{32}$ inch wide, and was found in the east mound where most of the trash is Late Bonitian.

One specimen is notched on the rear corners, 1 inch from the tip, and grooved part way across the front as if by friction of a cord. Above this groove and along the right margin are half a dozen lesser furrows (pl. 33, fig. e_2). Cord-worn grooves are noted on four other awls or fragments. The point of a second example, grooved an inch and a half from the tip, was broken off at a parallel groove an eighth of an inch above. A third is furrowed on the convex face only, three-fourths of an inch from the tip. Whatever their primary function, one might guess these five were also employed for firming cords or tightening warps on the loom.

Two other groups remain for consideration, and it is quite possible they should have been separated completely from the awls. First is a series of eight with spatulate butts. Four, one being a reworked fragment, were made from heavy bone, undoubtedly deer. Longest of the four, $4\frac{3}{8}$ inches (pl. 33, fig. *p*), is round-ended, and this is also true of that illustrated by figure *s*, plate 34. The fragment mentioned, itself made into an awl, has an obliquely ground end but it lies to the right, or opposite that of figure *k*, plate 33. In each case the beveling is on the concave surface; all except the fragment possess a gloss that comes only with long use. Whatever their purpose it certainly differed from that of the four delicate little spatulate implements shown on plate 34, figures *b-e*. A fifth possible member of this latter series is made of bird bone, its concave side rubbed flat at one end (U.S.N.M. No. 335026).

For the group next to be described a separate classification seems even more justified. There are 32 in the series, and they might be likened to pins (pl. 34, figs. *f-p*). They vary in length from $1\frac{9}{16}$ to

$7\frac{13}{16}$ inches; in diameter, from $\frac{3}{32}$ to $\frac{7}{32}$ of an inch. Average length is a trifle under 4 inches. All are solid and made from mammal bones. A few, split from metapodials, are naturally flattened on one side near the butt; a few possess the slight longitudinal curve of a mule deer's radius or tibia. Some are purposely tapered at the butt end, although most are direct and square cut. All have tips more finely and sharply drawn than the ordinary bone awl. It is this latter feature, together with the uniformly rounded shaft, that evidences exceptional care in manufacture and suggests that the group might have been articles of adornment—hair ornaments or pins to fasten shoulder blankets—rather than bodkins for sewing cloth, leather, and basketry. It should be noted, however, that only one of the 32, and that the bluntest (fig. *o*), is scored at the butt end, as if for attachment of feathers or other appendages.

Shortest of the series (fig. *g*) differs from all the others in having a shouldered or doweled butt an eighth of an inch long, clearly designed to fit into a socket. Another of comparable length, but flat-sided and with both extremities now missing, has a conical butt that likewise could have fitted into the end of a reed shaft (U.S.N.M. No. 335062).

Five of our "pins" bear discoidal heads that seem purely ornamental. Three of these are represented by figures *i-k*, plate 34, the third being notched six or seven times around the periphery. Longest of the five, $4\frac{7}{16}$ inches, has a flat-sided shaft with rounded edges and to this extent differs from the others. And if these were really ornaments, why not also that with the triangular head (fig. *u*); the slightly modified jackrabbit ulna (*v*); the bobcat fibula (*h*), needle sharp?

None of the 32 pins, plain or ornamented, was found in Old Bonitian houses or rubbish.

We recovered only one antler prong with tip rubbed to awl sharpness, and that came from Late Bonitian debris in Room 290 (335090).

Punches (*?*).—Three of the specimens (*m-o*) figured on plate 33 are doubtless one-time awls applied to some other purpose. Their tips are rounded and polished as if repeatedly rubbed with pressure against dressed skins, basketry, or similar resilient substances. The second and longest has been worn obliquely and in line with an old break, largely because the tool balances best in the right hand when held concave edge down and thumb in the marrow cavity. Of our six so-called punches none is scarred and gnawed about the point to identify it as a flaking tool.

Another specimen (U.S.N.M. No. 335189), $2\frac{1}{2}$ inches long by $\frac{3}{8}$ diameter, likewise remains unmarred by use as a flaker. Down its

length striations of the sandstone abrader are plain; a number of slanting notches appear on one edge.

Chisels.—Five chisel-like tools are next to be considered (pl. 34, figs. *w*-a_2). They vary, as awls do, from splinters to sawed and carefully smoothed sections of metapodials. Their one feature in common is a chisel-like blade, but this varies in width from one-eighth to five-eighths of an inch. With one exception (fig. *w*) each blade is beveled from both sides. Specimen *z* is blunted at the tip as though from retouching chipped knives and arrowpoints. A sixth possible member of this group (fig. b_2) lacks the thin cutting edge of the others. Except the fragment, a surface find, all six came from Late Bonitian rooms.

"Bark strippers" is undoubtedly an incorrect designation for the five round-ended specimens shown on the same plate as figures c_2-g_2, but it is in the right direction. Each evidences greatest wear on the inner or concave side where wear facets show the tools were held at an angle of from 10° to 35° when in use. In figure d_2, as illustrated, the left side clearly received most pressure in operation; reciprocal wear appears on the opposite side of the convex surface. This suggests that the instrument was forced between two resistant surfaces (as, for example, in stripping bark from prospective ceiling beams), but similar wear facets do not occur on either of the other specimens. The shortest, g_2, appears to be comparatively new but the other four display the polish that comes through use.

Worked ribs.—Two sections of deer rib, $4\frac{3}{4}$ and $6\frac{7}{8}$ inches long and both from the rubbish fill of Room 255, have their distal ends worn obliquely, and round off with the lower edge. In both the direction of wear is rearward from the concave side as if the ribs had been used by a right-handed person in smoothing, say, the abrupt inner curves of earthenware vessels. However, these two (pl. 32, figs. *a, b*) are the only ones of their kind; we found nothing comparable elsewhere in the village.

The rib fragment shown on plate 33 as figure *q* is also the only one of its kind. Both edges are slightly worn by scraping, but whether before or after the specimen was converted into a rude awl it is impossible to say.

Drawknife.—Another lone example is a drawknife made from the radius of a mule deer (pl. 32, fig. *c*). It comes from the fill of an abandoned kiva underlying the East Court arbor identified as Room 286. Its lower edge is still keen; the upper, despite considerable wear, preserves the conchoidal notches that prove that a hammerstone roughed out the knife. Both ends have been burned.

End scrapers, or fleshers, made from deer humeri are familiar to all

students of Pueblo prehistory. They belong to the Pueblo III horizon but apparently are restricted in distribution chiefly to the Mesa Verde region (Nordenskiöld, 1893, pl. 41; Fewkes, 1909, p. 49; Morris, 1919a, p. 36; 1919b, pl. 45, *b*) and thence southward across the Chaco to the Zuñi country (Roberts, 1931, p. 152; 1932, p. 137). One would expect them in late cliff dwellings of the Canyon de Chelly, but I find no published record of their occurrence there. In the Kayenta district, two have been reported from Betatakin (Judd, 1930, p. 62). They are unknown throughout the old Hopi territory. Except for the Pecos fragment described by Kidder (1932, p. 235), the type is not recorded from the Rio Grande drainage.

When Pepper (1905b, pp. 186-190) first directed attention to the humeri scrapers of Pueblo Bonito he carefully stated that they were rarely decorated; that their decoration, if any, was most likely to be incised meanders, crosshatching, and animal figures. However, his description of one inlaid with turquoise and jet, together with fragments of two similarly embellished specimens, tended to overshadow the more numerous, plainer variety. The latter were found throughout the village, in rubbish heaps and elsewhere. Almost all evidenced use; many were broken.

Hyde's table showing the distribution of worked bone (Pepper, 1920, pp. 366-368) lists 37 scrapers. Presumably they are all of the type under consideration. Twenty-five rooms are represented, and ten of them are elsewhere identified, either positively or probably, as depositories for debris of occupation. From that rubbish Pepper recovered 18 of his 37 scrapers. Since we do not know the makeup of the debris we cannot guess its source, but 8 of the 10 dumps were in Late Bonitian structures, 6 of which closely bordered the old, original portion of the village. If separation were to be made on a basis of the type of masonry of the room in which found, a meaningless criterion in this instance, we should find that 9 scrapers came from Old Bonitian structures, 28 from Late Bonitian. In either case it is clear that end scrapers, or fleshers, made from deer humeri were fairly common tools at Pueblo Bonito and that they were lightly tossed aside when broken.

Describing his two inlaid specimens from Room 38 and the fragment from Room 170, Pepper (1905b, pp. 185-196) quite properly emphasized their artistic quality. He assumed they were made for ceremonial purposes; regarded them as "part of the altar paraphernalia of some religious society" solely, so far as I can judge, because they are exceptional and he was loath to believe such exquisite tools were employed in fleshing ordinary deer and coyote hides. The thought

is equally distasteful to me, and yet I see no cause for putting the two in a special class. Certainly there is no justification for stamping the inlaid scrapers "ceremonial" just because they were found on a broken shelf in the same 6-inch layer of blown sand with five turquoise ducks and a turquoise-collared jet frog. If so, then all the beads and pendants intermixed with them, both jet and turquoise, likewise are ceremonial.

During the course of the National Geographic Society's explorations 20 humeri fleshers were unearthed. Four are inlaid. Three of the latter, figures *a-c*, plate 36, lay side by side on the floor in the middle of Room 244. Why they were left in that particular spot is not evident, for the room had been vacated and stripped of its furnishings before blown sand sifted in to spread a 1-inch blanket over scrapers and floor. Under the sand and against the south wall were a few fragments of a corrugated pot and a hatful of miscellaneous sherds, nothing more. The ceiling, partially consumed by fire, had settled to within 1 to 4 feet of the floor before masonry from the upper walls crashed through. In and upon this broken stonework were a number of artifacts—fragments of 4 jar covers, 5 hammerstones, 8 manos and fragments of 3 others, part of a metate, etc.

Our fourth inlaid specimen, figure *d*, was found beneath an oval basket tray buried with Skeleton 9, Room 326. This association, oval basket tray and bone flesher, invites inquiry. In all our digging we encountered only four such trays or recognizable portions thereof. All four were in Room 326. Each had been interred with the body of a woman; each was accompanied by an end scraper made from the humerus of a mule deer. The left humerus was utilized in three cases; the right, in one only. In each instance the basket lay flat and upright. Three of the fleshers had been placed inside their respective trays; the fourth, as noted above, lay underneath.

What is the significance of this association, if any? Only four baskets, but each with its end scraper and each accompanying the burial of a woman! Although only one of the scrapers is inlaid with turquoise and jet, perhaps Pepper was correct after all in surmising that it, and its kind, held some religious connotation.

Our four fleshers from Room 326 are illustrated in plate 37. They are thoroughly representative except that their distal ends have been altered more than usual. The first (fig. *a*), found in the tray with Skeleton 6, was so pressed down by the overburden as permanently to fix its imprint in the coils of the basket (pl. 44, *c*). Decayed basket fibers still adhere to its convex surface. Scraper *b* is the one found underneath the oval tray with Skeleton 9. The fourth flesher, *d*, lay in the tray at the right shoulder of Skeleton 12 (see pl. 92, upper), while

c had been placed in another tray (field No. 1681), with a burial my notes do not specifically identify. It is possible that this fourth basket is the more fragmentary of the two with Skeletons 8 and 9, no portion of which could be salvaged.

Of our 20 humeri scrapers, two came from as many kivas, while three are miscellaneous finds. The remainder were recovered in nine separate rooms of which two only, Rooms 320 and 326, are Old Bonitian. Six of the nine rooms and one of the kivas had been utilized as neighborhood dumps. The lone specimen from Room 320, seen in situ beneath the outermost of the two cylindrical baskets on plate 91, lower, is one of two in the series from which the distal articulation was entirely cut away. It is the only one with a suggestion of painted decoration—three faint black lines encircling the shaft an inch below the butt. None of our fleshers bears incised ornamentation.

Twelve specimens in the series are complete. They vary in length from $3\frac{1}{2}$ to $7\frac{3}{4}$ inches; average, $5\frac{1}{3}$ inches. The longest, unfinished, is made from the right humerus of a mountain sheep, while the other 19 have been identified as deer, most likely mule deer. Although all four of our inlaid examples were made of left humeri there is an almost equal division in the series as a whole—9 right, 11 left.[33] All but five are beveled on the inner or concave face of the blade, showing that it received most wear from friction while in use.

The drawing, figure 38, illustrates the simplicity of scraper manufacture. It was necessary only to batter off the head and then grind away an adjoining section of the shaft until a suitable edge was achieved. But we detect a certain procedure in the grinding: When the marrow cavity was first exposed, and at intervals thereafter, the inner edges were chipped away with a flaking tool just to speed the work. Transverse striations show use of an active abrader while the artisan supported the humerus by its distal joint and let the opposite end rest on his knee or the ground. Preservation of the high-curving trochlea naturally prevented utilization of a sandstone block fixed in position. The section removed is always the same, with a little latitude one way or the other, and extends from the middle inside wall of the shaft to and including all or most of the deltoid crest. The portion preserved thus retains for its cutting edge the widest possible part of the humerus. Commonly the more prominent articular ridges were rubbed down and smoothed over but not always to the degree evident on the four scrapers from Room 326. These four also surpass the

[33] Determinations and identifications by Dr. David H. Johnson, associate curator, division of mammals, U. S. National Museum.

average in the extent to which the whole distal end was modified. But however much the coronoid fossa was altered, its opposite, the olecranon, remained entirely unchanged.

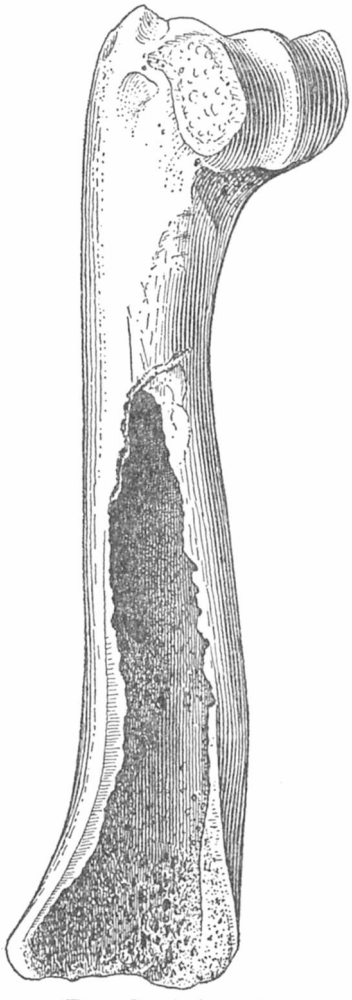


FIG. 38.—A bone flesher, unfinished.

The three inlaid scrapers from Room 244 deserve a special word. First of all, they look newer, cleaner, than the others; they are polished but in a different sort of way. It may be the gloss that results from repeated handling rather than of use but, even so, over a period of years the oil and dirt on priestly hands should have turned them darker than they are now. Their trochlear prominences have been neatly leveled; the borders of their coronoid fossae have been smoothed and squared inconspicuously and their epicondylar portions cupped for embellishment. On the first and third specimens these cups are occupied by half-inch disks of pink shell (*Spondylus princeps* Broderip) from the Gulf of California, but the disks on the latter are set within jet rings less than one-sixteenth inch wide. A segment is missing from the ring seen in our illustration (pl. 36, fig. *c*), but its opposite is not even cracked. Considering the brittleness of jet, I regard this particular scraper, with its two perfectly ringed shell disks, as one of the foremost examples of lapidarian skill, of precision in craftsmanship, ever reported from the pre-Spanish Southwest.

On each of the three, from one edge of the cut-away section to the other, the middle shaft is decorated with an inlaid band of jet-black lignite and sky-blue turquoise, an incomparable combination. That with the jet-ringed disks at the handle has three rows of purple *S. princeps* shell tesserae alternating with four of turquoise, the outer-

most of which are bordered by jet. On each specimen the longer tesserae have been ground in place to match the convexity of the bone and presumably their opposite sides are correspondingly concave. Similar pieces, from Kiva Q and elsewhere, of claystone, jet, and turquoise were concavoconvex. A reading glass over our illustration will show how perfectly the individual rectangles were fitted; that instead of eliminating an irregularity at the end of one bit, the next was ground to conform. A resinous substance, presumably pinyon pitch, holds the pieces in place. A channel of measured width and as deep as the combined thickness of pitch and tesserae was in each instance cut out for reception of the mosaic.

A flesher that imitates our type specimens was fashioned from the right mandible of a half-grown deer by cutting off the ramus and grinding the inner wall to a bladelike edge back of the third molar (U.S.N.M. No. 335172). The exposed teeth had been knocked off. The piece does not evidence extended use. It was broken at the second bicuspid and the anterior portion lost.

A closely related variety of end scraper was made from deer toe bones (fig. 39). Of 13 in our collection, 4 are from right proximal phalanges, 8 are from left, and 1, not at hand when this study was under way, remains unidentified.[34] Their average length is just a shade under 2 inches. With the possible exception of the misplaced one, found beneath the floor of Room 151, all are from Late Bonitian rooms or rubbish. Four came from kivas, two of which held trash piles.

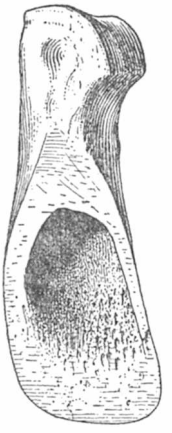


FIG. 39.—End scraper made from the toe bone of a deer.

Striations on the abraded surfaces vary all the way from transverse to longitudinal; therefore, and especially since the distal end did not interfere, we may be confident the grinding was done on a passive abrader. As with the humeri scrapers, length of the section removed varied somewhat, depending upon the angle at which the phalanx was held for grinding. The polish that comes with use lies on the flatter or concave face. Since none of our specimens is grooved or otherwise marked for attachment, we may assume each was held directly in the fingers of the operator.

Half the distal end of a canon bone recovered from Old Bonitian

[34] The designations refer to the side of the foot only, since it is impossible to distinguish between phalanges of left and right feet, or those of fore and hind feet, unless the proximal articulation is complete.

rubbish in Room 323, $2\frac{9}{16}$ inches long and beveled through wear on both faces, could be considered an ancestral type (U.S.N.M. No. 335154). It is the only one of its kind we found and echoes Guernsey's B.M. III specimen from Segi Canyon (Guernsey, 1931, pl. 56, *i*).

Antler.—With so many tools of deer bone one could expect to find a proportionate number made from antler. On the contrary, and despite a suitable representation of beam fragments and tines, we recovered few antler artifacts. One tine is finely pointed and doubtless answered for an awl; another, perhaps an awl in the making, is ground on opposing sides of the tip.

At Aztec Ruin, Morris (1919a, p. 43) observed a similar want of antler implements, while Hodge (1920) reports a relative abundance of them from historic Hawikuh. Historic Pecos pueblo likewise produced numerous antler artifacts (Kidder, 1932, p. 272).

Like bone, antler was commonly cut by sawing with a flint knife or sandstone blade until it was possible to complete the separation by physical force. But green horns were often cut from the skull and the larger prongs removed by hacking or gnawing with an edged tool. The marks left suggest flint; they are too fine and their results too minute for a stone ax.

Although we found no examples, wedges of some sort, probably antler, were employed in splitting out juniper boards and the ceiling slabs for certain third- and fourth-period rooms. Neither antler wedges nor wooden mallets for pounding them were unearthed during the course of our investigations.

IMPLEMENTS OF WOOD

Bodkins and billets of wood, combs and scrapers, wedges, and weaving implements were used almost daily in Pueblo homes a thousand years ago. They and their fragments, the chips and scrapings left from their manufacture, and numerous puzzling little gadgets wrapped with sinew or yucca string comprise an appreciable part of every collection from caves and cliff dwellings. But all these are lacking at Pueblo Bonito, and that the ruin stands exposed to the elements does not seem the full explanation. The objects next to be presented are, therefore, neither so numerous nor so diversified as I believe they should be. The Late Bonitians were skilled woodworkers, and a much more representative series of their wooden tools and utensils should, it seems, have survived.

Fire-making apparatus.—Three hearth fragments prove the Bonitians, true to the American tradition, made fire by friction of two pieces of wood. The hearth remained stationary while the drill, stand-

ing in one of the hearth's sockets, was rapidly twirled between the operator's palms. Wood dust, produced by the rotating drill, fell hot from the notched socket to ignite shredded cedar bark or grass tinder.

Two of our hearth fragments, figure 40, are of cottonwood. They had been placed for safekeeping between the paired roofing poles resting, respectively, on pilasters 1 and 6 in Kiva L. Split vertically, the smaller fragment had seen further brief service when its middle half-socket was used as a drill seating. Our third specimen (U.S.N.M. No. 335264) is a piece of willow, half an inch in diameter by $3\frac{1}{4}$ inches long, in which four sockets remain.

We recovered no fire drill or identifiable portion thereof. Drills presumably were straight willow stalks, peeled, smoothed by abrasion, and rounded at the bottom as a result of being rotated in the hearth sockets.

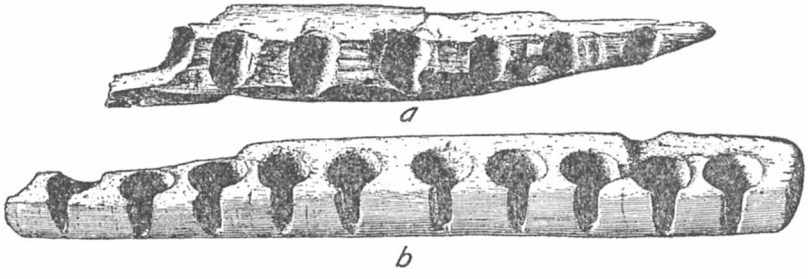


FIG. 40.—Fragments of fire-drill hearths.

Spatula.—The specimen represented by figure 41 may be the reworked blade of a digging stick. Its wood, unidentified, is much lighter than usual for such tools but this condition could be a consequence of decay. The irregularities at the neck are entirely owing to rot. For the upper half, both edges have been reduced slightly to emphasize the end knob.

Pottery scrapers (?).—Two wedge-shaped bits, one cottonwood and the other juniper, more or less resemble pottery scrapers (pl. 38, figs. *g, h*). Had they actually been used as such, however, their cut ends would have been abraded less abruptly. On the other hand, both are smoothed toward the tip as if from repeated use. Both are from the rubbish fill of Room 323.

Spindle whorls.—Figure 42, *a*, shows half a wooden disk, presumably a spindle whorl. Its edge is direct, except for a small segment thinned from both sides. The fragment is one-eighth inch thick; the drilled hole at center, three-sixteenths inch in diameter. Another fragment, three-sixteenths inch thick by $2\frac{15}{16}$ inches in diameter, is

from Room 327 (pl. 38, fig. *k*). Like the first example, it is of juniper; its periphery is thinned from both sides.

That illustrated by *b, b'*, figure 42, is the half of a third juniper spindle whorl, painted on both sides. Its interior has partially disintegrated leaving the exterior somewhat warped and shrunken. Three insect borings are indicated on the upper edge. I judge the shaft hole to have been one-fourth inch in diameter. The yellow-bordered toothed rings at center and periphery are, respectively, light green and blue; the field between is red. On the opposite side two light-green circles alternate with three yellow-bordered blue rings. Except for the red of the background, which was spread evenly, all the pigments were so thick as to pile up at time of application.



FIG. 41.—The reworked blade of a digging stick.

Our only complete spindle whorl is of gourd rind (fig. 43). Its shaft boring is just a trifle under one-fourth inch; its diameter, in contrast to the three of wood, is $1\frac{7}{16}$ inches.

Loom bars.—Lying side by side on the bench in the southwest quarter of Kiva D were seven knobbed oak bars we tentatively identified as the supporting elements of a waist loom. The number is still puzzling, for such a loom normally has but two, at most three, bars. Perhaps we have here the interchangeable parts of several looms, returned to a commonly accepted niche after they were last used. In any case, our identification has since won the support of Charles Amsden (1934, p. 23). Unfortunately, decay had progressed so far we were able to restore only two of the seven (pl. 72, figs. *h, i*). The worked stick that reminded Pepper (1920, pp. 155f., 157) of a ladder rung, from Room 32, is unquestionably another knob-ended loom bar.

From Room 320 we recovered two other sets, each consisting of four bars (pl. 38, figs. *n, o*). The rods vary in length from $13\frac{1}{4}$ to 19 inches; in diameter, from 1 to $1\frac{1}{8}$ inches at the butt. The one at the left is fairly dense and heavy and may be mountain mahogany. The others are light in weight, probably cottonwood. A 2-inch section on the left side of the next to last specimen is slightly concave in conse-

quence both of attrition and compression. This scar I take to be evidence that the piece rested upon a ceiling pole or similar timber

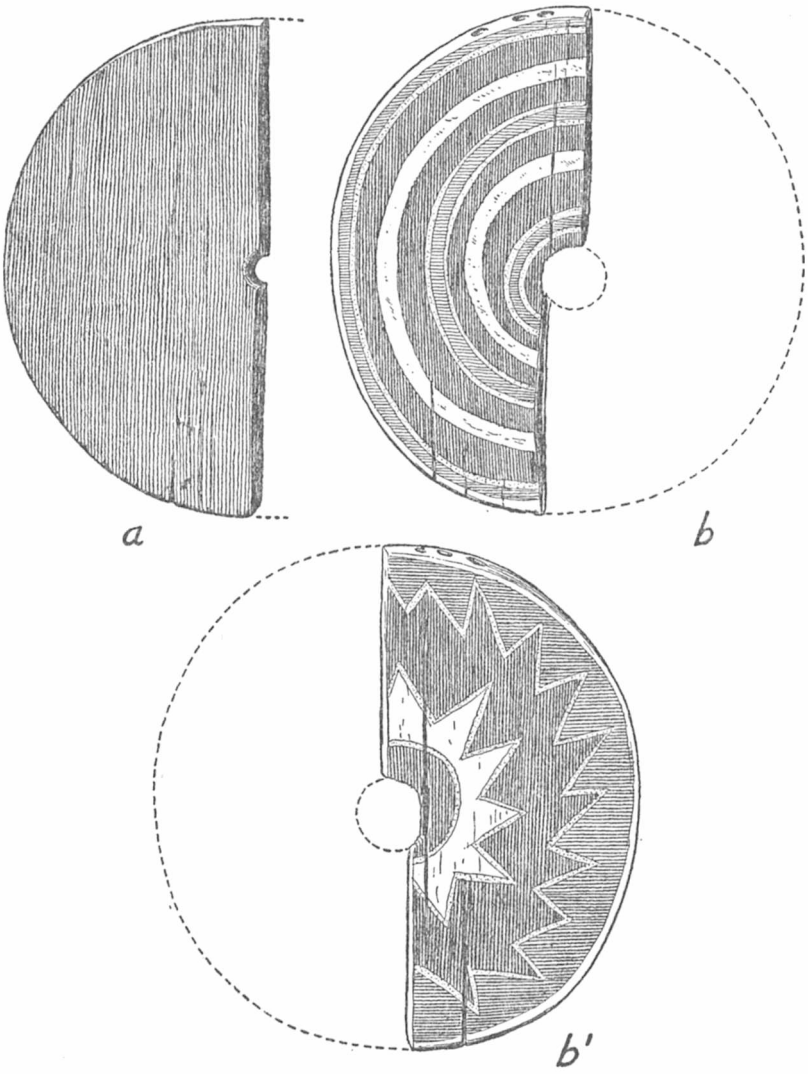


FIG. 42.—Spindle-whorl fragments of wood.

when in use. But neither this nor any of the others shows wear caused by ropes or cords.

Loom anchors (*?*).—The two pine boards illustrated on plate 39, figures *b, c,* may have been pierced for rope loops anchoring the end

bars of a loom. Formerly dressed on both sides, they are now more or less weathered and rotted. We found them among fallen masonry above the 12-inch layer of woodpile chips with which storeroom 296 was floored. Transversely across the face of specimen *c* are water stains spaced as if the board once rested upon the cut ends of ceiling poles. If this surmise be correct, then the superincumbent position of the board was secondary, perhaps part of a hatchway frame, since a pole covered the two borings at right.



FIG. 43.—Spindle whorl of gourd rind.

All the holes on specimen *c* are paired. They were cut to meet below the surface and take a quarter-inch cord. In the cluster at the left a comparable connection is noted between the middle hole and that immediately to its right, while a lesser drilling connects with the hole at the left. Lesser drillings likewise join each of the three upper holes with the one next below. An accident at the time boring was in progress punched the middle hole clear through the board and thus necessitated a plug from the opposite side. Specimen *b* is pierced by one half-inch hole, while a second was gouged out at an angle to emerge on the lower edge. Neither within nor without do any of these holes exhibit wear such as a taut cord would have produced.

We observed at Pueblo Bonito nothing comparable to the built-in floor anchors for looms in Hopi kivas (Mindeleff, 1891, p. 126, fig. 27) or those in northern Arizona cliff dwellings (Kidder and Guernsey, 1919, pp. 50, 60, 70; Judd, 1930, pp. 29, 61-62, figs. 3, 18). Like the paired holes in the sandstone cliff above the rooftops of Betatakin, our board *c* could have held yucca loops from which a waist loom might have been suspended.

Board ends.—The third plank, plate 39, *a*, with its middle growth rings marking the heart of a pine over 8 inches in diameter, belongs to a different category. Whether it was once longer we do not know. Neither can we guess the purpose for which it was originally made. As last used it formed part of the ceiling in the southeast quarter of subterranean Room 255. One end has succumbed to worms and weather; from the opposite, squared and smoothed by abrasion, a quarter-inch wedge had been gnawed with a stone ax, the better to fit it in place. Two sizable knots were leveled as if by machine. Even if some of the log had been split away with hammer and wedge it was



PLATE 34.—Bone needle, pins, and specialized tools. (Photographs by Robert F. Sisson.)



PLATE 35

Upper: Ring basket as found, on the floor of Room 290. (Photograph by O. C. Havens, 1923.)

Lower: Two decayed ring baskets among the burial offerings in Room 320. (Photograph by O. C. Havens, 1924.)



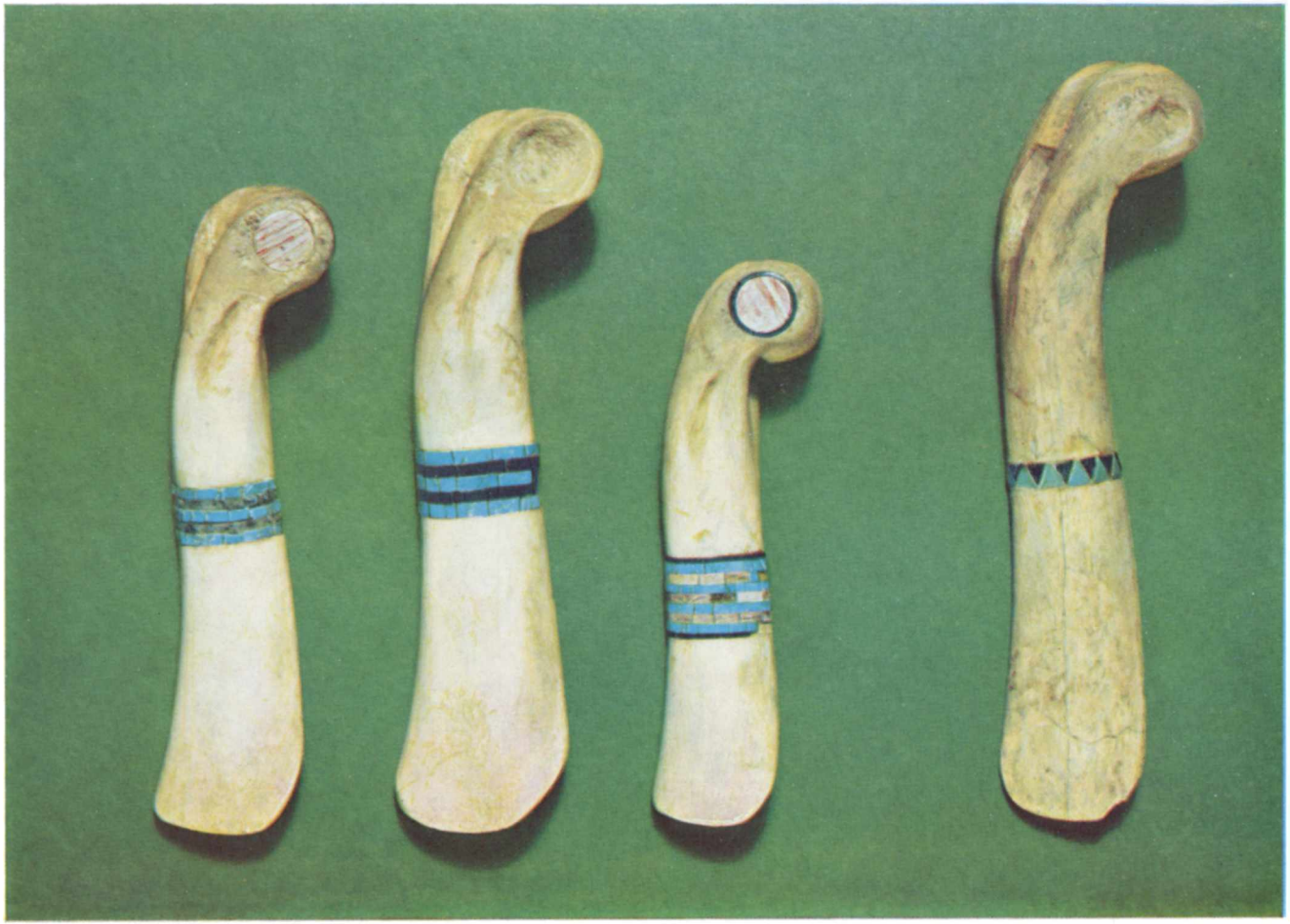


PLATE 36.—Scrapers made from deer humeri, inlaid with shell, jet, and turquoise. (Photograph by Willard R. Culver.)

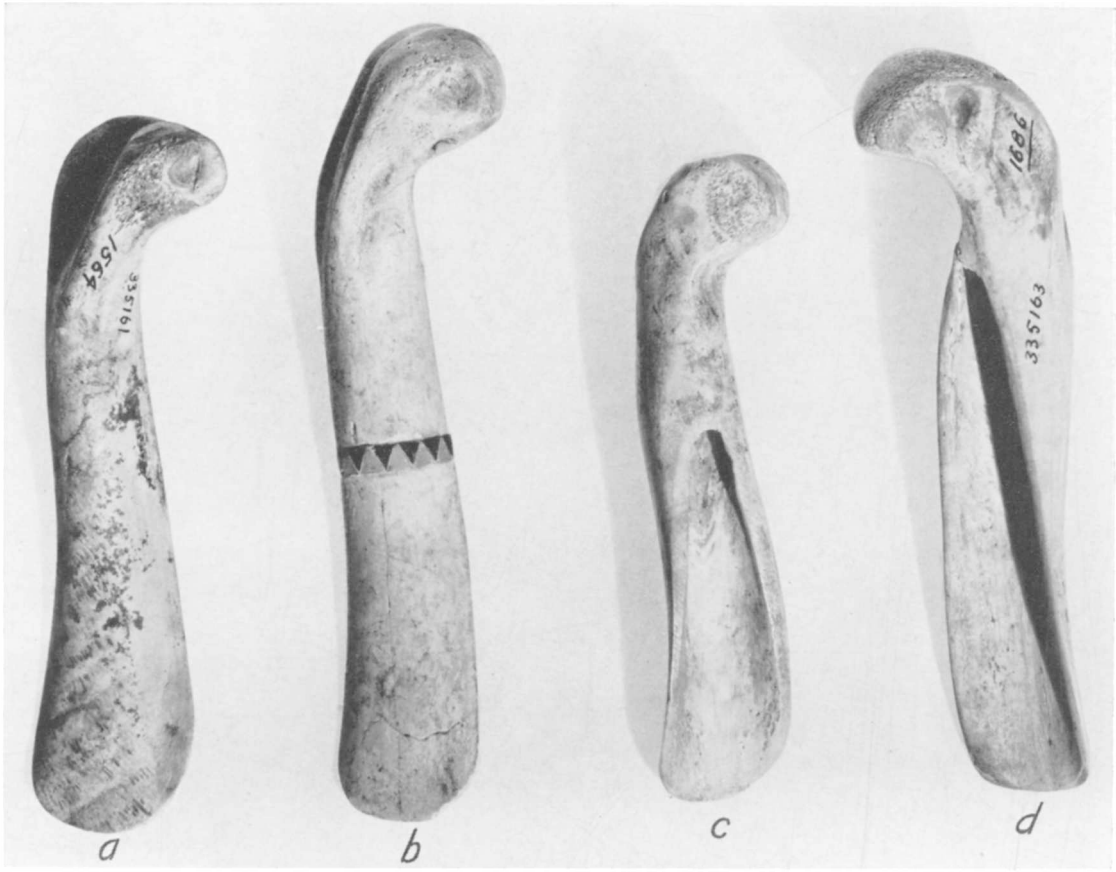
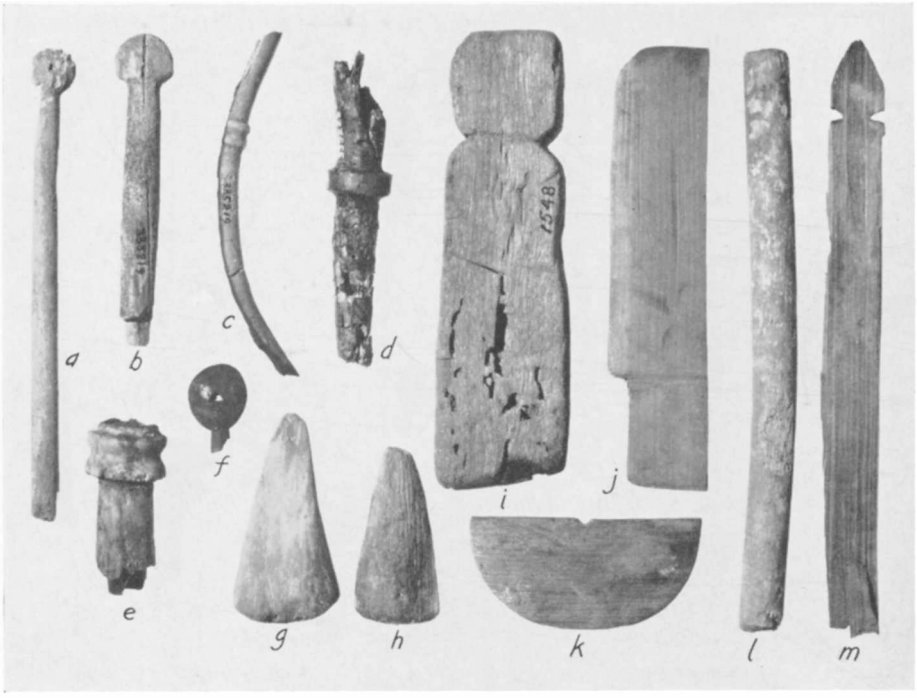
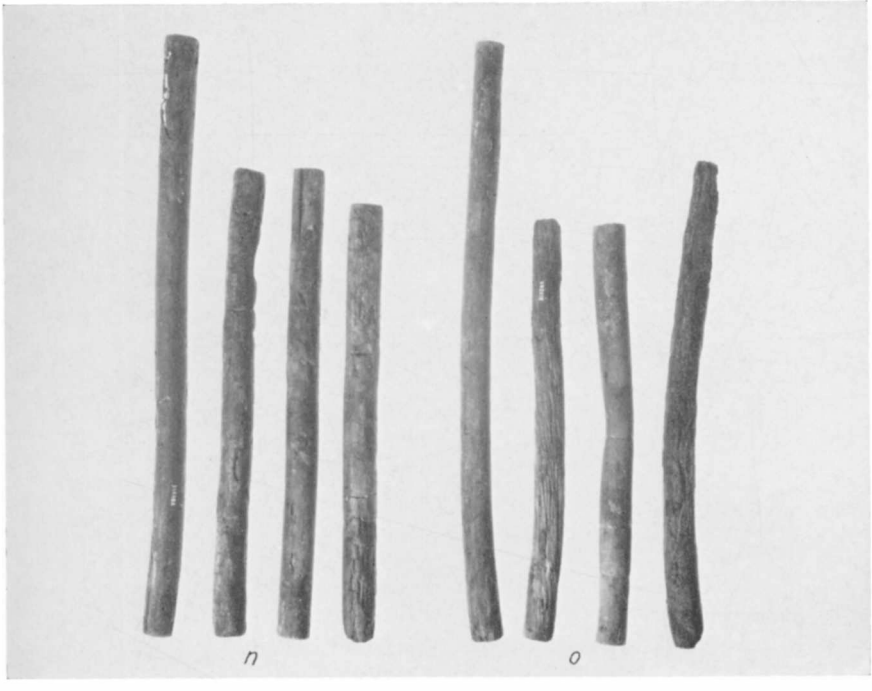


PLATE 37.—Four humeri scrapers from Room 326.



Miscellaneous objects of wood.



Two sets of loom bars from Room 320.

PLATE 38

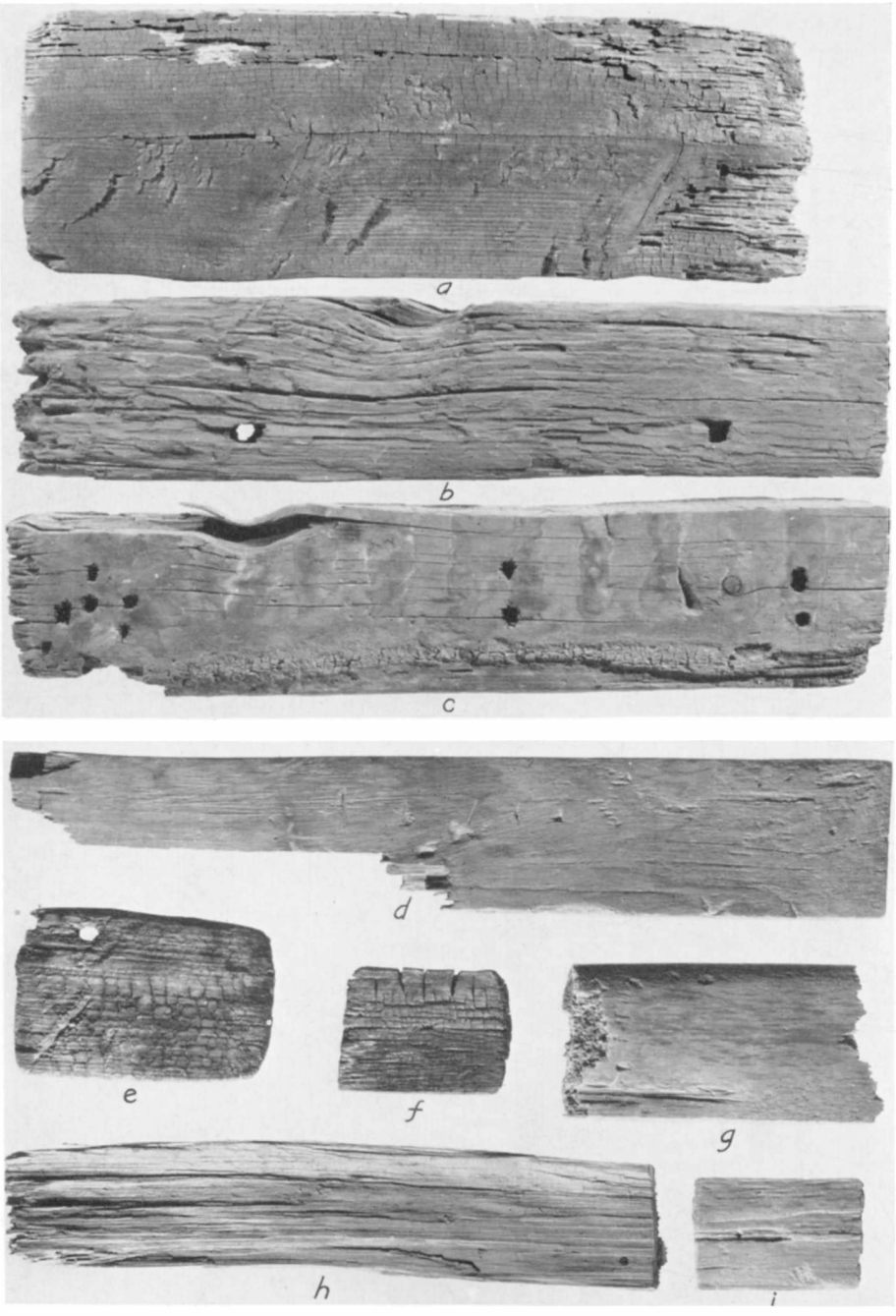


PLATE 39.—Part of a plank (*a*), two problematical loom anchors (*b*, *c*), and miscellaneous board fragments (*d-i*) showing cut ends.

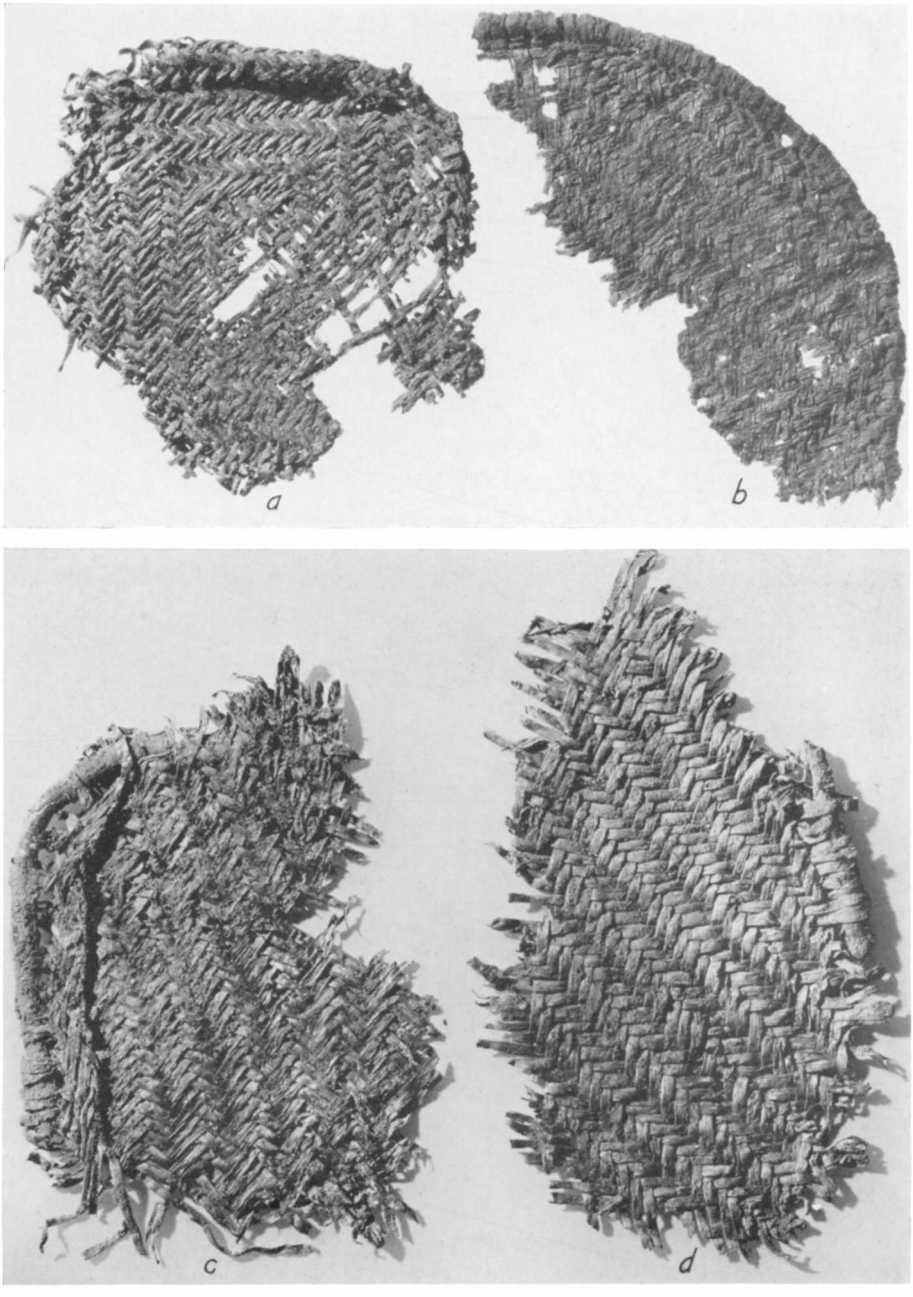
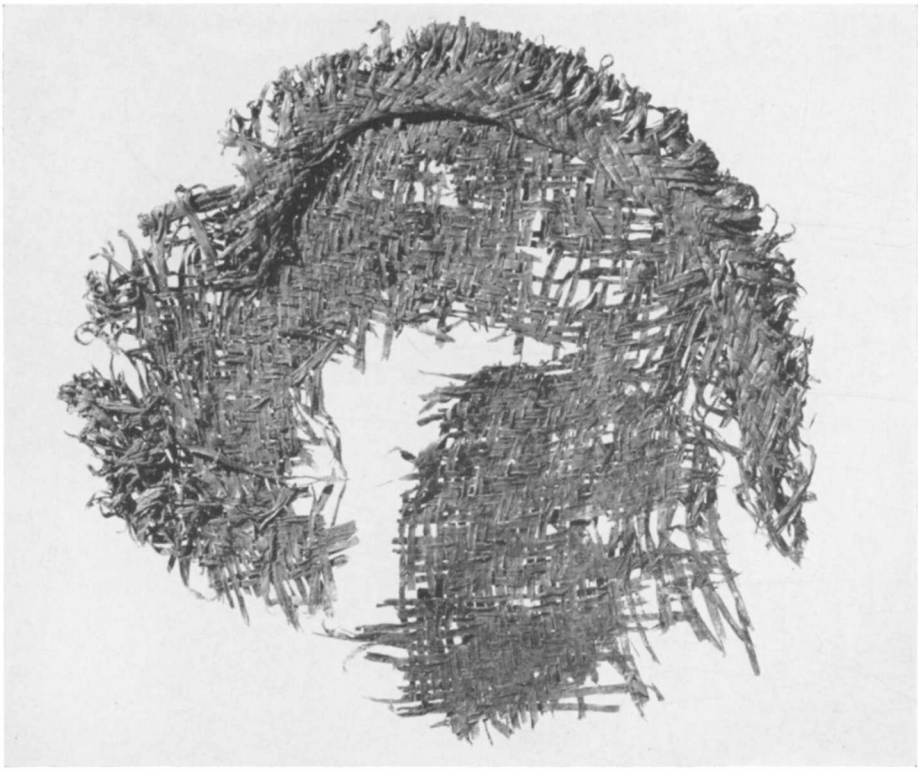
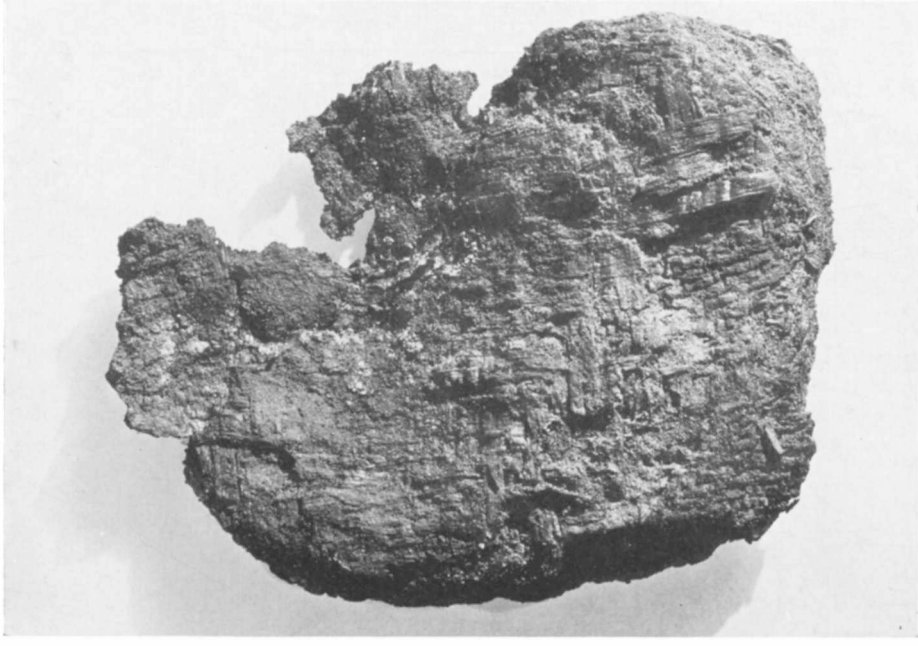


PLATE 40.—Fragments of ring baskets woven of split yucca (*a*, *b*) and rush leaves (*c*, *d*).



A, Part of a ring basket woven of rush-leaf strips.



B, Vegetable matter in a finely woven basket formed a pillow for Burial 5, Room 326.

PLATE 41

a prodigious labor to plane the remainder to a thickness of 1½ inches with no tools other than sandstone abraders. Planks were occasionally utilized as sills or lintels; less frequently, as flooring.

The smaller pieces (pl. 39, figs. *d-i*) not only illustrate Bonitian skill in dressing out a board, but also show how ends were severed with flint knife or stone ax. Figure *h,* although found in an Old Bonitian storeroom, is unquestionably part of a cedar shake from a Late Bonitian ceiling. It was sawed halfway through with a flint blade and the end then broken off. Others have both ends cut and from both sides. Pieces such as figures *e, f,* and *i* may have been detached for use alone. The exhibited face of *e,* covered by shrinkage cracks, is slightly concave through use as a work board. Its darker color is due to the application of paraffin.

Miscellaneous.—Besides the usual odds and ends, including splints with which the kitchen fire was roused, our collection contains several unusual artifacts of wood. The comblike contrivance represented by figure 44 remains nameless. Its two longest "teeth" are rounded at the tip while the others are broken; all four were broken off an inch above the crosspieces. These latter are split willow, bound with sinew; sinew also binds a fiber thread to one of the vertical members.

The angular object, figure 45, likewise remains unexplained. Knots have been removed and the crotch widened somewhat; one end is sinew-wrapped to check splitting. This specimen is reminiscent of the curved and angular knob-ended sticks that Pepper found in Rooms 32 and 33 and that he suggested might have been tossed in play (Pepper, 1920, figs. 61, 62).

Figure *i,* plate 38, carved from a cottonwood root, is as likely to have been a doll as anything else; the next piece, *j,* apparently is part of a juniper tablet accidentally split while being reduced in size. The lower end was sawed from both sides, but insufficiently, for only a corner came free when breaking pressure was applied. Where intact, the edges are smooth from abrasion, rounded, and somewhat thinned. Both faces of the tablet had been carefully dressed but longitudinal scorings appear on that presented in our illustration.

The next figure, *l,* is a section of peeled willow, both ends of which were severed in the customary way, by cutting and breaking. Neither end was abraded; the shaft bears no trace of former wrappings, no indication of use except a small, restricted area where marks of a flint flake evidence utilization of the stick as a cutting block. Perhaps no more than a discard, the section in any case is not to be confused with the peeled and abraded willows employed by the hundred in ceilings of second-type construction.

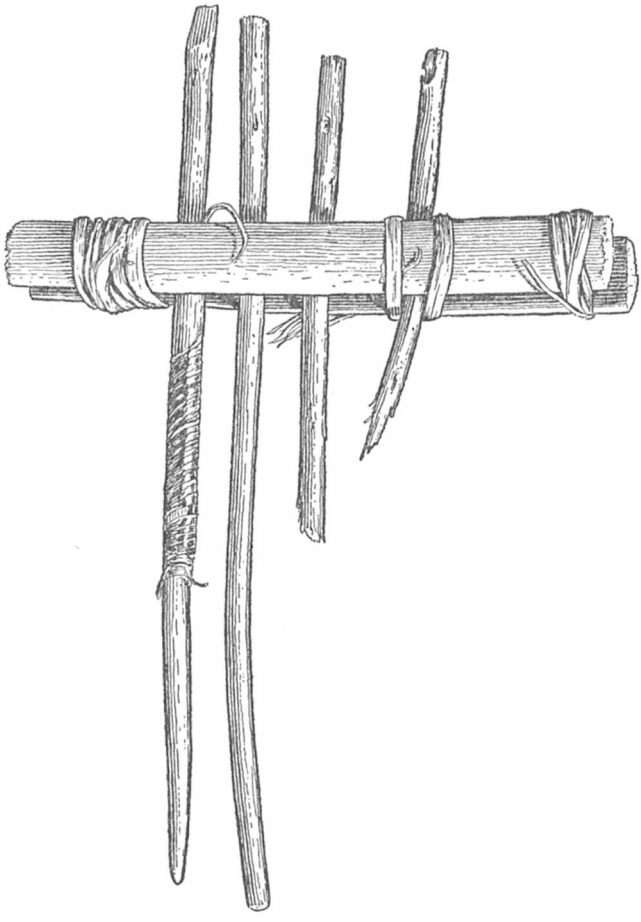


FIG. 44.—A comblike object.

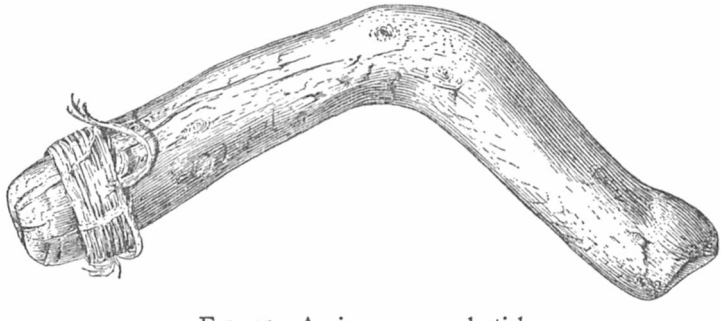


FIG. 45.—A sinew-wrapped stick.

Gourd bottles or canteens are evidenced by two fragments, one of which (U.S.N.M. No. 335367) preserves the crooked neck. Its peduncle attachment was cut out to form an orifice, and a small hole, presumably for a cord, was drilled through one wall three-fourths of an inch from the lip. Earthenware canteens in the form of gourds were fairly common in Basket Maker and Early Pueblo times.

BASKETRY

As kitchen utensils—food trays, water jars, even pots for boiling mush—baskets long antedated pottery throughout most of North America. Archeologists generally agree that wherever they occur together pottery followed basketry. This sequence is especially clear in the Southwest, where the first fired pottery produced by the Basket Makers imitated their baskets both in form and decoration. Some American tribes, including most of those resident in California, never quite abandoned basket utensils; others quickly substituted earthenware, once they had mastered the technique of its manufacture; still others calmly hung the new complex on the old and gradually relegated to each those household functions for which it seemed best suited.

Among the Hopi "basketry has at least as many uses as pottery." The harvests are brought home from the fields in baskets on the backs of men and burros. Around the hearth, coiled and wicker trays are piled with corn meal and other foodstuffs; there are baskets for parched corn, trays for piki bread, small globular baskets for various purposes, and sifter baskets for winnowing grains and seeds in preparation for grinding (Hough, 1915, pp. 93-94).

Some of the baskets represented in our Pueblo Bonito collections unquestionably had been utilized in the preparation and serving of foods; others just as surely were employed in ritualistic practices. And there is yet another group, one we cannot place with confidence in either of the foregoing categories. If the whole lot be classified by technique of manufacture, the usual practice, we find that 4 fragments are plaited and nearly 40 coiled. Whether this same ratio existed throughout the village, and from beginning to end, is a question we cannot answer. It is quite likely, however, that coiling and plaiting were not the only basketry techniques known and used by Bonitian women.

PLAITED BASKETS

Since Basket Maker days, approximately 15 centuries ago, plaited baskets have been common household utensils throughout the Pueblo

country. They are made and used today in most Pueblo villages. The modern Hopi employ the same technique in plaiting baskets and floor mats; their baskets, in fact, are no more than small mats bent over an osier ring and made fast. This long-established use of osiers to give plaited baskets their bowl-like shape has provided a handy term for the entire group: "ring basket."

Ring baskets in our collection are represented by the fragments shown on plate 40. The first, our only ornamented example, was square and may have been no more than a shallow tray. Its weaving interval is over-3-under-3, and the yucca strips were so manipulated as to create interlocking meanders. If the rolled edges were shaped over a rod, no trace remains of such a member; neither is it clear how the strip ends were secured.

Figure *b,* part of the nearer specimen shown in situ on plate 35, lower, is more in keeping with the typical ring basket. It was approximately 12 inches in diameter. The weaving elements, again narrow strips of yucca leaves, were brought across the osier ring, bent back underneath, and fastened in pairs by other strips twined close under the willow. That the weaver sought to fit her fabric to a waiting ring seems clear from the fact that the normal over-3-under-3 interval changes repeatedly around the periphery to under-2 and even under-1.

In figures *c* and *d* we have two fragments of another basket bowl. In this case, however, strips of rush leaves (*Scirpus paludosus* Nelson) rather than yucca provided the material, and the strip ends were retained to form an external, ornamental braid. Warping of the willow rod, not intent, gives the smaller piece a suggestion of squareness.

Finally we come to our best-preserved specimen, found on the floor of Room 290 (pl. 35, upper). Within it was a scrap of another basket or mat, twilled over-2-under-2, that may have been a patch. Our laboratory photograph (pl. 41, A) is of the exterior in order to show the manner in which the weaving elements, having been secured to the osier ring as usual by twining, were plaited to form an attractive selvage. This latter was woven snugly against the vessel wall and without any attachment other than that at the rim.

Thus, of four specimens identifiable as fragments of ring baskets, two were woven of yucca-leaf strips and two of rush. All four were plaited over-3-under-3. Two fragments of burned clay flooring from Room 260 bear the imprint of basketry twilled in the same interval (U.S.N.M. No. 335361).

We have five additional scraps, but I am uncertain whether they represent baskets or matting. All are twill-plaited over-2-under-2; all appear to be split rush leaf. Coarsest of the lot, with seven strips per

inch, is a fragment from Room 320 (U.S.N.M. No. 335312, orig. No. 1406). I should have classed it as matting except that the strip ends were bent back over a string, bound there by twined cords or shreds of rush, and trimmed to leave a rough, 1-inch fringe. I have never seen matting with that kind of selvage, and I never saw a Pueblo plaited basket with flexible rim.

Bits of a dirt-encrusted fabric (U.S.N.M. No. 335315, orig. No. 1873) were found among the scattered human bones in Room 330. My chief reason for thinking it might be from a small mat is that the piece had been folded. On the other hand, it seems too fine and closely woven, with 14 strips to the inch, for anything but a choice basket.

Two comparable pieces, both folded, were recovered in Room 326 (No. 335313). One is twilled 10 to the inch; the other, 16. The second has a bootlike appearance which I now believe to be purely fortuitous. Within its folds lie vegetal remains of some sort, too decayed for positive identification.

Similar fibrous material gives another fragmentary specimen a thickness approximating 1 inch; its irregular edge, however, without padding, is only the doubled fabric (pl. 41, B). Except for this doubled portion, the perimeter has rotted through. The concavity on the upper surface is due to the fact that this specimen last served as a headrest, or pillow, for Burial 5, Room 326. On the opposite side the woven elements are drawn together as though forming the constricted orifice of a bag. Made of rush strips twilled over-2-under-2 and 10 to the inch, the pillow lay beneath a mat of rushes on which the body rested.

Our attempts to preserve these and other basketry remains were less successful than we had hoped. In every instance the specimens were deeply buried when found, under at least 8 feet of blown sand, debris of occupation, and fallen masonry. In almost every instance the fabrics were damp and the heat of a midsummer sun caused contraction and fragmentation in one or two minutes. We tried to control evaporation by piling on damp sand and then brushing it away gradually but without avail. Our last alternative was to go over the exposed surface of the specimen as quickly as possible with a dustbrush and then apply diluted ambroid or melted paraffin, as the individual case warranted. With some of the cylindrical baskets we did not delay long enough even to remove the earthy contents.

Several years later, when opportunity came to study these particular remains, I first realized the difficulties in store. Without soaking in acetone and vigorous scrubbing, which they could not withstand, it was impossible to free the specimens from sand grains firmly cemented

to them by ambroid. Material coated with paraffin likewise was not in condition to be soaked. We learned that the most satisfactory means of removing surplus paraffin is heat, but for its application and control no equipment was available except a one-plate, open gas stove, a square of wire mesh, and a blotter. As the blotter absorbed the melting wax the basketry tended to flatten out and lose whatever had been retained of the original shape. In several cases, much to my surprise, specimens that had looked reasonably substantial in the field proved to be nothing more than shells of decayed vegetal matter when the supporting paraffin was removed. It was the ingenuity and skill of W. H. Egberts, then chief preparator in the department of anthropology, U. S. National Museum, that preserved for study purposes many of the remains herein considered.

COILED BASKETS

Coiled baskets are sewed, not woven. The sewing element is generally a tough but flexible splint, thinned and carefully trimmed to uniform width, that encircles the more or less rigid foundation as it progresses, stitch by stitch, to form the vessel wall. In our specimens the foundation usually consists of two rods, side by side, with a bundle of fibers above and between them. The rods appear to be slender young willow shoots, smoothed to the diameter of a pencil lead, while the bundle fibers look like shredded grass. Bundle and rods were encircled by each successive stitch, the sewing splint piercing the bundle next below to bind the two coils securely together. That coiled basketry fragments are more numerous than plaited in our collection may be due to their greater stability.

By shape, our coiled basketry divides itself into four groups: bowls, elliptical trays, cylindrical containers, and carrying baskets. Consideration of a fifth group, the bifurcated or ceremonial carrying basket, will be deferred until a later chapter.[35]

Bowls.—In Tewa, Zuñi, and Hopi homes I have seen basket bowls filled with edibles of one sort or another—peaches, in season; broiled mutton, bread, corn on the cob, shelled corn ready for grinding, and meal fresh from the milling stones. At Pueblo Bonito, we may assume that basket bowls were likewise employed chiefly in and about the kitchen.

Four, possibly five, coiled bowls are represented by fragments in our collection. One bowl, inverted, had covered the old, banded-neck

[35] Reviewing these paragraphs in 1942, the writer has profited from the incomparable study of Morris and Burgh, 1941.

cook pot shown as figure *e*, plate 50, while buried for storage purposes with its mouth at the floor level in Room 323. The basket itself had been crushed by the overburden of rubbish and fallen masonry, but several of the fragments could be preserved. One of these is illustrated on plate 42, figure *c*. It has 5 coils, 12 stitches, per inch. On fragments of other similar vessels coils per inch remain the same, but stitches run from 13 to 19. With one exception, all our fragments are close-coiled with noninterlocking stitches on a two-rod-and-bundle triangular, or bunched, foundation. This is the technique Weltfish describes as "Basket Maker." It was used not only by the Basket Makers but also by the later Pueblos whose baskets, in comparison, are generally more closely and more tightly sewed; and it was employed in baskets collected in 1881 by Stevenson at Zuñi and the Hopi villages (Weltfish, 1932, pp. 4-6, 34-36).

Figure *b*, plate 42, illustrates a bit from near the center of a bowl sewed in a second technique, one-rod foundation with interlocking stitches. The widely separated stitches number only seven per inch; the coils, half again as many. We found the fragment while clearing Room 6 of its post-Hyde Expedition accumulation of blown sand. Perhaps it is the same small fragment Pepper noted 25 years earlier (1920, p. 47).

In addition, we have two cup-sized baskets (pl. 43, *a*, *b*) and fragments of possibly two others. Both cups were sewed with an uninterlocking stitch on a two-rod-and-bundle, triangular foundation. The larger has 5 coils and 13 stitches per inch, a normal center, and a false braid termination for the rim coil. The direction of work is counterclockwise, and the sewing was apparently done from the inside since split stitches are more frequent on the convex surface.

The second cup (*b*), is a child's effort, if I judge correctly from the inexpertness of its whole makeup. The rods vary in diameter and finish; the splints are unequal in width, and while stitches circle the new coil as a rule, every now and then one passes beneath its bundle to engage the two rods only. Exhausted splint ends are brought to the outside and there clumsily bound by the next few stitches. Coils are $5\frac{1}{2}$; stitches, 11 per inch. Unlike the other, coiling in this instance is clockwise. The rim is lacking, but I guess the original height to have been $2\frac{1}{2}$ or $2\frac{3}{4}$ inches.

Probabilities are that two other specimens at hand also represent cups. One (U.S.N.M. No. 335326) consists of small sections of what appears to be yucca fiber wrapped about by split yucca or rush leaves. Together the fragments form a circle $1\frac{3}{4}$ inches in diameter and half

an inch wide with a three-quarter-inch opening at the center, a ring that could be the second coil of a small basket.

With our other problematical specimen it is the original height that is in question. Besides the flat bottom, now broken and ovoid through external pressure (pl. 42, fig. *h*), we have four rim segments only one of which carries as many as five coils. The fragments probably represent a cup, but they could be from a cylindrical basket about $3\frac{1}{2}$ inches in diameter. Their stitches are uninterlocked on a three-rod, bunched foundation—our sole example of this popular Pueblo III technique. I measure 4 coils and 13 stitches per inch. Coiling is counterclockwise; work progressed from the concave side.

The rim is bound by regular stitches except for the final $1\frac{1}{4}$ inches. Here the three foundation rods are cut away gradually to merge with the coil below and are enclosed by false braid. At commencement of this ornamental finish the end of an exhausted splint was cut off close against the outside wall and a fresh splint introduced from the opposite side. This substitute pierced the apex rod of the lower coil and was brought up from the outside, over and again through the apex rod in the coil below. Then it was brought up once more and carried back across the previous stitch to be thrust through the wall between coils. In this maneuver the splint retreated its own width, engaged the standing elements of the last previous stitch, and then came over again, forward two widths, and again through the apex rod to begin another backward loop. Our best example of false braid thus combines features of both Basket Maker and Pueblo types, as described by Morris and Burgh (1941, p. 23).

To those who know the Southwest it is impossible to visualize a Pueblo home without one or more coiled baskets lying about. Baskets are as much a part of the domestic scene as the ubiquitous, bare-bottomed toddlers. Thus when a few basketry fragments survived at a prehistoric ruin it seems that numerous other pieces, and even whole vessels, should have been preserved. Such, unfortunately, was not the case at Pueblo Bonito.

In his published field notes Pepper mentions but does not describe several baskets and fragments. From Room 2 he removed a tray of the "two-rod coil type" about 18 inches in diameter and another only 2 inches in diameter by a trifle over one-half inch deep (Pepper, 1920, p. 36); from Room 25, a twilled yucca ring basket and two fragments "of the three-rod coil variety" (ibid., p. 107). Two coiled bowls, apparently about 8 inches in diameter, had been inverted over broken pottery filling one of the subfloor pits in Room 62 and were in turn

covered by "a large basket" the surviving fragments of which, as photographed, look like one side of a burden hamper (ibid., fig. 100, pp. 227, 234). Another coiled bowl may be seen in Pepper's illustration of pottery in the northeast corner of Room 28—a partially disintegrated specimen lying in the smaller of two stacked earthenware bowls, directly in front of the left-hand door jamb (ibid., fig. 44, p. 116). Weltfish (1932, p. 22) interprets Pepper's coiled types as, respectively, two-rod-and-bundle-triangular and three-rod-triangular foundation. According to Morris and Burgh (1941, p. 13), the first of these two foundation types appears at all stages of Anasazi history and was actually dominant in Basket Maker times; in the Pueblo III period, the three-rod bunched foundation occurs about twice as often as that with two-rods-and-bundle.

Elliptical trays.—A shallow, elliptical, coiled basketry tray accompanied each of four women interred in Room 326. With each tray was a bone scraper, or flesher, made from the humerus of a deer (see pp. 148-149). The fleshers are of a type well known throughout the San Juan Basin (especially from ruins north of the river) but the baskets are unique in the Southwest, so far as I can learn.

Unfortunately, the condition of the trays was such that we were able to save only one reasonably intact (pl. 44, *b, c*). It was sewed with uninterlocking stitches on a two-rod-and-bundle, bunched foundation. Coiling began when the bundle and paired rods, closely wrapped with sewing splints, were extended $7\frac{1}{4}$ inches before being doubled back in a counterclockwise direction and stitched to the initial wrapping. The rim termination has not been preserved. That the tray was originally a thing of beauty may be judged from the fact that, in its present condition, I count 6 coils and 22 stitches per inch. It measures $13\frac{1}{4}$ by $6\frac{1}{2}$ by $1\frac{1}{2}$ inches deep but its original depth may have been nearer 2 inches and the other dimensions correspondingly less.

In the lower illustration (*c*) the imprint of the accompanying scraper is clearly seen at the lower right and above and to the left the black thread of our repairs. The second view (*b*) was taken from a lower angle after most of the paraffin had been melted off. Our field photograph, plate 94, right, shows this basket in situ at the head of Skeleton 6 and, inside, its associated scraper (fig. *a*, pl. 37) and the small black-on-white bowl seen to better advantage as figure *d*, plate 54.

Fragments of two other elliptical trays exhibit the same uninterlocked stitches on a two-rod-and-bundle, bunched foundation. One of the two (U.S.N.M. No. 335307), of which only a middle section of side wall and bottom remains, has 7 coils and 22 stitches per inch. As preserved the wall stands $2\frac{1}{4}$ inches, and I believe this was the original

height. With other funeral offerings the basket lay at the right side of Skeleton 12 and contained the bone scraper illustrated on plate 37 as figure *d*. The second fragment (No. 335313), a section of side wall with false braid over the rim termination, boasts 8 coils and 24 stitches per inch—the finest example of basketry in our collection. Decay has shrunk its sewing splints and exposed the foundation, but I doubt if this affects the original number of stitches and coils.

Our fourth elliptical tray was in a sad state of disrepair when first exposed, and a generous coating of paraffin was applied in an effort to save it. But the completeness of its disintegration was not realized until the wax was removed, for then the walls crumbled and only the skeletonized bottom remained (pl. 44, *a*). Even this remainder owes much to the fact that it rests upon a folded textile, perhaps a finely woven sandal, and on a number of what seem to be yucca leaves shredded at one end. It was the better preserved of two elliptical trays included among the offerings buried with Skeletons 8 and 9, Room 326 (pl. 94, left). Beneath the tray, as found, was the inlaid bone scraper shown as figure *b*, plate 37.

In contrast to the others, this fourth elliptical basket was built up with noninterlocking stitches on a two-rod-and-bundle, stacked foundation. I count $3\frac{1}{2}$ coils and about 20 stitches to the inch, a little finer work than that of a Mesa Verde basket in the same technique cited by Weltfish (1932, p. 19). The technique is repeated in fragments of two cylindrical baskets from Rooms 320 and 326, respectively.

Interest in these elliptical trays is naturally augmented by knowledge that all four were found in the same room; that each was buried with the body of a woman; that a bone flesher was placed in three of the trays at time of interment. In the case of the fourth tray, the flesher was placed underneath. Our excavations provided no clue to their intended purpose. Pepper does not describe a comparable basket among the Hyde Expedition collections and, so far as I know, their like has not previously been reported from the Southwest.

Cylindrical baskets are closely related to cylindrical vases, but we do not know which came first. We have no reason to believe either group was in any way connected with religious practices, yet they both seem useless for all practical purposes. Of the two, the baskets have greater diameter but less height. The average diameter and height of 14 pottery vases in our collection are, respectively, 4.65 and 9.87 inches. Of five cylindrical baskets whose diameter and height are measurable, the averages are 5.35 and 8.53 inches. Most of the vases have painted geometric designs and lugs perforated for suspension cords. Of all our cylindrical baskets, on the other hand, whole and

fragmentary alike, only one had handles, as far as we can see, and this same vessel carries the only visible, stained-splint decoration. One other boasts a painted design.

We have no idea what particular purpose cylindrical baskets were made to serve. That they were fairly common at Pueblo Bonito seems certain from our data on type frequencies and distribution. For example, we have fragments of only four or five coiled basket bowls—everyday utensils in every Pueblo household for 50 generations past. In contrast, our collection contains 5 cylindrical baskets in which both height and diameter have been preserved and fragments of 14 others, 19 in all. Three fragments were recovered from rubbish piles in as many Late Bonitian dwellings; the remainder, from six Old Bonitian houses of which three had been utilized as burial chambers and, thereafter, as dumps for kitchen debris.

Our best specimens, shown on plate 45, all came from Room 320, wherein the bodies of 10 women and girls had been interred. Presumably the baskets were present as mortuary offerings, but of this we cannot be positive since prehistoric treasure hunters had rifled the place with obvious contempt for the dead and all their possessions except jewelry. Specimens *a* and *b*, partially emptied of their sandy contents and paraffined in preparation for removal, are shown in situ on plates 91, lower, and 96, right. Specimen *e* will be recognized in our field photograph (pl. 92, lower) lying on the floor south of the east doorstep and a couple of inches in front of the ceremonial carrying basket to be described in a subsequent chapter. Beyond these two, near, but not positively with, the only undisturbed burials in Room 320, were baskets *d* and *f*.

Basket *d* is in good condition despite disintegration of its lower rear wall and some crushing in front. With 5 coils and 13 stitches per inch its structure is a bit coarser than average. Split stitches are numerous both inside and out; splint ends are cut off flush with the vessel wall. Part of the rim is missing but the remainder includes over 3 inches of false braid looped forward three, back two. In our effort toward preservation, a supporting rattan has been sewed inside the rim and the entire vessel coated with dilute ambroid.

A number of sandstone spalls had somehow gotten into basket *e* causing the irregularities visible in the illustration. Nevertheless, the specimen is of more than usual interest. It is the only one in our series bearing a design produced with dyed splints, and it is also the only one with a handle. The latter (only a vestige remains of its opposite) is a horizontal loop consisting of two stacked rods with bundle between, attached five-eighths of an inch below the rim. Some weeks

after our photograph was made the handle was inadvertently pulled off, and although it has since been replaced, several small pieces were lost. Study of the broken parts shows that the loop was bound to the outside after the underlying body coils had been completed, but while they were still pliable enough to bend sharply with tightening of the sewing splint. Because of the weights carried in the basket, the lower of its two handle coils has been bent out and up; stitches on coils immediately beneath the handle have been worn by friction of a carrying thong.

No other cylindrical basket in our collection equals this one in excellence of construction. Stitches average 20 per inch, while coils run $5\frac{1}{2}$. Unlike the others, the foundation does not show between stitches. The latter are uninterlocked; coiling is counterclockwise with a remnant of Pueblo-style false braid (forward 4, back 3 ?) at the termination. A design in black, red, and natural splint color, now faded and indistinct, covers the entire surface.

In our illustration two coils near the bottom are quite conspicuous on basket *f*, plate 45. They owe their prominence, however, to the accident of slightly larger foundation rods and are less noticeable on the opposite side of the vessel. This is one of two specimens whose coils run 7 per inch; stitches, 18. In numerous places the stitches have disintegrated and separated, revealing the foundation rods. A fragment of false braid remains on the otherwise normally wrapped rim.

The foregoing were all coiled counterclockwise with uninterlocking stitches on a two-rod-and-bundle, bunched foundation. This technique, a local favorite, is present in 16 of our 19 cylindrical baskets and fragments. The other three include one example of three-rod, bunched (U.S.N.M. No. 335330) and two examples of two-rod-and-bundle, stacked foundation.

This latter technique is clearly seen in figure *c*, plate 45. But here the last two and a half coils were sewed on a one-rod-and-bundle foundation. Coincident with this change the worker apparently shifted from the concave to the convex surface, for the number of outside stitches split by the sewing awl suddenly diminishes shortly before a single, larger rod replaced the two smaller ones. The broken rim lacks its terminal tie. Another example of two-rod-and-bundle, stacked, is the scrap shown as figure *a*, plate 42.

Reviewing these 19 cylindrical baskets and fragments, we note that the popular two-rod-and-bundle bunched foundation is the dominant type. In each instance stitches are uninterlocked. The concave side was the preferred work surface, although sometimes, to judge from the proportion of split stitches, sewing apparently progressed from the opposite side or from both sides, with irregular alternation. Coils vary



PLATE 42.—Fragments of coiled basketry vessels.

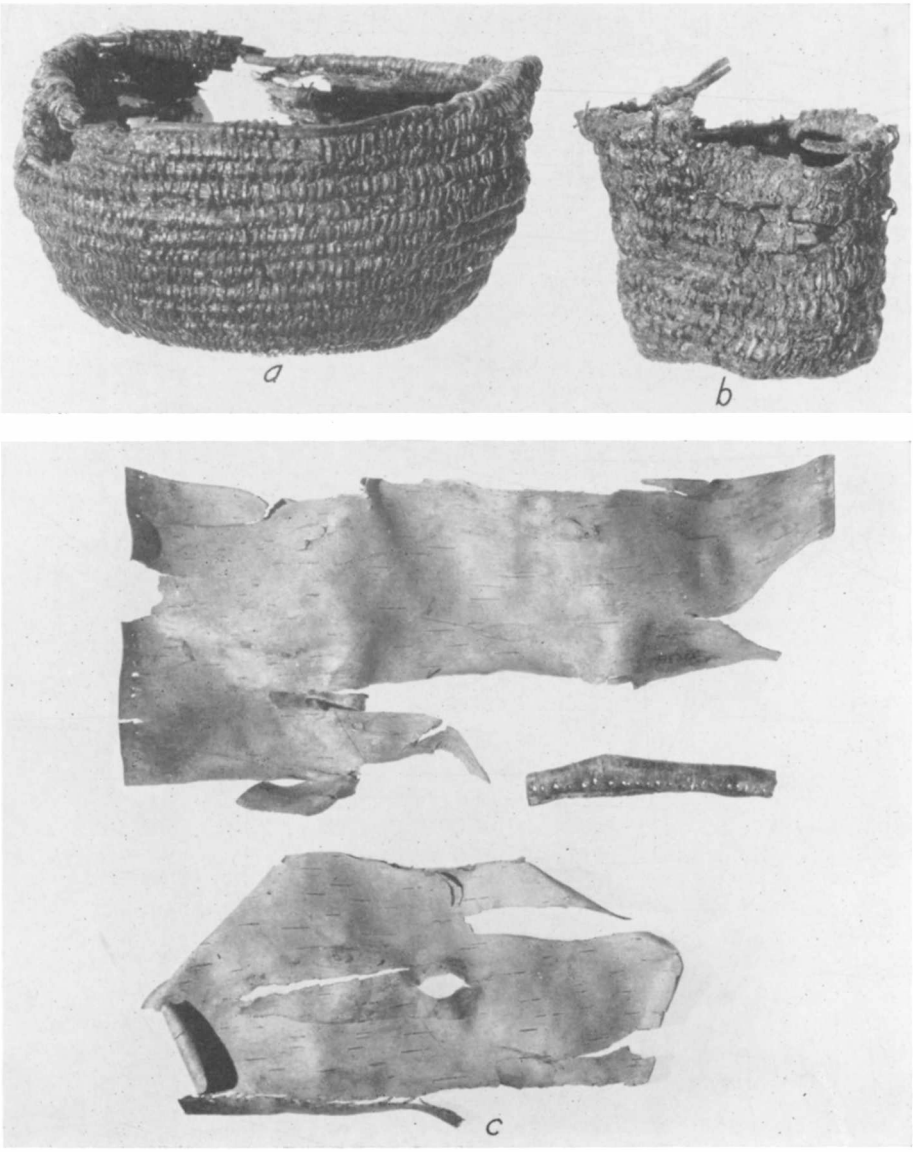
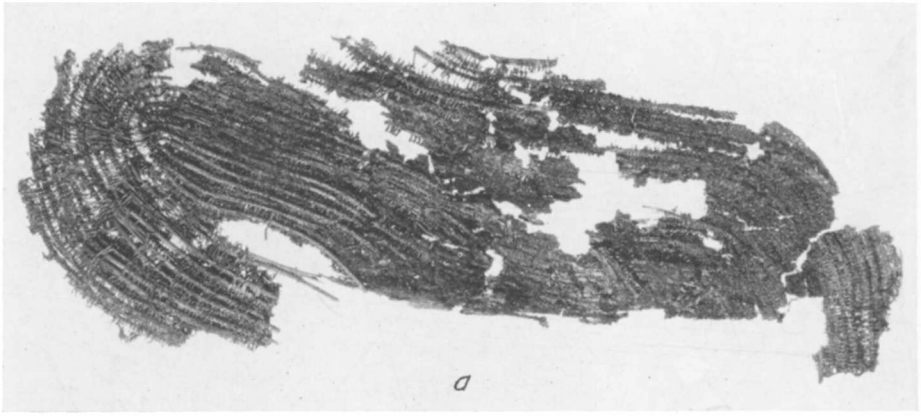
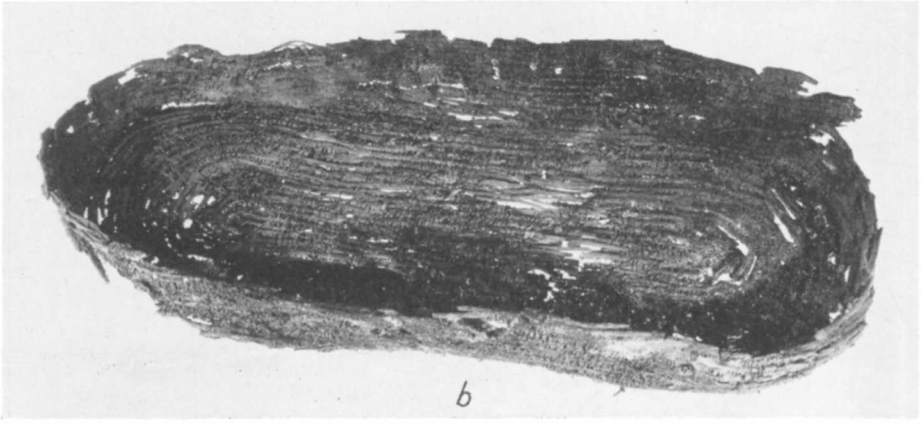


PLATE 43.—*a*, *b*, Coiled basket cups; *c*, fragments of birch bark vessels.





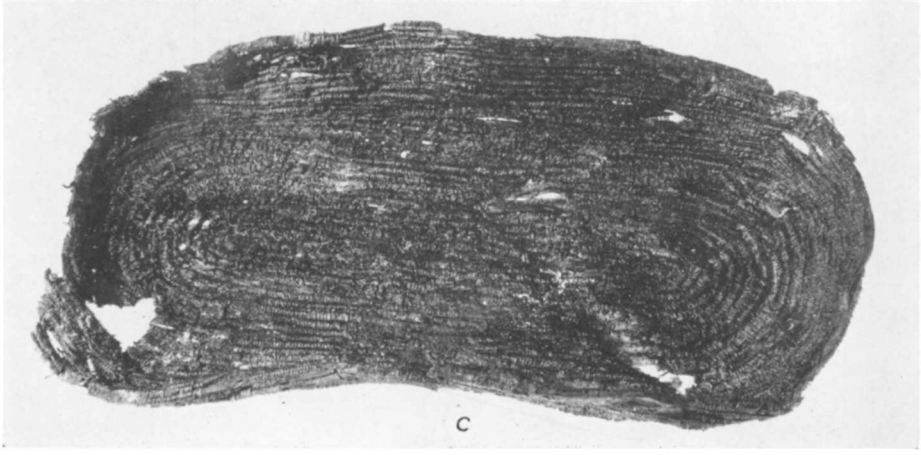


PLATE 44.—Remains of elliptical basketry trays found with burials of women in Room 326.

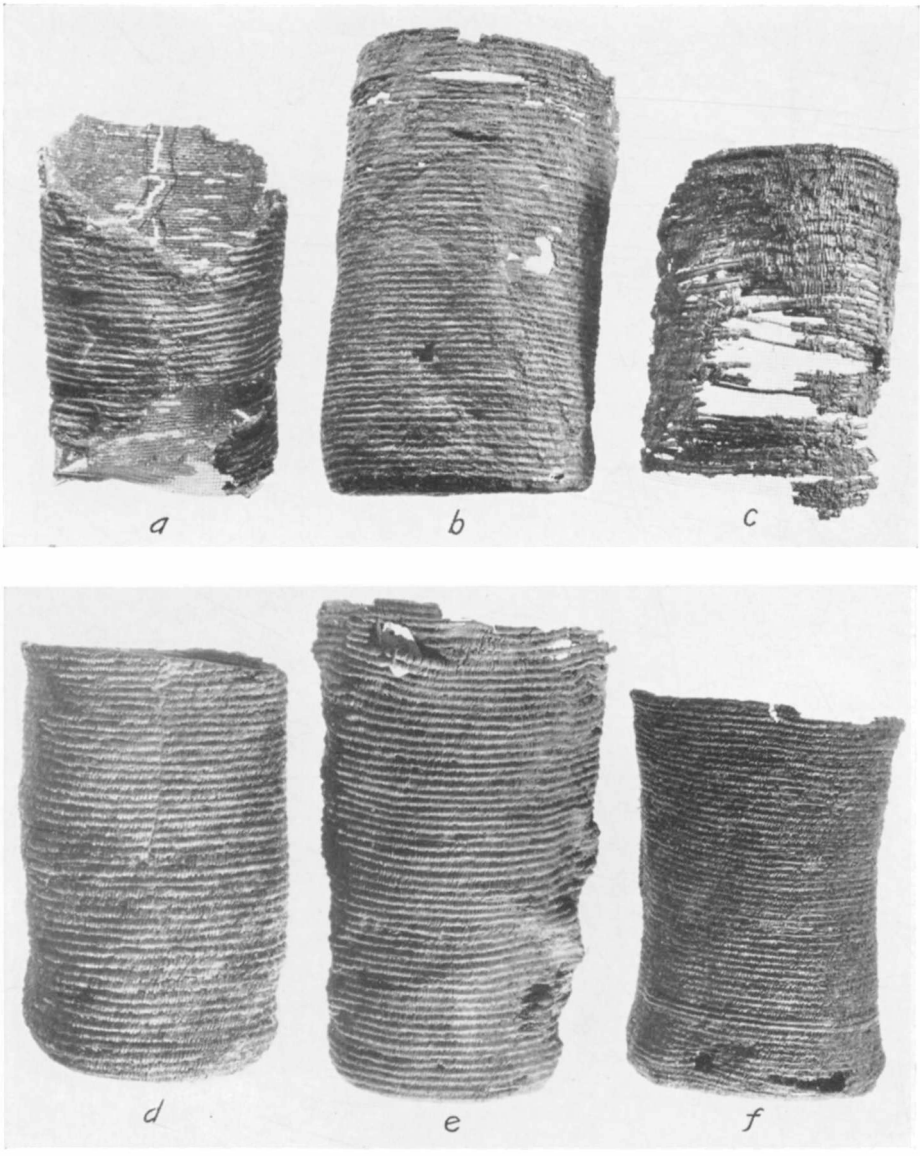


PLATE 45.—Cylindrical baskets among mortuary offerings in Room 320.

from 5 to 7 per inch; stitches, from 12 to 20. At the center, where the coiling begins, double and wrapping stitches invariably occur; where the coil first rises from the flat bottom to start the vertical wall the inner foundation rod often lies a trifle higher than its companion in consequence of tightening the sewing splints. In every specimen where direction can be determined, coiling is counterclockwise, and in at least four it terminates in false braid of the variety described as "Pueblo" by Morris and Burgh (1941, fig. 7, *h*). However, as the splints loop forward and back to weave their terminal tie, they do not always gather in a fixed number of standing elements; the number may vary from two to five even in the same specimen. One fragment boasts added fancywork, a bit of beading. One and one-half inches of false braid remain, and for 2 inches immediately preceding this the customary fiber bundle of the coil is replaced by a strip of splint running alternately over and under the otherwise normal rim stitches.

Perhaps because their flatness gave them greater durability, bottoms are conspicuous among our cylindrical basket fragments. There are eight in the series. That shown on plate 42, figure *i*, never passed the stage represented, for the splint wrapping of the outermost coil has not been punctured by the sewing awl. Figure *g* is one of three compressed by weight of the accumulation above it.

In describing the six cylindrical baskets from Room 320 the possibility of their being burial offerings was mentioned. It is equally possible, of course, that they were among the paraphernalia of some secret society and were merely stored in the room at the time it was pressed into service as a tomb.

Of all our cylindrical baskets only two were undeniably associated with interments, the double burial in Room 326 (pl. 95, upper). Another (U.S.N.M. No. 335305) accompanied the sizable fragment of a bifurcated basket (No. 335313, orig. No. 1680) as it lay above an infant's skeleton (No. 10) in the southeast corner of the same room. Since it was not customary at Pueblo Bonito to place grave furniture on top of a body it is quite likely that both these baskets really belonged to one or more of three disturbed adult burials near the child's.

Coiled baskets of the type we have just considered are, so far as I can learn, peculiar to Pueblo Bonito. Weltfish (1932) refers several times to "cylindrical" baskets, but in each instance where I made further inquiry the specimen cited proved in shape to be a deep, inverted, truncated cone.[36] From Aztec Ruin, however, Morris (1919a,

[36] Baskets of this description are well known from the Mesa Verde. The Nordenskiöld basket from grave *c* in Step House is such a one (Nordenskiöld, 1893, pl. 44, fig. 3); so, too, are the four Wetherill specimens in the University of Pennsylvania Museum, as I learn from data kindly furnished by Miss H. Newell

p. 56) recovered a single fragment that may represent a basket of our Pueblo Bonito type. Pepper mentions only one cylindrical basket, his justly famous turquoise-covered specimen from Room 33 (Pepper, 1909, pp. 227-228; 1920, pp. 164-173).

We know neither when nor why the Bonitians first made a cylindrical basket. The Basket Makers produced nothing comparable; one searches the literature in vain for its precursor among Early Pueblo remains. The flat-bottomed basket bowls of the Marsh Pass region (Guernsey and Kidder, 1921, p. 61) may be direct ancestors of Mesa Verde's deep, inverted, truncated-cone type, but the latter is a far cry from the one under discussion and, at the earliest, no more than contemporary with it. The earthenware bowl molded in a conical basket, which we recovered from Kiva 2 E, bore a pseudo-Mesa Verde design (pl. 52, C). Late Mesa Verde pottery occurred on the most recent Bonitian trash heaps. Thus all the data on which I can put a finger indicate that the truly cylindrical basket herein described was a product solely of Pueblo Bonito. Since only 3 of our 19 specimens were found in the newer sections of the village, and then only in household rubbish, it is barely possible all were made by the Old Bonitians. If this point could be established we should know that the cylindrical basket foreshadowed the vase, examples of which, although dominantly Late Bonitian in ornamentation, were most numerous in Old Bonitian houses.

Besides that above mentioned, we have fragments of eight other earthenware bowls molded in deep, conical baskets (U.S.N.M. No. 336071). Two only are unslipped, unpolished inside. Of two rim sherds, one is flat and tapered from the inside; the other, rounded and slightly outflaring. This latter is part of a deep bowl whose inner wall to within 1 inch of the bottom is covered with inclined bands of negative rectangles alternating with parallel lines—a typical Mesa Verde design. The basket imprint on this specimen shows 5 coils and 16 stitches per inch. Finest sewing is represented on two sherds where I count 8 coils and 22 stitches to the inch. Two other sherds bear black-paint decoration over the basket imprint.

These fragments of cylindrical baskets, bowls, and elliptical trays may be entirely characteristic of local basketry, but it is extremely doubtful whether they illustrate all the coiling techniques known at Pueblo Bonito. Certainly they provide no index to the number of baskets actually produced there. Of the 30-odd Anasazi coiling proc-

Wardle. Burgh (1937) describes another Mesa Verde example. Morris and Burgh (1941, p. 51) say "the flaring cone with flat bottom is not known to appear in Anasazi basketry prior to Pueblo II . . . a forerunner of the deep conical basket which was later so highly formalized at Mesa Verde."

esses recognized by Morris and Burgh (1941, p. 8), only four are represented in our collection.

Carrying baskets.—Subfloor pocket 2, Room 62, was filled with broken pottery over which two basket bowls had been inverted and the whole covered by "a large basket," the major portion of which had decayed (Pepper, 1920, p. 234). The remainder, as seen in Pepper's figure 100 (p. 227), appears to be about 2 feet long by 14 or 15 inches wide. A fragment of such size, with over 80 coils visible, can only represent a burden basket. Pocket 5 likewise contained the remains of "a large basket"; fragments of at least one "very large basket" were found in Room 32 (ibid., pp. 162, 235). Repetition of the adjective in connection with these three separate cases seems convincing, if only circumstantial, evidence the Bonitians used carrying baskets. And here, as elsewhere throughout the Western Hemisphere,

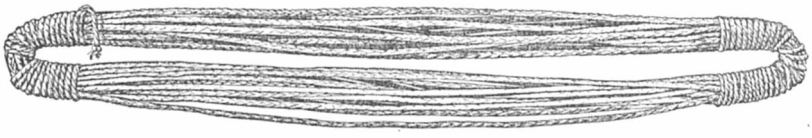


FIG. 46.—Headband of braided yucca fibers.

burdens borne on human backs were supported by means of a tumpline across chest or forehead.

Tumplines at Pueblo Bonito are represented by three fragmentary examples in our collection. Found among the wreckage in Room 320, two of these (pl. 46, figs. *a* and *b*) are of yucca-fiber cord. The third, and best preserved, consists of 13 or 14 flat three-strand braids, one-eighth inch wide, bunched and wrapped with 2-ply string at each end to form loops for attachment of ropes. The drawing above, figure 46, provides a clearer conception of how this particular specimen looked when in use.

Our two smaller fragments differed from the third in one detail only: instead of being braided, the component cords are of a coarse, 2-strand twist; at least 11 are present, looped and wrapped as in the first case.

Part of a twined-woven headband (U.S.N.M. No. 335344) was recovered in Room 325. It is 1⅛ inches wide and has 13 warps. Tightly coiled upon itself when found, the strap has since broken into half a dozen pieces of which one is the outer curve of an eyelet. This latter embraces four warps only and thus suggests that the middle five were cut short as weaving progressed down one side, around the end, and

back to complete the loop. Pepper (1920, p. 108) mentions a like specimen, woven of cotton and yucca, from Room 25.

From Aztec Ruin, Morris (1919a, p. 52) reports a woven headband in which the two middle warps were shortened at each end to provide for eyes. In a kiva at Ruin 12, Mesa Verde National Park, Nordenskiöld found a fourth example, woven of cotton on yucca warps. As I read his illustration (Nordenskiöld, 1893, pl. 49, fig. 2), there are 23 warps in the fabric and of these the middle 7 were cut short at each end in order to create a triangular opening 1 inch or more in length as the 8 warps on either side were divided into two bunches of 4 each and woven into the double-ribbed loop that closed the opening and terminated each end of the band.

Fewkes (1909, p. 45, fig. 22; 1911b, p. 76, fig. 4) shows two more Mesa Verde woven headbands with the middle warps shortened to leave triangular eyelets, and the remaining warps bunched to serve as foundations for the thicker, compressed weaving at the two extremities. Apparently this variety of headband loop is a Mesa Verde trait; if so, our lone Pueblo Bonito fragment and that unearthed by Pepper provide two more ties to the homeland.

Miscellaneous containers.—This seems as good a place as any to record the following items:

First, a section of heavy fabric that looks like part of a headband or belt (U.S.N.M. No. 335328). It is $3\frac{1}{2}$ inches wide and $\frac{3}{16}$ inch thick; the warps run lengthwise, and both edges are selvaged. The material appears to be loosely twisted cotton cord twined on warps that were smaller and of stiffer fiber, undoubtedly yucca. Folded upon itself without visible sign of stitching, the fabric forms an oval cup or bag $2\frac{1}{4}$ inches deep and bulging to a width of 2 inches with its granular contents. The latter have not been analyzed but may be no more than pulverized sandstone overlaid with bits of vegetal remains and charcoal. The specimen was found in the passageway connecting Rooms 251 and 256, both of which contained quantities of household rubbish. We saturated the piece with paraffin and thus preserved it as found.

Something of an enigma is presented by six pieces of birch bark perforated along one or two edges as though parts of a box or handbag.[37] Indeed, one fragment is still selvaged with half a willow rod

[37] Identified by George B. Sudworth, U. S. Forest Service, as red birch, *Betula fontinalis,* whose range is given by Wooton and Standley (1915, p. 163) as British America to Colorado and New Mexico. In the latter, red birch grows along streams in the Upper Sonoran and Transition zones and has been collected in the San Juan Valley and in the Tunitcha Mountains, both accessible from Pueblo Bonito.

bearing traces of the close-lying splint stitches that formerly bound it in place. The longest fragment, the grain running longitudinally, measures 11½ inches; both ends are perforated one-quarter inch from the straight-cut edge. All six were exposed in an exploratory trench just outside the south wall of Room 154 but my field notes failed to give the depth. They are not decayed, and they look very un-Puebloan —but there they are (pl. 43, *c*).

A half dozen scraps of another bark, each having one or more cut edges, were recovered from the rubbish in Room 255 (U.S.N.M. No. 335384). The bark is three-sixteenths inch thick and remains unidentified.

Jar rests, or pot rings, were simple contrivances devised especially for large, round-bottomed vessels. They afforded comfort to the carrier and they provided necessary support for standing bowls and jars while used for storage.

Pot rings are of almost worldwide distribution. They are employed today wherever it is woman's task to fetch water from well or pool. Those seen during his first few days in Hawikuh reminded Coronado of home and Spain so he sent a couple to the Viceroy along with his letter of August 3, 1540, and boasted "One of these Indian women, with one of these rolls on her head, will carry a jar of water up a ladder without touching it with her hands" (Winship, 1896, p. 563).

The four examples we found at Pueblo Bonito differ from one another (pl. 46, figs. *d-g*). Figures *d* and *f* were made of cedar bark, but the latter was wrapped with both shredded bark and yucca cord; the former, with bark alone. Both are charred. Figure *g* is merely a handful of cedar bark, hastily rolled and bound to meet the need of the moment, while *e,* made up entirely of cornhusks, required more time for preparation. In Room 24 (N.G.S. Room 229B) Pepper unearthed a jar rest of braided yucca and another made from the feather-wrapped cords of a discarded blanket (Pepper, 1920, p. 96). These are all comparatively crude, but we may be certain that the Bonitians were capable of weaving pot rings quite as attractive and as durable as any produced by their contemporaries of the cliff villages.

On plate 53, figures *a* and *b*, we have illustrated the neck portions of two cooking pots as probable floor rests for water jars or other vessels.

Earthenware vessels are rightfully described as household utensils, but owing both to their diversity and to their peculiar interest as culture indices in the Southwest we shall consider them alone in the next chapter.

V. POTTERY

Kitchen and table wares constitute the most characteristic, diagnostic element in Pueblo culture. Pueblo pottery differs from all others; it varies within itself from time to time, from place to place, and yet the distinctive qualities are such that one familiar with it often can tell at a glance the approximate age of a given vessel and the circumscribed area within which it originated.

There are those who still argue whether the basic idea of pottery manufacture budded independently in the Southwest or was introduced from the highlands of Mexico by vendors of beans, maize, and pumpkin seeds. But doubt no longer exists as to the rude beginnings of Pueblo ceramics and the successive stages by which it came to full flower. Its development has been traced convincingly from the unfired, bast-tempered mud dishes of the Basket Makers to the degree of perfection attained at Pueblo Bonito, and elsewhere, in the eleventh and twelfth centuries. Its gradual retrogression from this peak is generally recognized. In those few villages where pottery making survives, studies of present-day methods show that Pueblo technique in the manufacture of earthenware has not changed appreciably in the past 1,200 years, although the advent of sheep, cattle, and horses following the Conquest did introduce a new fuel.

Among the Pueblos pottery making is now, and always has been, woman's work. As their mothers did before them, the women go at intervals to a known source of suitable clay, dig out a quantity and pack it home in basket or shawl. They may use it within a few days or store it against future need. Pebbles and vegetal matter are winnowed or picked out by hand. The clay is mixed with temper, water is added, and the whole patiently and thoroughly kneaded. Quartz sand, finely crushed rock, or pulverized potsherds—to name the common Pueblo tempering materials—reduce shrinkage and thus lessen the likelihood of cracking while the vessels are sun drying and during the firing process. There is no measuring of ingredients; the potter knows when proportions are correct. The more thorough the kneading, the better the paste.

Seated on the floor with her implements close at hand—a stone slab or cloth on which to rework the tempered clay; modeling, scraping, and polishing tools; water and mops for applying surface slip—the Pueblo potter begins her day-long task. No two proceed in exactly

the same way; each has a more or less standardized, but flexible, routine. But every useful vessel made, irrespective of shape and size, has practically the same origin—a handful of paste pressed and patted into a saucer-shaped disk. Upon this base the walls rise as an inch-thick roll of plastic clay is laid down coil by coil, each finger-pinched to its predecessor.[38] With three or four coils in place, thinned by scraping and partially smoothed over, the incipient vessel may be set aside until its walls have dried sufficiently to support the weight of another roll or two. Meanwhile, a second is begun and a third.

The larger bowls and jars are supported by an ash-filled tray, frequently the base of a broken olla, which rests upon the floor and is turned a few inches at a time as the potter continues the coiling or wields her modeling and finishing tools. This supporting tray, or turnpot, is as close as the American Indian ever came to inventing a potter's wheel.

As each vessel approaches final form it is again set aside briefly to dry in the sun. It is scraped and smoothed until junctions of the overlapping coils are obliterated and the walls reduced to the thinness desired. Air bubbles are eliminated, flaws and small cracks repaired. There follows another period of drying before the surface is wholly or partially coated with a fine clay slip and polished with a water-worn pebble. Upon this polished slip the decoration, if any, is next painted. Firing completes the manufacturing process.

From start to finish Peublo pottery making is a tedious, exacting task. A variety of accidents may mar or ruin the work at any stage, but the possibility of loss is multipled while the vessels are in the fire. During that critical period an air of anxiety prevails; the women are quite likely to reflect excitement and worry. They fear material loss, to be sure, but, more important still, every vessel is to them a living thing possessed of a spirit, a soul. New lives are created when pots are made!

When the National Geographic Society's Pueblo Bonito explorations were inaugurated in 1921 pottery was the handiest gage for measuring the age and the cultural level of any Southwestern ruin. Hence our initial efforts were directed toward ascertaining the sequence of local pottery development. In front of Pueblo Bonito lay

[38] According to Guthe (1925, p. 34), San Ildefonso pottery is built up from the inside. Examination of our sherd collection shows that Pueblo Bonito vessels invariably were made by attaching the successive clay rolls from the outside except, possibly, when forming the rather squarish shoulders of certain pitchers and jars. Late Bonitian cooking pots were usually coiled from the start and always from the outside.

the village dump, two conspicuous mounds composed of household sweepings and other waste thrown out by successive generations. Deposited first, material at the bottom was obviously oldest; merely by sectioning the two piles and collecting fragments from bottom to top, we could obtain a synopsis of Pueblo Bonito pottery from first to last.

For this fundamental study we chose a previously undisturbed section of the larger, west mound. Our trench reached clean sand at a depth of 20 feet (pl. 47, left). The synoptic sherd series was taken from a 3-foot-square section whose superimposed layers, varying in thickness and composition, were separated by ash, sand, or clay lenses.

The results of that first test proved amazing. Pottery fragments, whose technique of manufacture and style of decoration experience elsewhere identified as early, were found above fragments known to be late. Greatly perplexed, we cut a second section—and with the same result. Something was wrong!

We began our 1922 season with a new stratigraphic study, this time sectioning both the east and the west mounds. Two years later we tried both mounds again. The smaller, east dump was clearly the later of the two since it contained fewer sherds of early type. But this observation did not solve our problem. In every test made since the first, that of 1921, our findings had been the same—vessel fragments unquestionably older occurred with, and above, fragments culturally later.

As I continued to puzzle over this stubborn fact there seemed only one logical explanation for the illogical rubbish deposits of Pueblo Bonito: An old debris heap had been removed during one of the several expansion programs apparent in the town's masonry. I decided to lengthen our west mound trench, to project it into and through the ruin. The West Court had been cleared to its last occupation level in 1924, thus revealing the character of the stonework immediately surrounding it; any trash pile formerly associated with the oldest dwellings, those of first-type construction, would have stood a short distance in front of them.

Our first objective for the 1925 season, therefore, was a quick look beneath the West Court. We extended the west mound trench to Room 135 and thence north to Kiva Q (pl. 47, right). Midway, at a depth of 10 feet 6 inches, we exposed the floor of a huge kiva which, in its time, had been razed and replaced by other structures. And there was the answer to our 4-year-old puzzle!

The excavation for that subterranean chamber, over 50 feet in diameter, had cut into a vast accumulation of Old Bonitian rubbish.

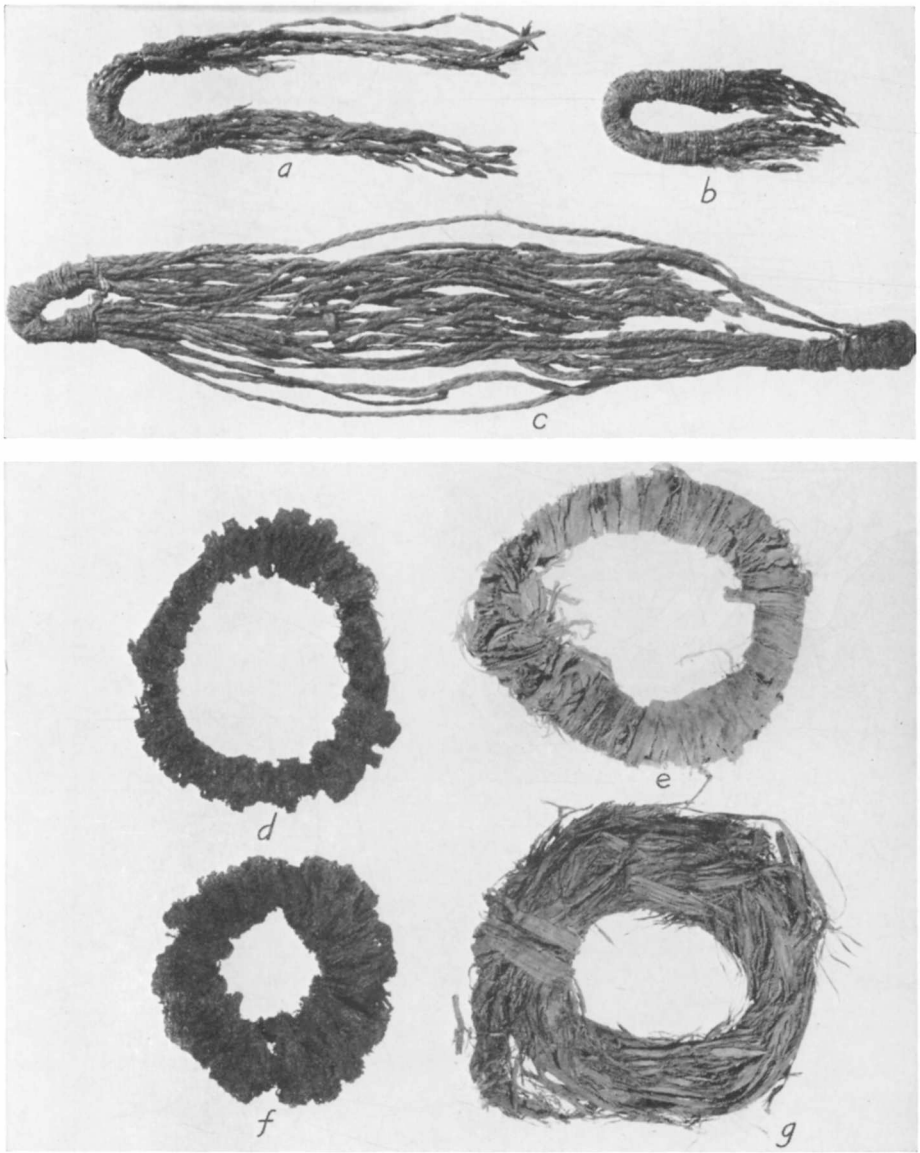
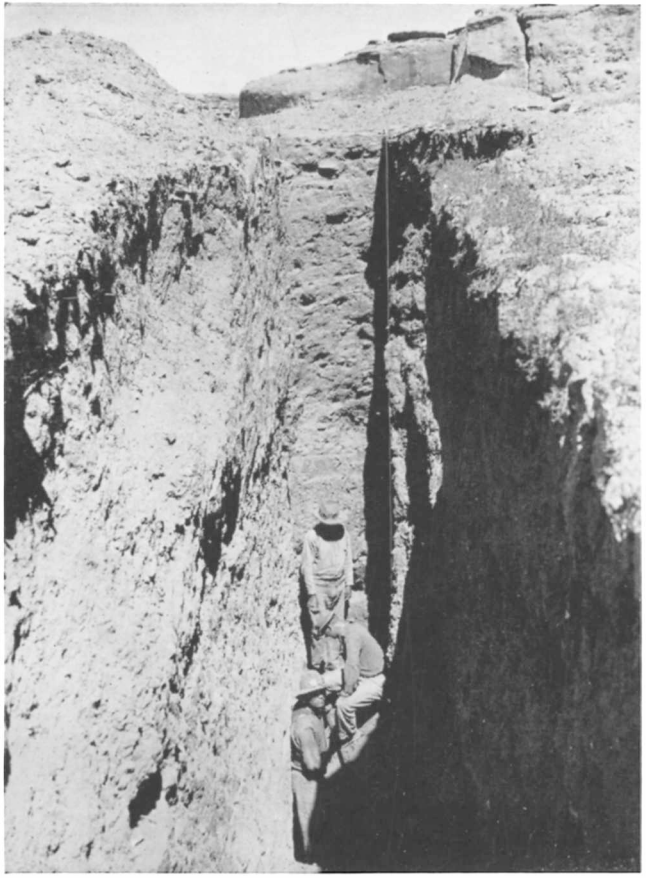
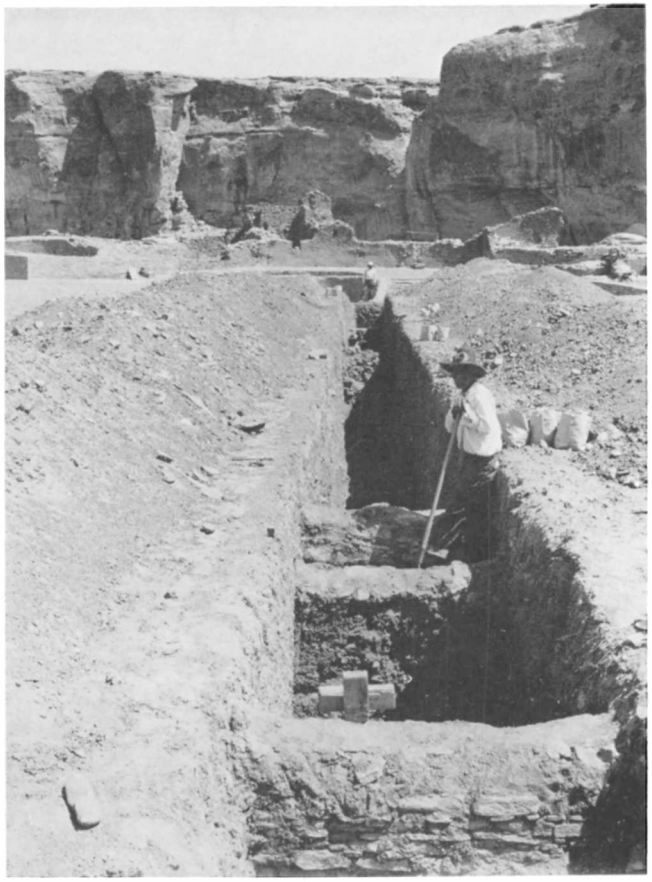


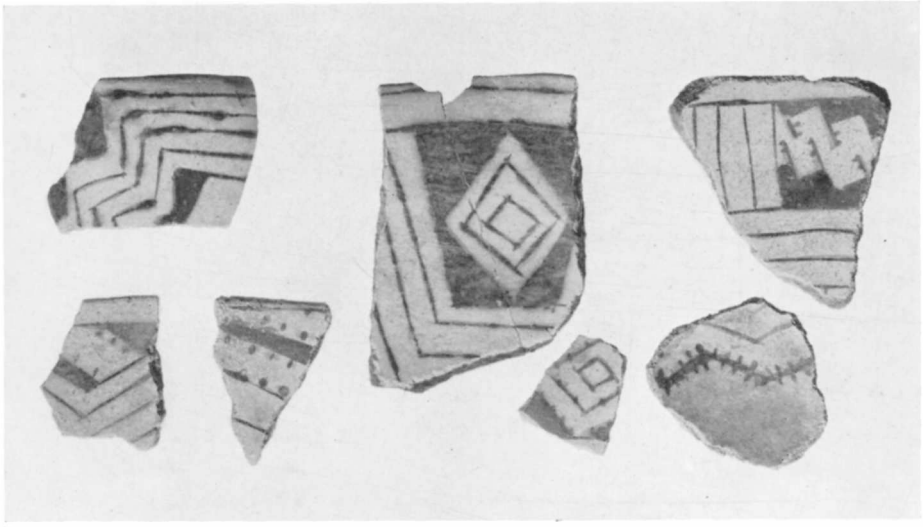
PLATE 46.—*a-c*, Tumplines for burden carrying; *d-g*, potrests of cedar bark and corn husks.



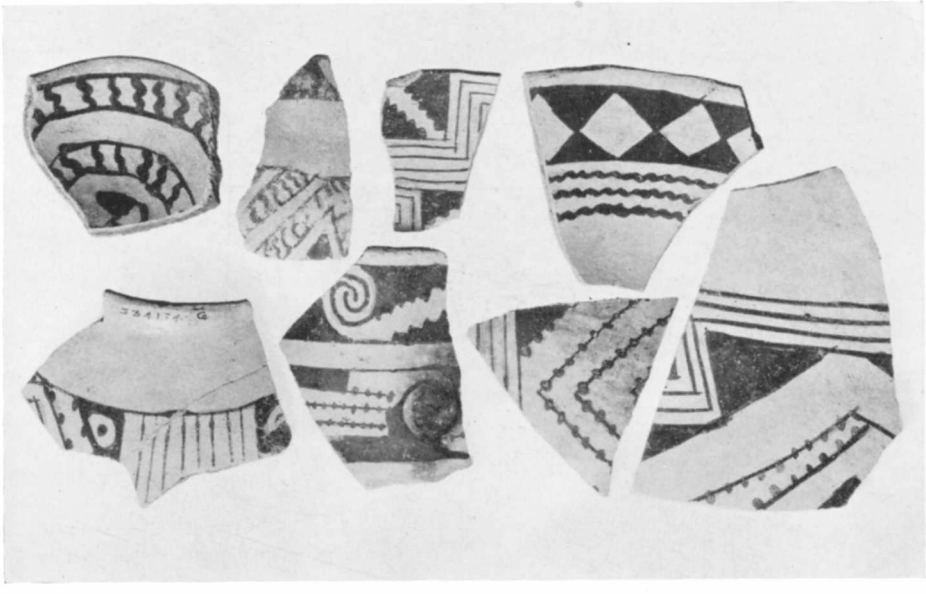
Twenty feet of rubbish in the village dump revealed changes in pottery types from first to last. (Photograph by O. C. Havens, 1921.)



An exploratory trench through the West Court disclosed remnants of razed buildings and part of the Old Bonitian trash heap. (Photograph by O. C. Havens, 1925.)

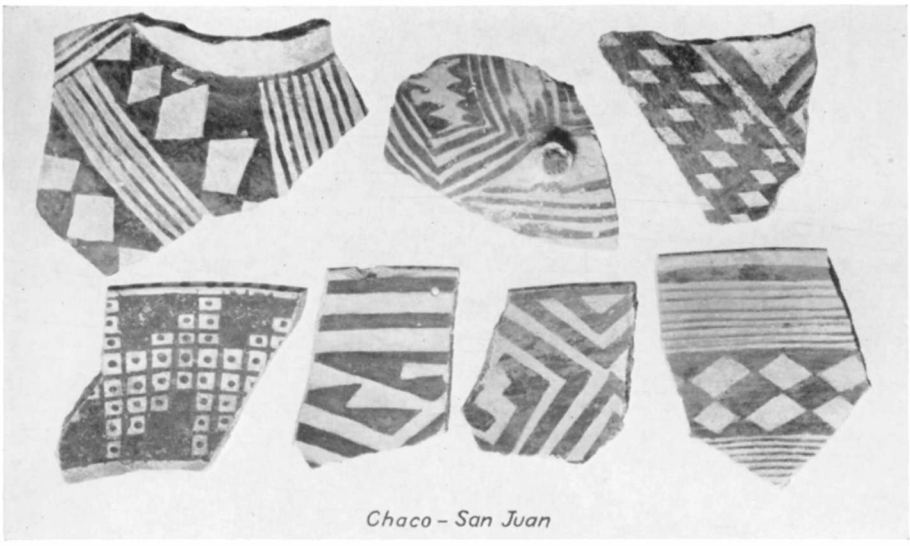


Fragments of pre-Pueblo pottery with characteristic designs.

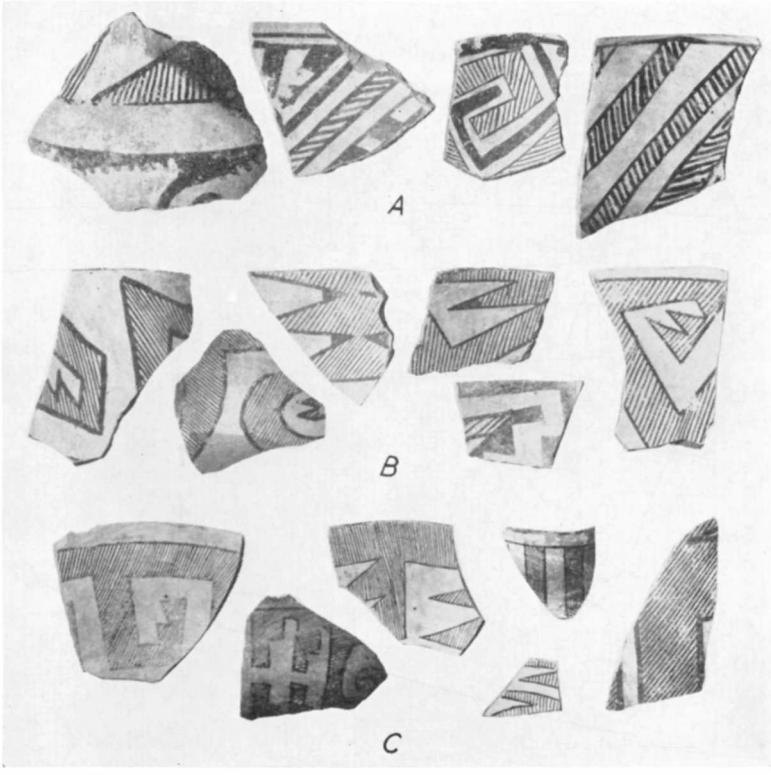


Sherds of Transitional ware from Tests I and II, West Court.

PLATE 48



Jar and bowl fragments of typical Chaco-San Juan ware.



Sherds illustrating straight-line hachure in styles *A*, *B*, and *C*.

PLATE 49

The excavated rubbish had been carried just outside the newly enlarged village and dumped on the mound already rising there. Thenceforth floor sweepings of the Old Bonitians mixed with floor sweepings of the Late Bonitians; debris of reconstruction was added from time to time as the west mound gradually assumed its final proportions.

But there is more to the story! Close beside the former south wall of that razed kiva, and a foot below its floor level, our trench revealed sandstone slabs lining the remains of a Pueblo I pit house. Above those remains, and extending at least 20 feet southward, stood an undisturbed remnant of the old trash pile. Into that remnant Roberts and Amsden, to whom I had entrusted our pottery study, cut two yard-square test sections, the first 13 feet in depth, the second, 12. The sequence of pottery types there preserved is the foundation for our analysis of Pueblo Bonito ceramics.

From bottom to top, with a few exceptions to be noted presently, that ancient rubbish contained pottery fragments of a single, generalized type. This Amsden and Roberts called the "Transitional" because, to quote the latter's field notes, "it often has a pre-Pueblo appearance . . . appears to be a transition between the pre-Pueblo and Early Pueblo wares." The terminology here employed, the reader will observe, is that in common usage prior to the Pecos Conference of 1927 (Kidder, 1927). We would now call the earlier ware "Pueblo I" and the Transitional "Pueblo II," or, as Roberts (1936, p. 530) has more recently suggested, we might combine the two periods under the single designation "Developmental Pueblo." Although the everyday terms we used at the ruin are to be replaced in Roberts's report on the pottery of Pueblo Bonito, they will suffice for this less specialized consideration of the subject.

To summarize the diagnostic traits determined by Roberts and Amsden: Chaco Canyon *pre-Pueblo* pottery includes bowls with tapering rim; ladles of half-gourd shape; pitchers, commonly globular with squat neck and handle extending from rim to shoulder; small globular jars with wide mouth; water jars, somewhat pear-shaped with high shoulder and sloping neck; cook pots with banded neck and smooth body. Painted ornamentation includes stepped and triangular elements bordered by thin, widely spaced lines often running past corners; ticked lines; lines and triangles with pendent dots. The decoration was applied while the slip was still damp; hence the locally characteristic blurred effect after the surface was polished (pl. 48, upper).

Of 1,644 black-on-white potsherds from West Court Test I, 1.52 percent are classed as pre-Pueblo; of 1,389 like sherds from Test II, 3.40 percent belong to the same category. Our statistical study of

sherds from excavated rooms shows that of 203,188 fragments tabulated, 134 are pre-Pueblo. These data, gathered in 1925, thus prove that pottery we have since come to know as Pueblo I found occasional local use while Pueblo III civilization was here making its farthest advance. Except those represented at the bottom of Test I, these few pre-Pueblo vessels could have been brought to the village as chance discoveries at older sites in the canyon. Not a single Pueblo I sherd was unearthed at Pueblo del Arroyo.

Transitional pottery is, in some respects, very much like the pre-Pueblo. Bowls are a little larger and deeper, but they have the same rounded bottom and direct, tapering rim. Ladles remain of the half-gourd type, but there is a little experimenting with a more detached, thicker and flatter handle. Water jars acquire a low, vertical neck; later, the neck lengthens and there is often a secondary bulge between it and the shoulder. Duck-shaped and effigy vessels are added to the earlier forms. Culinary ware continues smooth-bodied, but coils, often indented, gradually supplant the older neck bands. Painted decoration includes the same stepped and triangular elements with thin bordering lines noted on the earlier ware and, in addition, volutes or whorls, checkerboard and diamond-shaped patterns, waved or "squiggled" lines, and squiggled hatching. But there is this difference: whereas Pueblo I vessels were polished after the designs were painted, Transitional pottery was polished before painting.

In its earliest phase Transitional ware was coated with thick slip, which sometimes acquired a sleek, enamel-like quality under vigorous use of the polishing stone. But this practice did not last long. Smoothing tools replaced polishers; slips became thinner and thinner and finally were omitted altogether on bowl exteriors. Except at the beginning, bowl and pitcher rims were painted black—a custom that was thenceforth to become one of the most distinctive features of Chaco Canyon pottery. Typical Transitional designs, on sherds from Tests I and II, are illustrated on plate 48, lower.

This was the dominant type of painted pottery throughout the infancy and adolescence of Pueblo Bonito. A little black-on-red appeared, and a little brown-with-polished-black-interior, but not much. As time advanced and pride in craftsmanship declined, the Transitional was partially supplanted by a "Degenerate Transitional." After the village reached middle age, so to speak, new types suddenly appeared, as evidenced by our West Court tests and others. From strata A-C, embracing the upper 50 inches of Test II, Roberts and Amsden removed 43 fragments of straight-line hatching (3.1 percent of all black-on-white sherds from the 12-foot cut) and 31 fragments

(2.3 percent) of Chaco–San Juan. A lone Mesa Verde sherd came from layer B, 18-24 inches below the surface. Chaco–San Juan and straight-line hatching (pl. 49) were the prevailing types in those sections of the village where most Late Bonitian dwellings are situated; Mesa Verde ware was one of several foreign varieties introduced during occupancy of those dwellings. Examples of all three occurred with Transitional vessels in burial rooms of the old northwest quarter. How to explain this apparent anomaly?

As stated in the introduction, I believe Pueblo Bonito represents the work of two distinct peoples; that the Old Bonitians were the real founders and that the Late Bonitians were eleventh-century immigrants. I believe the Late Bonitians were first to vacate the village and that, in addition to what they had previously acquired through barter, the Old Bonitians speedily appropriated all useful utensils their former neighbors left behind. These convictions derive both from observations in rooms excavated and from data gathered in various stratigraphic tests.

After four years' search, chance had led us to an undisturbed portion of the trash heap associated with the house cluster from which Pueblo Bonito developed. That trash heap had grown into a mound over 8 feet high before the Late Bonitians arrived upon the scene. Piled in the lee of the dwellings, the debris had been spread farther east and southeast by the prevailing upcanyon winds and a natural tendency on the part of housewives to dump their floor sweepings leeward. From its crest the mound sloped away to cover more than an acre. We found traces of it under Late Bonitian dwellings even in the far southeastern corner of the ruin.

From a test pit to clean clay, 9 feet 6 inches below the original floor of Room 153, we took 786 potsherds, and there were no late types among them. Apparently that floor had been laid directly upon the sloping surface of the old dump. There were no late types among 548 sherds gathered under Room 225.

Elsewhere, tests frequently showed a mixture of early and late fragments. Of 50 sherds collected beneath the latest floor in rebuilt Room 252, late hatching, late black-on-red, and Chaco–San Juan each represented 4 percent of the total; corrugated-coil culinary, 20 percent. We found no late types below Room 330, but several fragments did appear under nearby Kiva X. Of 642 sherds from a subfloor test in Room 334, 10 were late black-on-red and five carried late hatching; 147, or 23 percent, were fragments of corrugated pots. A few pieces of Mesa Verde ware were noted, among other late examples, in test pits dug below the floors of Room 344 and Kiva A.

From these stratigraphic studies in various parts of the village, Roberts and Amsden deduced their succession of local earthenware types and decorative styles, beginning with the pre-Pueblo and ending with the third phase of straight-line, oblique hatching. Among the ancient Pueblos, pottery illumination was no more static than it has been among our own people. Styles come and go. Tablewares in vogue today differ from those our grandmothers used. And so it was at Pueblo Bonito. Each generation introduced one or more changes, however inconspicuous. New patterns were created; old ones were altered; straight lines replaced curved, or vice versa; designs were banded or paneled, or drawn over the entire surface. At one time, a number of Bonitian potters had a fancy for solid tips on certain units of hachured design.

When straight-line hatching was introduced at Pueblo Bonito, the lines composing the patterns were rather widely spaced and as heavy as, or even heavier than, the lines that framed them. Solid elements sometimes balanced the hatched figures. This is our "Hachure A" (pl. 49, lower). But the women who favored this style of pottery ornamentation were not content with it. They began almost at once to experiment, to seek new combinations. Framing lines were made still heavier; angles and angular tips were filled in solid; designs were enlarged to cover the whole visible surface of the vessel. And the results, our "Hachure B," lasted so long that fragments of it seem predominant in the rubbish piles; it has sometimes been described as the outstanding variety in Bonitian ceramics. Individuality persisted, however, and preferences changed. Finally, composing and framing lines again became approximately equal in weight but thinner; their comparative thinness, straightness, and uniform spacing evidence supreme confidence both in composition and in execution.

Typical Bonitian pottery, from the early Transitional to the latest straight-hatched group, is decorated with mineral paint. Organic paint appears on vessels imported from the Mesa Verde area and elsewhere; also, in large measure, on the so-called Chaco–San Juan ware, a variety that combines northern designs and pigments with methods of surface treatment equally characteristic of the Chaco. We never did decide whether this ware was made in the canyon or imported. It was in abundant supply throughout Late Bonitian times, but its use of organic paint remained at variance with local custom. Quartz sand was available nearby but no lava or other igneous rock. Hence the chief reliance of Bonitian potters throughout the long history of their village was a temper of pulverized potsherds. Because it lessens paste

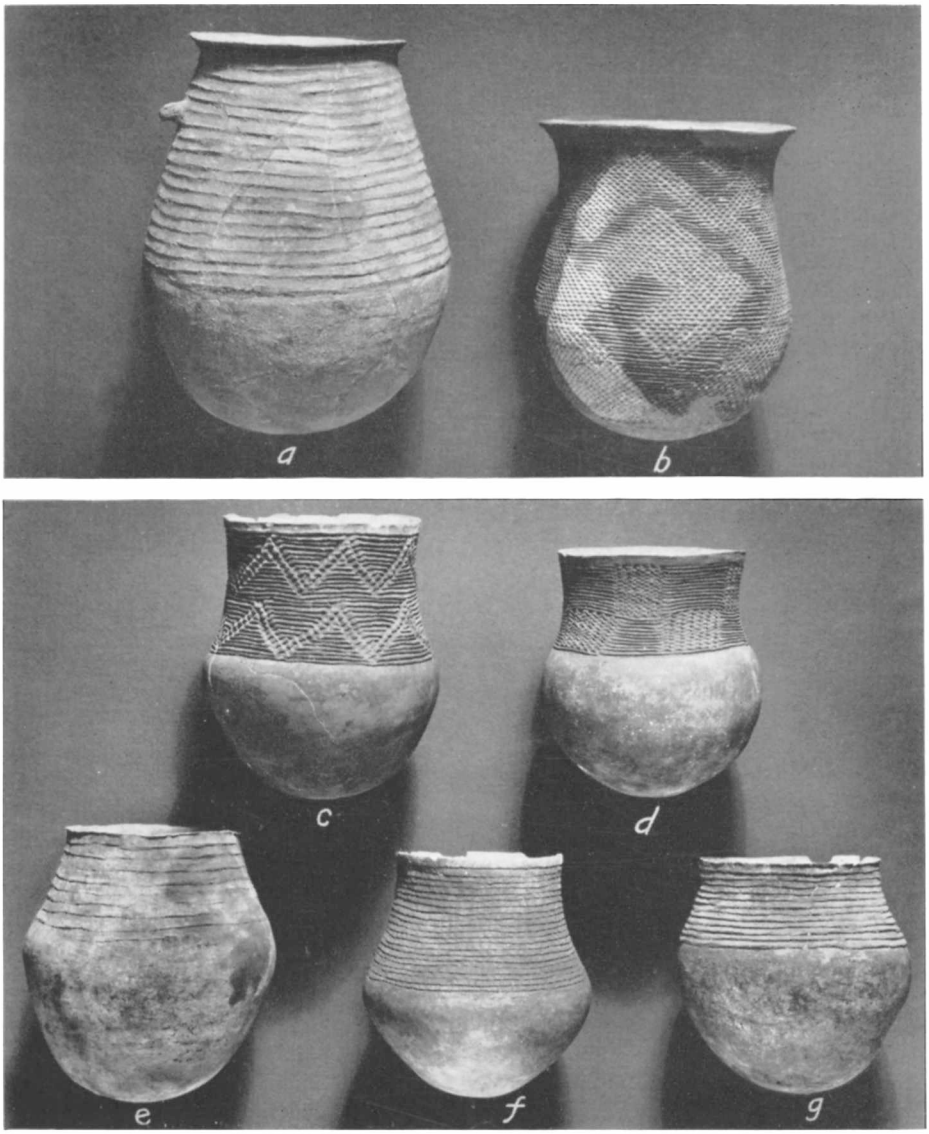


PLATE 50.—A possible foreign cook pot (*a*) from Pueblo del Arroyo and a Late Bonitian example (*b*) from Room 256, Pueblo Bonito, and five Old Bonitian pots (*c-g*) from Room 323.



PLATE 51

Upper: Bowls broken by fallen ceiling, Room 298. (Photograph by Neil M. Judd, 1923.)

Lower: Cook pots used for storage under floor of Room 128. (Photograph by Neil M. Judd, 1926.)



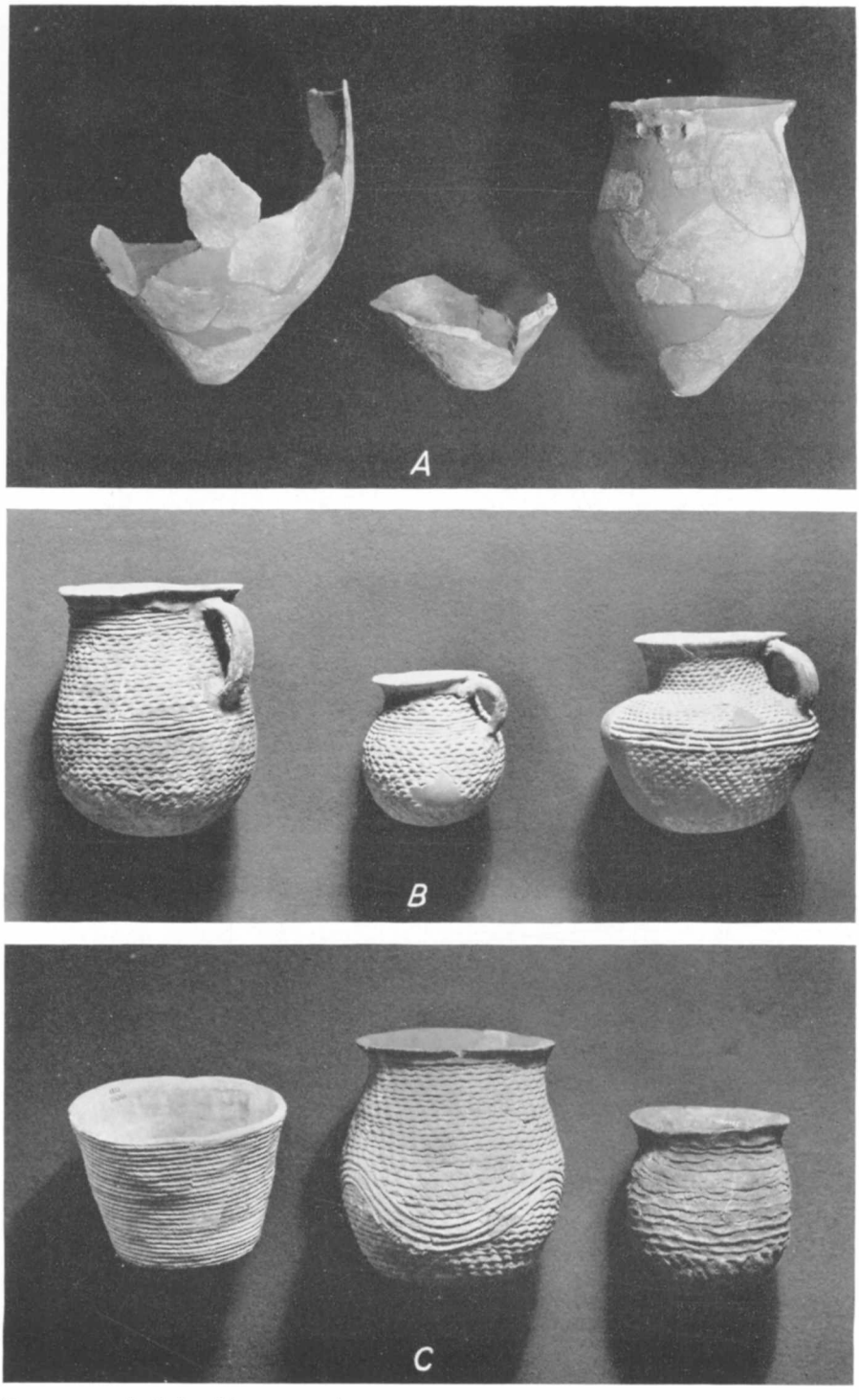


PLATE 52.—*A*, Pointed-bottom cook pot and fragments; *B*, corrugated-coil pitchers; *C*, bowl molded in a basket, and two small culinary vessels.

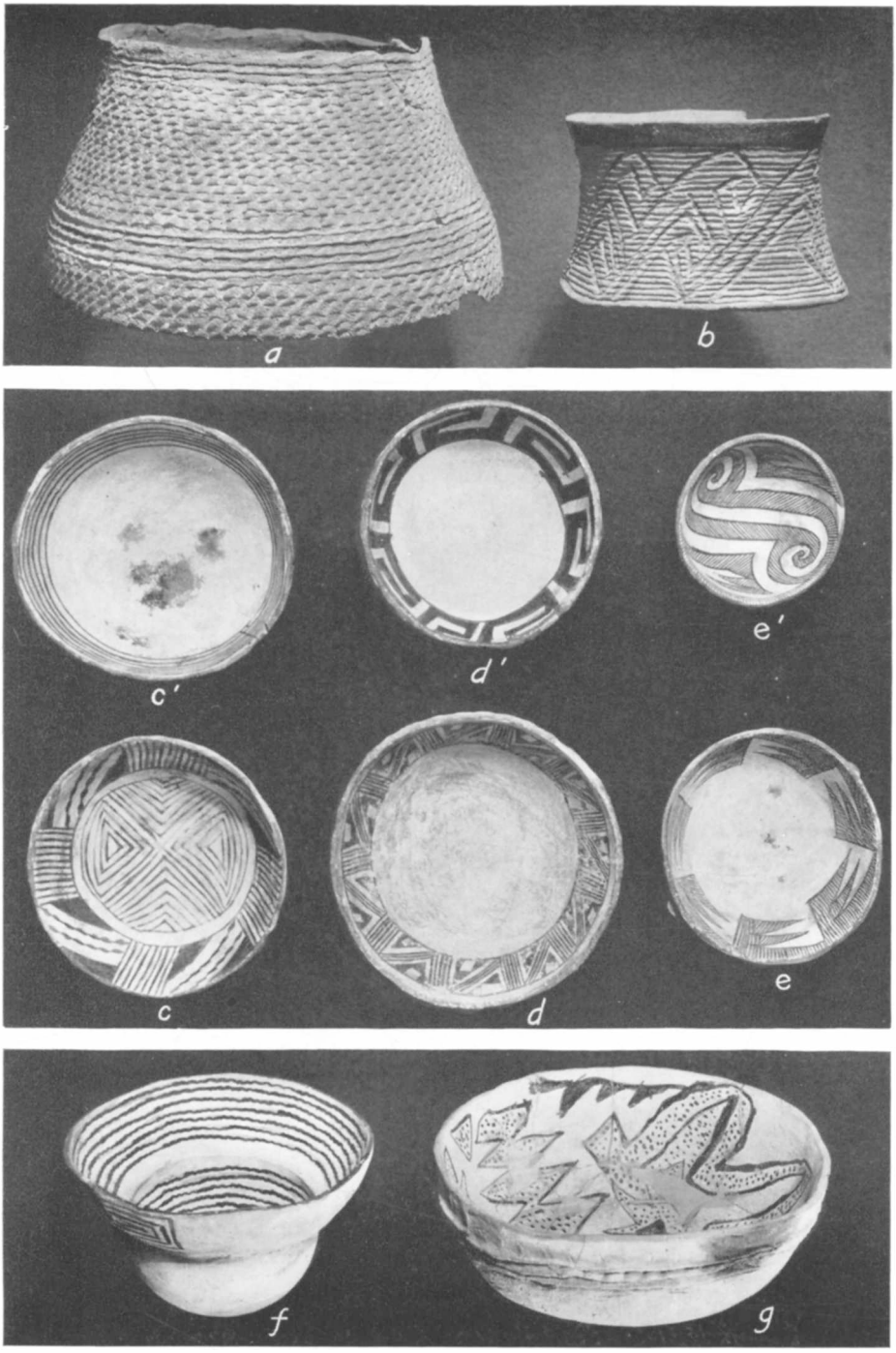


PLATE 53.—Sections of culinary vessels (*a, b*) used as supports for round-bottomed jars; three bowls (*c, d, e*) containing food, and above (*c', d', e'*), the bowl with which each was covered; vessel simulating two superimposed bowls (*f*), and a beginner's effort (*g*).

shrinkage and reduces danger of breakage in firing, temper is of prime consideration in pottery manufacture.

Since determinations based on simple ocular examination have always seemed to me of doubtful value and since we lacked the means for thorough chemical analysis, I had not intended to consider at this time the complex problem of paste inclusions. But in 1936, and again in 1937, Miss Anna O. Shepard sampled our sherd collections as a contribution to her study of pottery from La Plata Valley ruins, some 70 miles north of Pueblo Bonito. Although limited to fragments from our stratigraphic tests II and IV and to a selection of sherds illustrating design sequence, Miss Shepard's inquiry disclosed most interesting facts about Bonitian tempering materials. We are privileged to introduce herein certain results of her observations under the petrographic and binocular microscopes.[39]

To summarize Miss Shepard's findings: Most black-on-white fragments from Test II in the old dump under the West Court were mineral-paint types and sherd-tempered. Sand and powdered rock also appeared regularly as tempering agents but their frequency gradually decreased as sherd-temper increased. For cooking pots, sand continued in favor throughout, but sanidine basalt gained steadily until it occurred in 56 percent of all pot fragments in four upper layers, F to C. While the basalt appears as a primary temper in cooking pots its presence in the mineral-paint ware is largely secondary; that is, it was the rock used as temper in vessels whose fragments later were pulverized to provide sherd-temper. Andesite appeared occasionally in both mineral-paint and kitchen-ware fragments, and it was the chief temper for early black-on-red pottery, sherds of which were found in all except the two lowest strata. Pieces of vegetal-paint vessels likewise were noted in all layers except the two lowest, but, curiously enough, they were much more common in the upper half of the deposit than in the lower. Considered together, this organic-paint group gave the following variations in temper: Sand, 17.9 percent; pulverized sherds, 14 percent; sanidine basalt, 60.2 percent; and a mixture of sherds and basalt in 7.6 percent—figures that suggest three or more points of origin. Sanidine basalt became the dominant temper for both organic-paint black-on-white and culinary wares while layer F was being laid down and remained so thereafter.

Now the puzzling factor in all this is the presence of andesite and

[39] Since these lines were written, the data Miss Shepard derived from our Pueblo Bonito sherds have been published. See her Technology of La Plata Pottery, 1939, p. 280. The present writer is further obligated to Miss Shepard for her helpful review of this and the next following pages.

sanidine basalt, two igneous rocks that do not occur in sandy Chaco Canyon. Reeside (1924, p. 24) reports andesitic debris as a feature of the McDermott formation, which underlies the Ojo Alamo sandstone and extends from La Plata County, Colorado, southward along the western margin of the San Juan Basin to within 15 miles of Pueblo Bonito. But we have no proof that this nearby exposure actually supplied the andesite used as temper in some of our earthenware vessels. The nearest known source of sanidine basalt lies in the Chuska Mountains, 50 miles due west of Pueblo Bonito. It is difficult to believe that Bonitian women walked 50 miles and back just to obtain this unusual rock for use in pottery manufacture. The only alternatives are (1) a nearer supply not yet discovered, or (2) importation of finished pottery, chiefly culinary ware, from the west. Miss Shepard favors the latter possibility.

If the presence of sanidine basalt temper in pottery exhumed at Pueblo Bonito identifies that pottery as foreign, then Bonitian women were annually becoming more and more dependent upon others for their pots and pans. Of nine sherds from the lowest level (K) of Test II, three are plain-surfaced culinary ware and one of them is tempered with sanidine basalt. Another fragment, that of an unpainted pitcher or olla, is tempered with the same rock. Nearly 14 percent of all sherds in Stratum H, or 17.3 percent of the culinary ware only, are likewise tempered with sanidine basalt. For Stratum F the percentages are, respectively, 24 and 53.3; for C, 29.9 and 66.6. Thus as Old Bonitian rubbish accumulated, pottery tempered with sanidine basalt, both cooking pots and tableware, was gaining in local favor. The rock appears, although rarely, in Pueblo I sherds, in fragments of early mineral-paint vessels, and in the several organic-paint types. Corrugated-coil culinary ware came suddenly into use during deposition of Stratum C and of 39 corrugated-coil fragments in that layer 30 are tempered with sanidine basalt. Because potters repeatedly searched the rubbish piles for fragments suitable for sherd temper it is only natural that sanidine basalt should have found its way indirectly into Late Bonitian mineral-paint pottery whose principal temper is pulverized potsherds.

These several facts suggest two questions we cannot now answer: (1) Did the Bonitians, both Early and Late, import the raw material or readymade pottery, chiefly culinary wares, tempered with sanidine basalt, and (2) did they pulverize fragments of rock-tempered cooking pots to provide sherd temper for vessels of their own manufacture? I have long entertained the notion, for which I find no recorded justification at the moment, that modern Pueblo potters carefully avoid

culinary ware when gathering sherds.[40] Sanidine basalt was the temper in 40.7 percent of all culinary ware fragments and in 60.2 percent of all vegetal-paint, black-on-white sherds from Strata C-K, Test II. However, no vegetal-paint sherd was found in the two lowest levels and none with sanidine basalt temper below F. This rock was the dominant temper of corrugated-coil cooking pots, sherds of which appeared first in Stratum C.

Sanidine basalt is the temper, also, in at least two vessels from a Pueblo I pit house 1 mile east of Pueblo Bonito (Judd, 1924a). One of these (U.S.N.M. No. 324809) is unpainted; the second (No. 324811) is decorated with vegetal paint. Two other vessels from the same pit house are mineral-painted, sherd-tempered (Nos. 324806, 324881C). A sample lot of 43 fragments (No. 334122) from a Basket Maker III site 9 miles east of Pueblo Bonito, later excavated by Roberts (1929), shows 18 mineral-paint sherds of which one is tempered with andesite and 17 with sand; one vegetal-paint sherd, sand-tempered; and 24 plain-surfaced sand-tempered fragments. Thus andesite, if it did not originate in exposures of the McDermott formation south of Ojo Alamo, presumably represents trade from the north, beginning in Basket Maker III times. And the sanidine basalt, unless a nearer source really exists, must represent a western trade that began in Pueblo I and thereafter gradually increased in volume until the closing years of Pueblo Bonito. If this commerce was chiefly in kitchenware, as appears to have been the case, the presumption is that Bonitian potters utilized a good many culinary-ware fragments in preparing their sherd temper. These presumptions and possibilities doubtless could have been replaced by definite statements if opportunity had only permitted Miss Shepard a more extensive examination of our Chaco Canyon sherd collections.

In large measure, Pueblo Bonito pottery was not polished. Bowl interiors were smoothed with moist fingers, or a mop of some sort, until the finer clay particles in the paste were brought to the surface; exteriors usually retain tool marks and striations left when temper grains were caught by the scraper. Most potters preferred a relatively thin slip, if any; some of them sometimes drew a casual band of slip paint outside a bowl rim or wiped their slip mop across the bottom. All were not equally skillful. Each generation had its artists and its housewives who made pottery only because they had to. Some of our early Transitional, some in the Chaco–San Juan group, and certain

[40] Shepard (1936, p. 472) states that Pecos potters did not differentiate in selecting sherds for temper; quotes Hodge to the effect that Zuñi women, gathering potsherds at Hawikuh, always rejected cooking-pot fragments as unsuited.

foreign wares were both heavily slipped and stone-polished; but the average, locally made nonculinary vessel is thin and hard, sherd-tempered, hand-smoothed, white-slipped, and ornamented with mineral paint.

In the following paragraphs we shall look upon the earthenware vessels in our collection not as subjects for the test tube and microscope but rather as household utensils. For herein we are concerned less with paste, design sequence, and percentages than with the pots and pans in which each family prepared and served its daily food. A more critical study, however, in which are considered the sequential variations of Bonitian ceramics and their relationship to the products of adjacent areas, will be published, it is planned, as a subsequent number of this series under the signature of Dr. Frank H. H. Roberts, Jr., one of my colleagues during the 1925 and 1926 seasons and to whom I delegated this important phase of the Society's investigations.

Materials.—The raw materials and the tools employed in pottery manufacture were encountered less frequently than one would expect in so populous a community as Pueblo Bonito. About four bushels of unslaked clay had been stored in the southwest corner of Room 212; at its base, the pile was bordered by 51 crushing tools—manos, mano fragments, and rubbing stones. (Guthe, 1925, p. 20, reports that each fall San Ildefonso women gather clay for winter use.) Sausagelike lumps of prepared clay bearing finger imprints, apparent leftovers from the day's work, were noted among the rubbish in several abandoned rooms. Quantities of worked potsherds, the so-called "spoons" used in thinning, scraping, and smoothing vessels during the modeling process, were found all about the village, in debris heaps and elsewhere. Local potters obviously favored this kind of scraper (fig. 47). We found a few comparable examples of wood but none made from gourd rind. More surprising still, we unearthed less than a dozen pebbles evidencing use as polishers and none of these was deeply worn. Yet polishing stones assuredly were employed to produce the glossy surface on certain classes of Bonito pottery.

Most of our vessels may be described as "black-on-white." The whitish background on which the blackish designs were painted represents one or more coatings of liquid kaolin. The preparation and application of this kaolin slip by Bonitian potters 900 years ago differed little, if at all, from methods Mrs. Stevenson (1904, p. 375) observed at Zuñi toward the close of the nineteenth century: "A white clay is dissolved in water and then made into cones which are dried in the sun. When required for use these cones are rubbed

to powder on a stone, again mixed with water, and applied in the liquid state to the object with a rabbit-skin mop."

Besides numerous small pieces, we found several masses of prepared kaolin. Three of these, including that shown in figure 48, had been

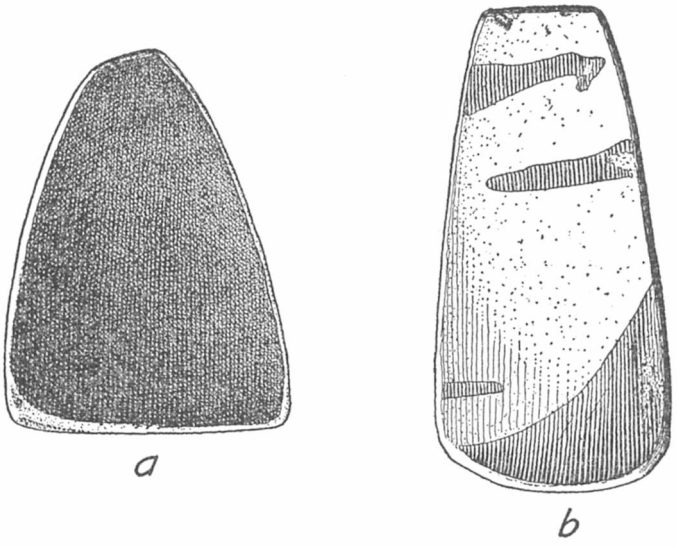


FIG. 47.—Pottery scrapers made from potsherds.

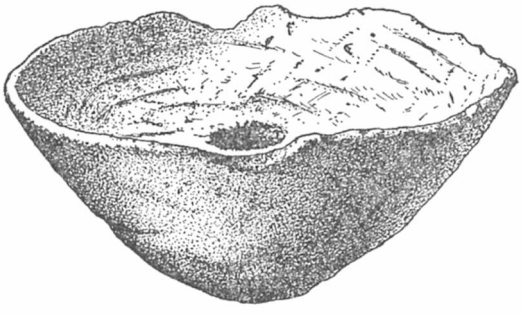


FIG. 48.—Molded cake of kaolin.

thrust through by a small stick before solidifying; all show marks of scraping tools or evidence of rubbing. Three unused cakes (U.S.N.M. No. 334879) from Room 51, Pueblo del Arroyo, measure $5\frac{1}{8}$ inches in diameter and average 2 inches thick. They were formed by pouring a thick kaolin solution into the body portion of a broken pitcher.

Pueblo Bonito potters preferred a black mineral paint, an iron oxide. But some early wares and a larger proportion of late vessels,

many of which may have been imported, were decorated with organic paint. This latter doubtless was obtained by boiling young shoots of the Rocky Mountain beeplant (*Cleome serrulata*), after the manner still followed at San Ildefonso and other New Mexico villages. In any case, this annual still flourishes on flooded areas near Fajada Butte; fragments of the plant were found in Pueblo Bonito. I assume the paint brushes used locally were strips of yucca leaves, shredded at one end, like those employed by Pueblo potters a generation ago.

We uncovered no structure identifiable as a pottery kiln but did observe burned areas here and there on successive court levels. Today the Pueblos do not build permanent kilns, and there is no reason to believe their ancestors did. The universal Pueblo practice at present is to fire pottery under a heap of dried barnyard manure piled on any space convenient to the dwelling. Cedar wood only is used in kindling the potter's fire, a formalism that suggests the fuel employed prior to Spanish introduction of sheep and horses. The Hopi frequently add native coal to the dung blocks (Hodge, 1904, p. 581; Colton, Harold S., 1936; Colton, Mary-Russell F., 1938, p. 10). At Pueblo Bonito coal was customarily utilized in kiva construction but we observed no evidence of its use as a fuel, either indoors or out.

On the basis of form and function, Bonitian pottery is separable into various groups or classes: Cooking pots, food bowls and ladles, pitchers, water jars, canteens, cylindrical vases, and a few odd pieces that may or may not have been designed for household use.

Cooking pots.—Sherds from the old trash pile under the West Court show that the founders of Pueblo Bonito used smooth-bodied cooking pots, the necks of which were formed by broad or narrow overlapping bands. Broad bands were sometimes rubbed longitudinally and partially obliterated; the narrow ones were often rounded, occasionally tooled between as though by a bone awl. There were sherds with waved or undulating imbrications; sherds with coiled or flat clay ribbons applied to the finished vessel solely for decorative effect; sherds with nubble or loop handles. But mostly the fragments represented pots whose upper third was composed of unobliterated bands, each of which completely circled the neck and joined upon itself. The last band, frequently wider than its predecessors, formed the rather direct lip for a large orifice. Similar pots, both large and small, were recovered in 1922 from a Pueblo I pit house 1 mile east of Pueblo Bonito (Judd, 1924a, pp. 399-413).

Besides fragments such as those just described, the upper layers of the old rubbish contained sherds of plain-bodied pots, the necks of which were built up of longer, narrower strips that coiled one and a

half or two times around before the next was added. Frequently the strips were so manipulated during the coiling process as to leave externally a bold, geometric pattern. Although these designs usually were produced by finger-pinching each coil as it was attached, an instrument sometimes was employed to give sharper indentations. The pleasing effect of such treatment is illustrated on two of the five cooking pots from Room 323, an Old Bonitian dwelling 35 feet long (pl. 50, lower, figs. *c, d*).

These two, with coiled necks on which the designs were partly emphasized by tooling, are still soot-covered as though but recently lifted from the kitchen fire. The other three have plain banded necks. Their rims slightly below floor level, all five had been buried to serve as storage jars.[41] Four of them lay within 8 feet of the southwest wall: two near the base of ceiling supports and another below the eastern jamb of the southwest door. The neck of another pot, broken cleanly from its smoothed body just where the first neck coil joined, and bearing a deeply tool-indented key figure, was recovered in adjoining Room 326. I have no doubt it served as a cradle, or support, for a large round-bottomed vessel (pl. 53, fig. *b*).

The age of Room 323 is suggested by the fact that its two datable ceiling beams were cut about A.D. 935. In due course the dwelling was abandoned, but while its ceiling was still partly in place the room had been utilized as a convenient neighborhood dump (pl. 31, lower). From this household rubbish we removed many discarded stone implements and quantities of potsherds. After eliminating all recognizable duplicates, Roberts and Amsden counted 24,587 sherds, of which 40.5 percent were from old-style cooking pots and 13.1 percent from those made in the later, over-all corrugated-coil technique.

Four Late Bonitian pots, likewise embedded for storage purposes, were unexpectedly encountered in Room 128 while we were tracing the wall of an abandoned kiva previously discovered beneath Rooms 340-341. The old kiva's roof-pole offset had been partially torn away on the west side and here the four pots were placed, side by side, with their rims just below the original floor (pl. 51, lower). Sometime later, the vessels forgotten, a 10-inch layer of sand and debris of occupation was spread throughout the house as the base for a new floor. Still later, after the dwelling was vacated, windblown sand accumulated on this second surface, not to be laid bare until Richard Wetherill had the room cleared in anticipation of the return of the Hyde Expedition. We found this upper sand layer about 3 inches thick in the

[41] In present-day Hopi and Zuñi homes, jars and cooking pots stand on floor or bench for storage of foodstuffs and water.

middle. But more sand had gathered since 1897 and, with it, cedar chips from the Wetherill woodpile, rusted tin cans, and broken glass.

The largest of the four pots, its base missing, had been set on a stone slab and a new bottom improvised with adobe mud. One of the others contained a small quantity of grass seed, too decayed for identification. All four were made in the over-all, corrugated-coil technique and with flaring rims. The differences between them and culinary vessels of the Old Bonitians are at once apparent. Two were embellished by alternately pinching and leaving unindented sections of each successive coil; the other two were provided with solid down-turned lugs as handles. All four probably had been cracked in service and thereafter buried to answer as handy grain bins. Fragments of their broken rims were put aside for the photograph.

Only six of our Pueblo Bonito cooking pots have handles. One of them is a small, rude example from Kiva W having a conical lug opposing a rounded, vertical loop. However, pot handles of diverse type were repeatedly noted in household rubbish. From debris in Room 251, a rebuilt dwelling on the east side of the village, we recovered the neck portion of a pot with two lugs, each turned horizontally to the left (U.S.N.M. No. 335253). Its direct rim and its thick, deeply pinched coils identify it as Old Bonitian.

Our Bonito cook pots, 29 in number, vary in size, shape, and workmanship. One of the smallest measures $4\frac{5}{8}$ inches in diameter by $4\frac{3}{4}$ inches high (pl. 52, B, center). The largest, $13\frac{3}{4}$ by $15\frac{3}{4}$, is the bottomless one from Room 128. For the entire group, average diameter is 9.06 inches; height, 10.13 inches. The five buried under the floor of Room 323 are the only restorable Old Bonitian pots we recovered. Distribution of the remaining 24 was as follows: One each from Kivas H, U, and W; one from Room 309, a ceremonial chamber built of second-type masonry abutting an older wall; one buried upright under the second floor in Room 348; 16 from dwellings of third-type masonry; and three from fourth-type houses. Of the 24, all but one are coiled counterclockwise. Coils per inch vary from 3.5 to 7.5, with single examples at each extreme. Average for the 24 is just a shade under five coils per inch. But coiling varies on each pot, being narrower at the beginning, broader on the shoulder and neck. None approaches in minuteness of coiling (11 to the inch) a small jar, three fragments of which were found in Rooms 292-293.

It is noteworthy that only 5 of the 29 pots were found in Old Bonitian dwellings, and that these were of early type and no longer used for cooking. I cannot explain this absence of culinary ware from the older part of the pueblo, where indications of late occupancy were

otherwise most apparent. In Hyde's distribution table No. 2, 8 of the 20 "corrugated jars" listed are from houses in the old northern section. But the only one figured (not included in table 2) is a Pueblo II vessel from Room 85 (Pepper, 1920, pp. 278, 359-362). Our several stratigraphic tests showed that smooth-bodied, banded- or coiled-neck pots gradually passed out of use after arrival of the Late Bonitians. Corrugated-coil sherds appeared in the upper 2 feet of Test I; in the upper 4½ feet of Test II.

Of four corrugated pots with vertical loop handles, three are illustrated on plate 52, B. The two smallest bear no smoke stains and might properly be classed as pitchers. On another unsmoked vessel (pl. 52, C, center) the potter exercised her ingenuity by interrupting the regularity of the indentations to introduce a waved belt of four plain coils. The idea was locally an old one, for we found no less than 10 sherds with undulating imbrications in Test I.

The small, rude pot illustrated in plate 52, C, right—probably a child's effort—was started as a clay disk, pressed cuplike so the edge was pleated; upon this base broad, irregular coils were laid clockwise. In contrast, the work of a master is represented by a restored pot from Room 256 (pl. 50, fig. *b*). The lighter area down the left side resulted from more intense heat on those particular fragments when fire burned the vegetable matter in which the shattered vessel lay.

Sherds from both early and late rubbish piles prove that utility ware was occasionally ornamented with incised designs; sometimes with scrolls or chevrons applied to the upper neck.

The 25 cooking pots we unearthed at Pueblo del Arroyo average 3 inches larger, both in diameter and height, than those from Pueblo Bonito. Rim flare seems a bit more pronounced than on Bonito pots; four are definitely more globular, with shorter necks and higher shoulders. Twelve of the number were standing in Room 65 and one of them is conspicuous from the fact its body is smooth while the upper part is composed of broad coils, laid counterclockwise and horizontally smoothed (pl. 50, fig. *a*). Lug handles are placed 2½ inches below the outflaring rim; particles of sand temper protrude through the surface.[42]

Bowls comprised the principal tableware at Pueblo Bonito. They were the dishes in which food was placed before the family, seated on the floor. Tables and chairs were not used in Pueblo homes until

[42] Despite its flaring lip, rounded bottom, and superior workmanship, this vessel has a profile reminiscent of one figured by Mera (1935, pl. 7) from that strange cultural admixture, the "Gallina Phase," between headwaters of the Rio Chama and the San Juan.

a generation ago and are not used at meal time even now by the more conservative. But the ancient Pueblos, like their living descendants, probably did not restrict bowls to food service exclusively. Large bowls are utilized today for kneading bread, as receptacles for ground meal, and for other purposes; smaller bowls often answer as catchalls and as containers for water and paint at pottery-making time.

Luxán, recording his observations among Rio Grande pueblos in 1582, found the Tigua a "neat and clean people, for so they are in eating and sleeping . . . and they use very good crockery" (Hammond and Rey, 1929, p. 82). I have seen Hopi, Zuñi, and San Ildefonso families sitting on the floor around a bowl of cornmeal mush or a mutton stew, with fingers substituted for forks, and bread crusts for spoons. And each time I marveled at the modest Pueblo appetite, compared with my own. In former times Pueblo families had but two hot meals a day, in midmorning and in late afternoon.

The 251 bowls in our Pueblo Bonito collection vary in diameter from 1 to 13 inches. The smaller surely were toys, although they are usually as carefully made as larger ones. The average measures $7\frac{1}{2}$ inches in diameter by $3\frac{9}{16}$ inches deep. Over 93 percent are black-on-white. The "black" varies from rusty brown to coal black; the "white," from chalky white to slaty gray. A number, both large and small, are reddish brown on the outside with a smudged black interior. Still fewer are slipped with red clay and decorated inside with black geometric designs. Irrespective of size and color, surface treatment, or skill in execution, Pueblo Bonito bowls tend to be hemispherical with rounded bottom and thin, direct rim; and the rim edge is usually painted black, a distinguishing local feature. In most instances this rim line is interrupted at some point to provide a "path" or "gateway" for the spirit resident in the vessel.

When the second-story floor of Old Bonitian Room 298 burned and collapsed into the storeroom below, it broke 7 of the 12 bowls ranged against the northeast wall (pl. 51, upper). The smallest of these vessels is $3\frac{3}{4}$ and the largest $11\frac{1}{8}$ inches in diameter. Nine of the 12 are ornamented in the Transitional style, one in Chaco–San Juan, and two in straight-line hatching. In the smaller of the two latter, framing lines are heavier than composing lines; in the second, largest of the lot and misshapen through crowding in the firing pile, composing and framing lines are of almost equal weight. Neither of these two is slipped on the outside but the larger bears a broad cross in slip paint extending from rim to rim. The Chaco–San Juan bowl alone has handles—rounded loops pressed close against the sides. It is 5 inches in diameter and its rim is dotted. With a single doubtful exception,

the other bowls have black-painted rims. One, 4 inches in diameter by 2 inches deep, bears a thick, crackled, chalky-white slip; the sole decoration is a black ring on its quarter-inch-wide, outflaring rim. No other vessel in our collection has a like rim. Fragments of two gourd-shaped ladles were also found in Room 298.

In the adjoining storeroom, 296, we found three bowls and a pitcher. Two of the bowls, slipped and partially polished outside, are decorated on the inside in the old Transitional style; the third bears a 4-unit, straight-hatched design that is noticeably blurred as if its lines were painted while the slip was still damp. After the potter finished slipping the inner wall of this third bowl she drew her slip mop around the outer edge to leave a careless band of thin kaolin. Over this band three strokes of a paint-filled brush emphasized the line break, or spirit path, in the black line circling the rim. The pitcher accompanying these bowls is decorated with stepped elements bordered by thin, parallel lines in good pre-Pueblo style, but its slip was stone-polished before the design was added. A squarish shoulder divides the decoration into two zones; the handle extends from rim to base of neck.

Fire had destroyed the ceilings of these two ground-floor rooms. In both cases the broken bowls found in and under the wreckage had belonged to families who once occupied the living quarters above. There can be little doubt of that. Similarly, we may be sure that the two vessels accompanying the body of a middle-aged man (Skeleton 23), buried in a hole dug through the floor of Room 330, were familiar to him during life and were offerings from his family or close relatives at time of interment (pl. 93, lower). So, too, with the bowl under the right knee of a fellow warrior we know only as Skeleton 10 (pl. 98, lower).

Twenty-three men, women, and children were entombed in Room 330. Their burial furniture included 17 bowls, 11 of which are quite small, about the size of a cereal dish; but they represent a group surprisingly numerous at Pueblo Bonito, and we shall not go far astray if we regard them as porringers. Indeed, one of them (U.S.N.M. No. 336344) still held a food remnant.

Eighteen of the 26 bowls from Room 329 belong to this same category. Six others, 2 to 4 inches in diameter, neatly made and decorated, are believed to be children's toys.

Three of the Room 329 bowls contained remains of food offerings, perhaps cornmeal. Chemical analysis proved the substance of vegetal origin but exact identification was not feasible. These three are illustrated on plate 53, figures *c-e*, and, above them, the bowl with which each was covered. The smallest of the six is slipped all over; the larg-

est is unslipped on the outer surface; the remaining four have bands of slip paint, narrow to wide, outside below the rim.

In Room 326 one man, nine women, and an infant were buried. Among the offerings placed with the bodies were 62 food bowls, all but one of which are shown on plates 54 and 55. Of the total, 22 measure less than 6 inches in diameter. All are black-on-white with three exceptions: two brown-with-polished-black-interior (figs. *b, c*) and one black-on-red (fig. *t*). The 2-unit interior design of this latter consists of interlocking, stepped scrolls bordered by parallel lines plus a little squiggled filling. Its black rim line is unbroken by the customary spirit path.

Almost the whole range of Pueblo Bonito ceramic history is represented here. Both early and late wares will be noted and in their several variations; also, a couple of pieces from other culture areas. Only two of the 62 have handles, the largest and one of the smallest. The former is a veritable tub, $12\frac{1}{8}$ inches in diameter by $5\frac{3}{4}$ inches deep, with an interior, over-all, 4-unit design, a flattish bottom, an unpolished, slip-washed exterior, and two double-roll, horizontal handles just below the painted rim (pl. 55, fig. g_3). One handle is pressed so close there is no space betweeen it and the vessel wall. The second bowl with handles, one of the brown-with-polished-black-interior, is 4 inches in diameter and half as deep; its round loop handles are attached so high they curve above the rim (pl. 54, fig. *b*). In plate 55, figure a_3, four spirit paths or line breaks were required when the tails of as many white triangle scrolls reached the edge. Room 326 pitchers, 15 in number, are illustrated on plate 57.

Sometime during the occupancy of Room 266, in the northeast quarter of Pueblo Bonito, five jar-shaped storage pits had been dug into the hard clay below its floor. The first of these, Cist 1, was filled with blown sand; from the lower half of that fill we removed 22 broken bowls, only 2 of which were more than $5\frac{3}{4}$ inches in diameter (pl. 56).

Small bowls are conspicuous in our Pueblo Bonito collection and since the 20 from Cist 1 are thoroughly representative, a description of them will answer for all others. Each bears external striations of scraping tools but two, figures *q* and *r*, appear also to have been partly stone-polished. Only one, *a*, is slip-coated over all, but *u* shows a "puddled" exterior as though modeling while the paste was wet had brought the finer clay particles to the surface. After slipping the inner wall the potter drew her mop carelessly around the outside rim to leave a more or less conspicuous slip band on all except *a, e, l, q, u,* and *v*. Fourteen are ornamented with hachured designs, of which four, *n,*

o, p, and *u,* are either squiggled or a combination of squiggled and straight hatching. In every instance the rim edge was painted black and, presumably, provided with a spirit path. (On six specimens the rim line is partly erased.) External emphasis figures appear on six bowls, *d, e, g, h, n,* and *v,* but only on the three latter do these figures actually coincide with the path or line break. On the outside of *d* a stepped triangle hangs from the lip a third of the way around to the left of the break; *e* has a pendent V 2 inches to the right of the path. From the opening in the rim line of *h* three connected, wide-spreading V's extend in decreasing size to the right. A like figure, partly erased, appears on *g; n* has an outturned scroll at each side of the path, while *v* has a scroll at the left only. Usually, but not always, the spirit path lies where an open space in the design reaches the rim. Paint-brush strokes form an X on the bottom of *b;* two straight marks appear on the bottom of *j;* a single brush stroke is noted under one lug on both *s* and *t;* a broad dash of slip paint underlies the emphasis figure on *v.* Five (*p-t*) of these 20 small bowls have lug handles. On the first, that with four, the handles are wider and rounder but, like the others, they were thrust through vertically with a rounded stick or awl to clear the opening. Freedom of individual expression is perfectly obvious in this assemblage.

Our collection includes 95 of these below-average bowls (average, $7\frac{1}{2}$ inches), and handles occur on 12 percent of them. Two is the customary number, but one in five has four. A single example, from Room 272, is equipped with three (U.S.N.M. No. 336187). In a few instances postattachment modeling partially closed the handle perforation, but even so a fine cord could still be inserted, if desired. Room 272 produced a second unique bowl—one 7 inches in diameter by 4 inches deep, with two pairs of conical, unperforated nodes placed an inch below the rim (No. 336186).

The average Bonitian bowl is handleless, but larger examples sometimes were provided with horizontal loops or broad, shelflike lugs. The latter kind, as we know from sherds, usually are downraking and slightly cupped on the under side. Handles of this type appear on 2 of our 12 bowls 11 inches or more in diameter; in the case of a Chaco–San Juan specimen from Room 227, the lugs are pierced (U.S.N.M. No. 336133). A $12\frac{3}{4}$-inch bowl from Kiva 2-D, ornamented with opposed solid triangles bordered by many thin parallel lines, has slightly pressed-in loop handles placed 2 inches below the rim (No. 336335). In contrast, a dish from Room 326, likewise decorated in Transitional style, has close-pressed, double-roll, upturned handles a mere half inch below its rim (No. 336283). Room 268 produced an

11¼-inch bowl with a double-roll loop on one side and a solid, bifurcated lug on the other (No. 336183). Perhaps owing to their weight while drying, or to crowding in the fire, these large bowls are sometimes misshapen and occasionally flattened on the bottom, but only one, a Chaco–San Juan vessel from Room 255, has a base noticeably concave (No. 336142).

Subfloor pit 3, Room 266, was filled with clean sand from which we recovered a few miscellaneous sherds and three restorable, black-on-white bowls. Part of one was found near the top and the remainder near the bottom, showing that the pit had been intentionally filled and all at one time. Two of the bowls are decorated in late, straight-line hatching, while the third bears a design foreign to Pueblo Bonito.

Fragments of six other foreign bowls lay among household rubbish dumped through the second-story west door some time after Room 266 was abandoned (pl. 58, lower). The first three, however unlike in ornamentation, have several points in common: they are relatively shallow, averaging only 3¼ inches in depth; their inner and outer walls, stone-polished, creamy gray in color and velvet smooth, have crackled or spalled minutely; their rims are rounded, slightly incurved, and unpainted; *i* and *k* wear an external band of thin slip paint at the rim. The second trio(*l-n*) averages an inch deeper, with thinner, steeper walls and more rounded bottoms, and rims that are direct, partially flattened and unpainted. Their exteriors are slipped over all, but *m* only was stone-polished; surface cavities and striations on *l* and *n* evidence a relatively coarse angular temper. There is no line break in the upper border of the two complete designs, on *i* and *k*. All six are ornamented with what I judge to be organic paint.

These six bowls are probably importations despite features in common with some of our Chaco–San Juan vessels. I do not know where the first two originated, but the others are decorated with designs I remember well from southwestern Colorado and southeastern Utah. Modern archeologists probably would classify these four as "McElmo black-on-white." The over-all design in *j* is so unusual it would never be forgotten. Two other bowls in the collection combine in their ornamentation elements to be found in the six now before us. Both are 4¼ inches in depth. One is gray and unpolished outside; its rim is thinned on the outer edge by scraping and remains unpainted. The second, more heavily slipped and much smoother inside and out, has a rounded, slightly incurved rim that is also unpainted. Neither bowl wears the external band of slip paint seen on *i* and *k;* both have an interior, all-over ornamentation that combines the broad, widely spaced lines of McElmo design with single or inter-

locking scrolls ticked on the convex edge in the manner of the toothed elements so prominent in *j*. I should guess this distinctive figure to be a mark of some restricted area but fail to find its like in any of the reference works at hand.

Other foreign wares are more easily identified as to source: The Mesa Verde district in the north; the Kayenta region in the west; the Little Colorado, Upper Gila, and Mimbres areas in the south. In each case these imports reached Chaco Canyon late, after Pueblo Bonito had attained full development.

One variety of alien pottery we never thought to find is illustrated on plate 52, A. All three examples came from Kiva W, on the west side of the West Court, a chamber filled with debris of reconstruction overlain by blown sand in which clay lenses evidenced the presence, from time to time, of water trapped after summer showers. The pottery is so unlike the associated Bonito sherds that our Zuñi workmen must have noted the difference, but they said nothing at the time. However, they told me later that the pieces came from about bench level, approximately 6 feet below the terrace immediately north and south of the kiva.

Variable striations left by scraping tools appear on the three specimens; neither has been slipped; all are gray in color. In each case the bottom is thick, the upper wall relatively thin (one-eighth inch for *a*).[43] Finger imprints remain on the fragment in the center, inside and out, showing the vessel began as a conical cup, molded by hand; upon this beginning an inch-wide band of clay was laid down. Attached to this base, as illustrated, is a fragment found in Room 314, at the north end of the East Court. Below the flaring rim of the pot at the right an ornamental collar of thin vertical nodes was formed by pinching the plastic clay between thumb and forefinger. Six smoke-blackened neck fragments of a fourth and larger jar, likewise from Kiva W, evidence a succession of three concentric circles scratched into the striated surface by way of decoration.

Although, unfortunately, neither I nor one of my colleagues saw these sherds in situ, I have no doubt they actually came from the buildings indicated. They were tossed into the sherd boxes along with other fragments exhumed by the workmen and were not detected until Roberts and Amsden tabulated the material in midsummer, 1925. Room 314 was excavated in 1923; Kiva W, the following year. The fact that the Room 314 fragment fitted one of those from Kiva W was not noted until these paragraphs were being written in Washington

[43] The temper in the left-hand fragment, the only one examined by Miss Shepard, was identified as "coarse sand."

10 years later. There is a noticeable difference in color between the two pieces.

When the fragments first appeared we guessed them to be of Navaho or Apache manufacture, remnants of vessels abandoned by wandering tribesmen after Bonito had been deserted. Recent investigations by Mera (1935; 1938) and Hibben (1938b, pp. 131-136) have corrected this early surmise and identified the place of probable origin as an area bordering the Continental Divide 60-odd miles northeast of Pueblo Bonito. Here has been disclosed a strange cultural admixture, basically Puebloan but favoring conical-bottomed cooking pots. Hall (1944, p. 61) associates the latter with a "Largo-Gallina" phase which he times between A.D. 900 and 1100. The area is generally recognized as the ancestral home of the Navaho.

One of four Largo houses Mera excavated, a pit dwelling, gave a construction date of A.D. 1106. The latest ceiling beam we found in Bonito was cut in 1130. Thus there is reason to believe that inhabitants of the two districts knew of each other's existence. But the bases of our three Kiva W pots are decidedly more pointed than any yet figured from the Largo; in the same way they differ from historic Navaho vessels. The pinched-up collar on the third specimen, plate 52, A, is a type of decoration used, with less precision, both by Gallina potters and by the Navaho.

Elsewhere in this report I have directed attention to the similarity between a small earthenware pipe from a Largo house and one we unearthed at Pueblo Bonito.

If the presence of pre-Spanish Navaho pottery in Pueblo Bonito proved a complete surprise, so too did a sherd from Room 256—the bottom of a brown, finely corrugated bowl with polished black interior bearing a matte design (fig. 49). The coils, eight to the inch, possess a minuteness and regularity more at home in the San Francisco River Valley of southwestern New Mexico than in Chaco Canyon. Previous to the finding of this fragment we supposed, as did everyone else, that Maria and Julian Martinez of San Ildefonso originated the black-ware paint they have employed so successfully since 1921 (Guthe, 1925, p. 24). But theirs clearly is a rediscovery, since they could not possibly have known that the same peculiar pigment was used at Pueblo Bonito more than eight centuries earlier. The one datable beam recovered from Room 256 was cut in A.D. 1052; seven timbers from two adjoining rooms were felled between 1047 and 1083.

A restored bowl from Pueblo del Arroyo is likewise ornamented with matte paint. In this example, however, the brown exterior is

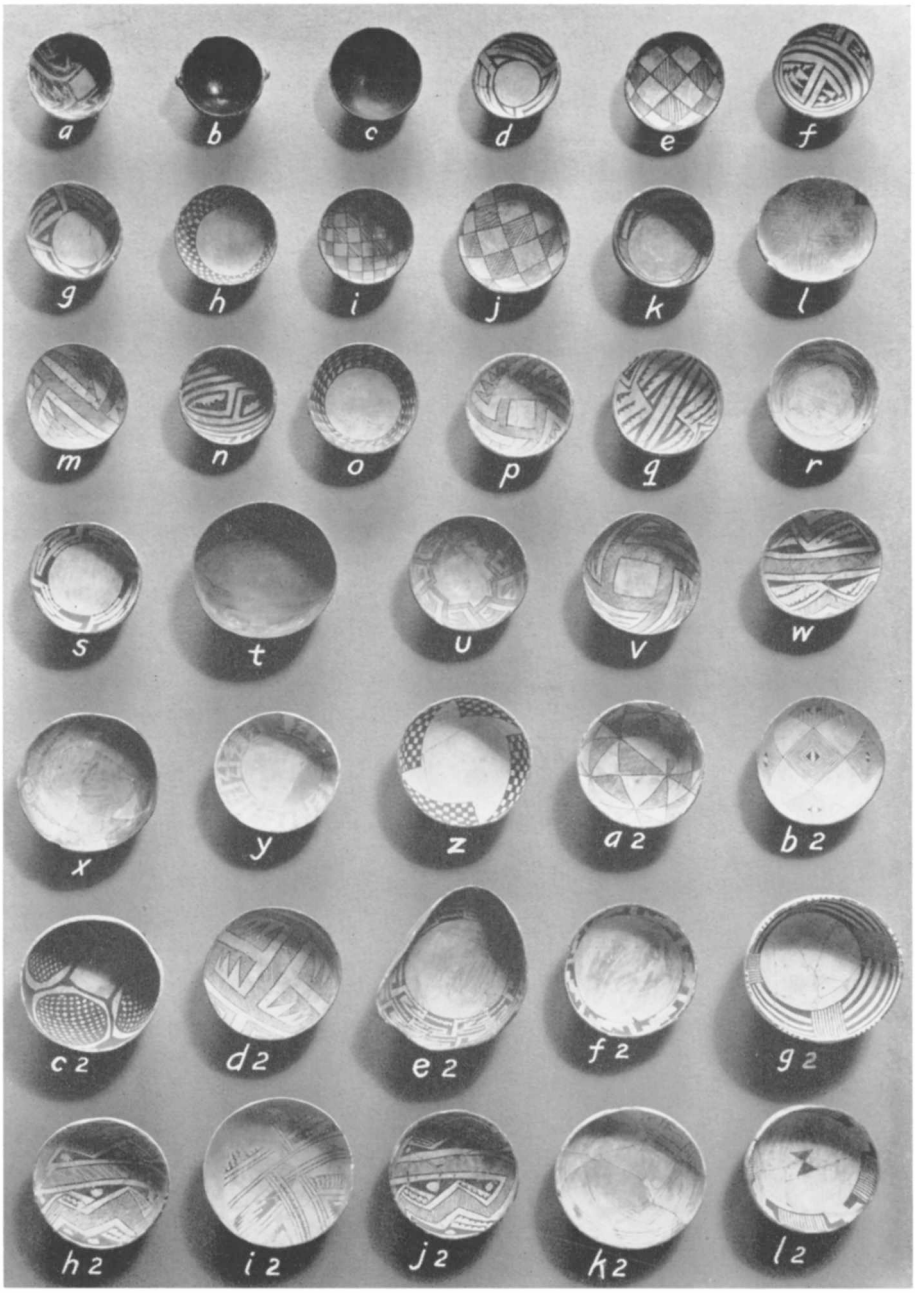


PLATE 54.—Thirty-eight of the 62 food bowls among the burial offerings in Room 326 (see also pl. 55) illustrate almost the entire range of ceramic history at Pueblo Bonito.



PLATE 55.—Larger bowls among the 62 recovered from Room 326 (see also pl. 54).

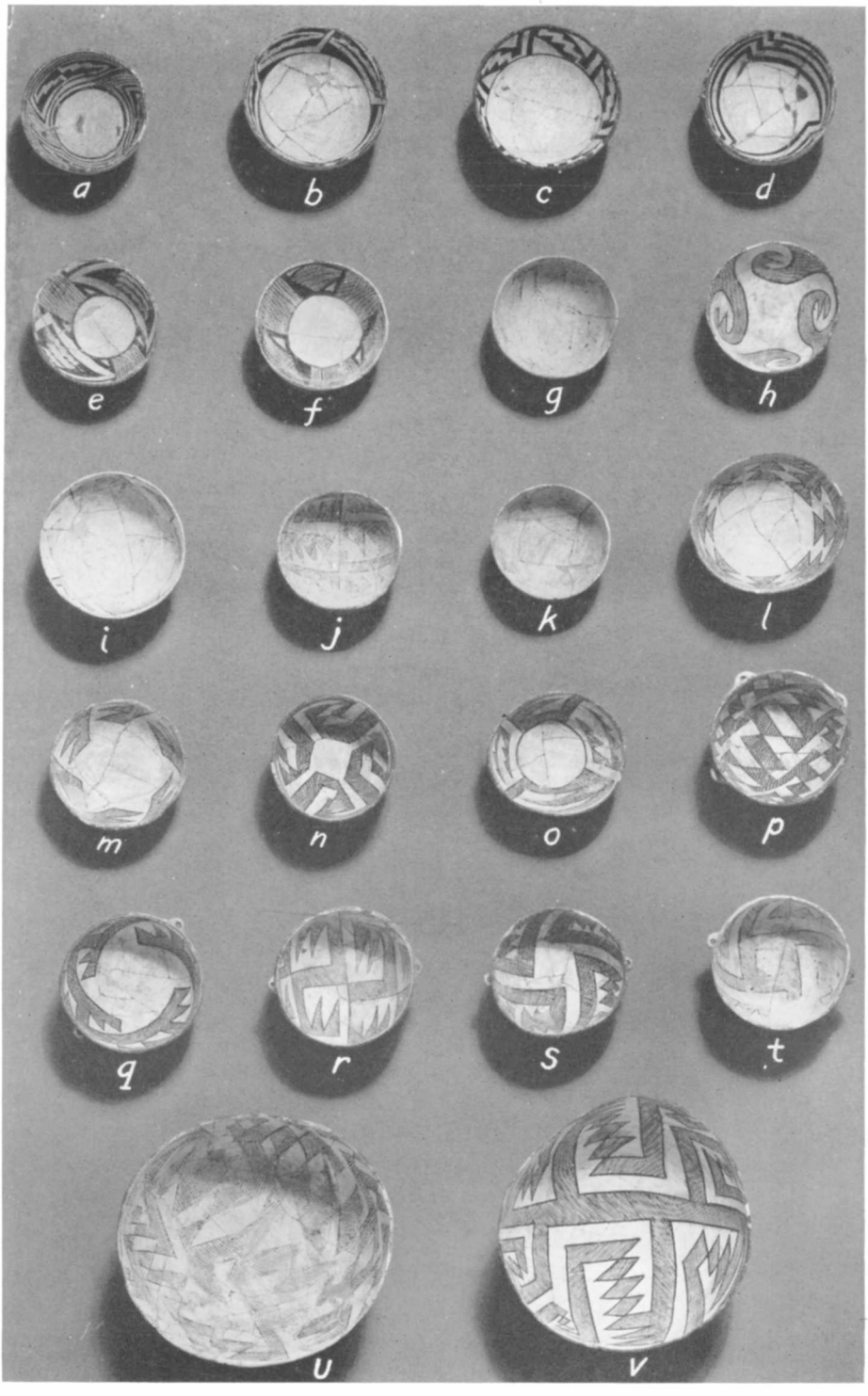


PLATE 56.—Bowls restored from fragments found in subfloor Cist No. 1, Room 266.

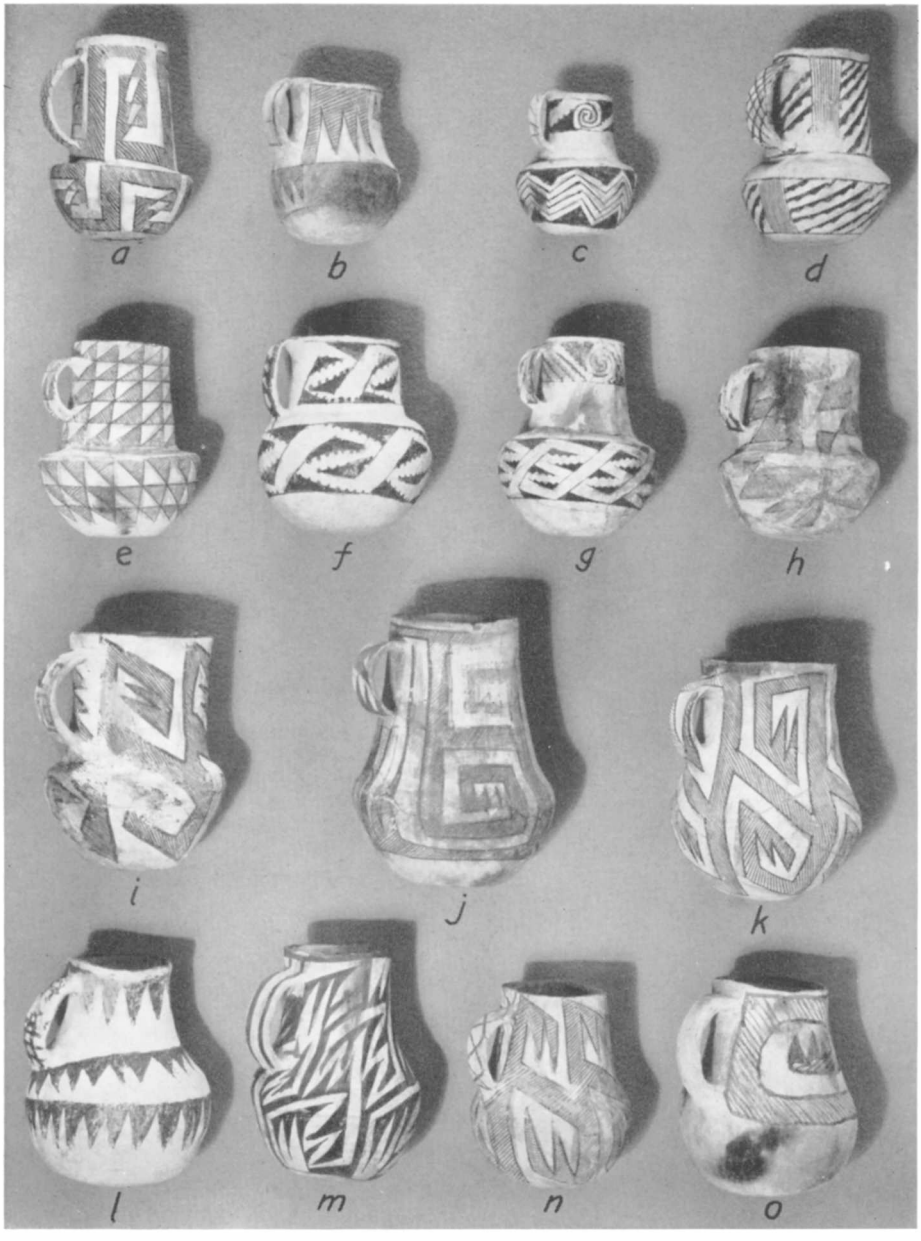


PLATE 57.—Fifteen pitchers were included among the grave furnishings in Room 326.

irregularly stone-polished rather than corrugated, and the design on the glossy black inner wall is a four-line, stepped and bordered composition decidedly Pueblo I in appearance (U.S.N.M. No. 334618).

At first we thought brown-with-polished-black-interior represented trade from the headwaters of the Rio Gila. But doubts arose when we recovered fragments of it well toward the bottom of the west refuse



FIG. 49.—Sherd with matte decoration.

mound and noted its presence elsewhere (1.2 percent of tabulated sherds from excavated rooms). While cutting our West Court stratigraphic sections, we found one fragment of the ware in Test I, Stratum G (8′ 6″-9′ 8″ below the last utilized court surface), two fragments in Stratum E (depth, 5′ 2″-5′ 9″), and 11 fragments in layers A-B (surface to 3 feet below). In Test II, three fragments only were recovered, in Strata A and B (surface to 2 feet depth). These two tests thus evidence an occasional brown-with-polished-black-interior bowl during Old Bonitian times and a sudden increase in numbers shortly after the local appearance of corrugated-coil culi-

nary ware and the Chaco–San Juan group. Many of the polished-black-interior bowls were thinned externally at the rim, a Chaco custom, and the inference is that these, at least, were made in the canyon. Sherds from the older rubbish are less glossy black inside and browner outside than later fragments.

On the other hand, the collection includes sherds of cooking pots and black-interior bowls that almost certainly originated on the Upper Gila—bowls with outflaring rim, bowls and pots with exceedingly fine corrugated coiling, and others with the corrugations partially smoothed by rubbing. None of the bowl sherds is provided with that characteristic Upper Gila treatment, an external band of two to six corrugated coils below the rim.

An over-all, externally corrugated bowl with black-on-white interior decoration, probably of northern origin, vanished completely sometime after exhumation. It is to be seen, however indistinctly, in Haven's field photograph, reproduced as plate 91, upper. We have only one other comparable piece.

Food bowls shaped in a basket, and preserving the basket imprint externally, occur repeatedly at unit-type ruins north of the San Juan but are not generally associated with Pueblo III cultures. Yet we found fragments of eight such vessels, in Room 251 and Kivas A, B, J, L, and 2-E. Each of these is a Late Bonitian structure; each contained more or less Late Bonitian rubbish.

Kiva 2-E, in the southeast corner of the East Court, is probably later than the other four but we cannot so easily fit it into local history. Although built of salvaged stone, its architecture is unlike that of nearby kivas. After it ceased to be used for religious purposes the hatchway in its flat roof openly invited the dumping of household sweepings. From that rubbish in 1923 we recovered the major portion of a deep bowl molded in a basket (pl. 52, C, left). Two years later, after the vessel had been restored, I picked up a fragment of its rim from the *surface* of the east refuse mound—an inconsequential fact but one that suggests the lateness both of the kiva and the bowl.

The gray interior, irregularly smoothed, appears to have been puddled rather than slip-coated. It is ornamented with two bands of faded black figures pendent from single lines: above, elongated elements that remind one of shirts hanging by their sleeves and, below, solid triangles, point down. Two black lines encircle the outer wall; the flat rim, one-fourth inch thick, is marked by close-lying dots. Holes drilled from the inside a half inch below the rim evidence ancient

repairs. Like fragments of the other seven, this basket-molded bowl is sherd-tempered and decorated with vegetal paint.[44]

Bonitian potters occasionally modeled vessels in the form of mammals, birds, and human beings, but they rarely found courage to portray these creatures by painting. Several of their efforts in this direction are illustrated in figure 50, *a-g*. The first (*a*) is on an Old Bonitian bowl the inner surface of which is stone-polished and bears an all-over, rectilinear design in oblique, squiggled hatching; its outside is unevenly smoothed and so thinly slipped the gray paste shows through. Fragment *c* shows like treatment; *f* possesses a rather pinkish color, perhaps an accident in firing, and its paint is quite red over a very thin, whitish slip. The black-on-red fragment, *e*, belonged to a bowl from the Little Colorado area, eastern Arizona, while *d* and the hunchbacked flute player, Kokopelli (*g*), were interior bottom designs on imports from the Mesa Verde district. Representations of horned toads are shown in two restored Mesa Verde bowls on plate 58, figures *a, b*.

Although a number of our local bowls, especially the larger examples, were misshapen through careless crowding when piled for firing, relatively few exhibit intentional novel treatment. One such, from Room 326, simulates two superposed dishes (pl. 53, fig. *f*). It is slip-coated inside and out, and imperfectly polished; its simple, waved-line ornamentation is typically Old Bonitian, but the external overemphasis of the "spirit path" marks the vessel as later. Gladwin (1945, p. 64, pl. 29, *b*) places a bowl of like form but different design in his Red Mesa Phase, which is "Early Pueblo II."

Fragments of several small double bowls are noted among the sherds saved for study. In each instance the painted design differs in the two halves; the junction wall is sometimes straight, sometimes omitted from one half to fit the convexity of the other. Our lone fragment of this character from Pueblo del Arroyo represents a rectangular, vertical-walled, stone-polished brown vessel, one compartment of which is smudged inside.

All Pueblo potters learned their art through experience. Instruction began early, when a mother or grandmother sought to occupy the toddler at elbow with a lump of moist clay, and continued throughout childhood and adolescence (pl. 60). In their want of skill in execution, several of our earthenware vessels suggest the work of children, but none more clearly than a bowl from Room 307 (pl. 53, fig. *g*). Its

[44] Determinations by Miss Shepard.

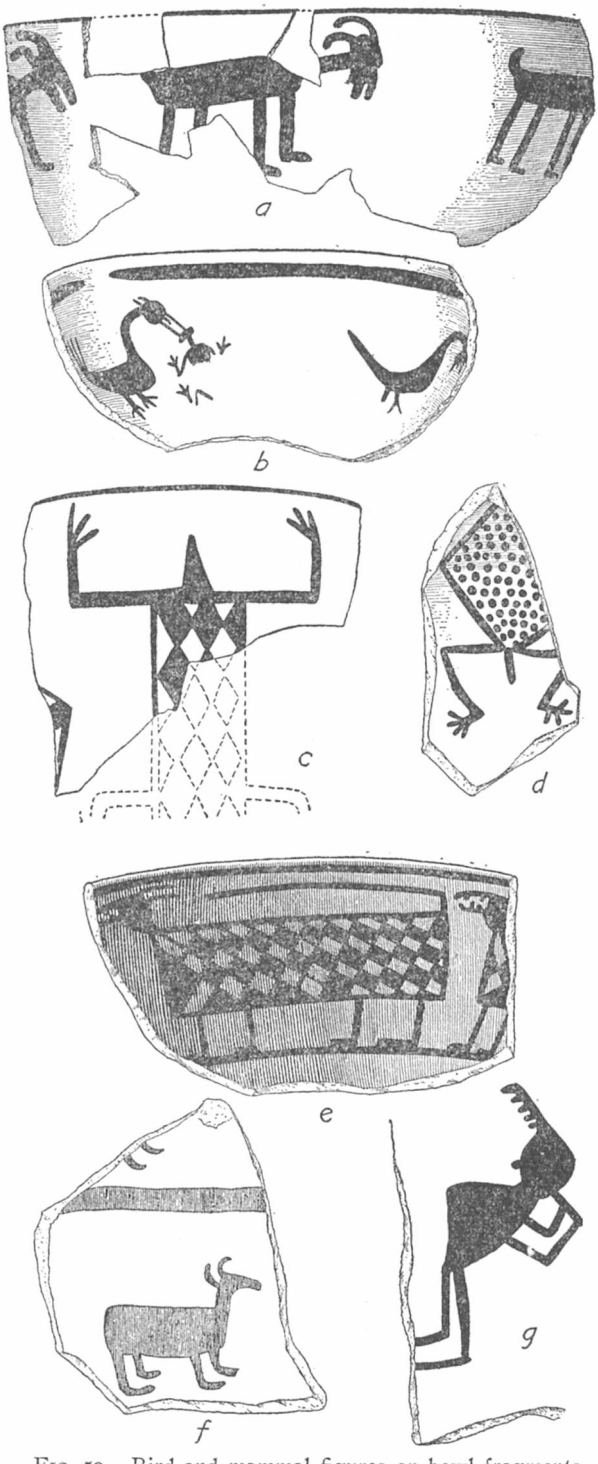


FIG. 50.—Bird and mammal figures on bowl fragments.

upper half consists of three coils, unevenly applied and irregularly finger-pinched, and a broader rim band marked by thumbnail imprints; its inner surface was lightly slipped before the uncertain design was painted. The only other restorable piece of pottery from this Old Bonitian dwelling is an undersized ladle of the half-gourd type; its rim is painted black and a ticked-line figure continues from the bowl into the open handle (pl. 69, fig. *b*).

Ladles are no more than small bowls with a jutting handhold. They serve as well for ladling rabbit stew as for dipping water. Many ladles in our collection are noticeably worn from scraping against pot or sand. Rarely does the worn edge indicate left-handedness.

In his report of observations among the Hopi in 1881, Bourke (1884, p. 254) remarked: "Table ware is made of pottery, but spoons and ladles of horn, wood, and gourds, are in every house." Gourd ladles are more frequently seen in Pueblo homes of the present generation but those of earthenware have not been wholly discarded.

The Basket Makers used dippers made from wild gourds and naturally imitated these familiar utensils in clay when they learned the art of pottery manufacture. Early Pueblo potters followed suit. Because it served its purpose well the half-gourd-shaped ladle or scoop persisted until Pueblo II times before it was entirely superseded by the bowl-and-handle type.

Our Old Bonitians were a Pueblo II people. Their dippers were of the old style, from less than 4 to over 14 inches long, and ornamented with characteristic designs that continued full length, down one side and back up the other (pl. 61, figs. *f-i*). From this beginning, the broad, flat handle (*e*) developed. An intermediate stage, locally represented by sherds only, is the scoop with thin partition separating bowl from concave handle. From a Pueblo I village in southwestern Colorado, Roberts (1930, pp. 101-102) reports the same ladle sequence we observed in the older rooms and rubbish heaps of Pueblo Bonito.

Late Bonitian ladles were wholly of the bowl-and-handle type (*a-d*).[45] The two parts were made separately and joined while the paste was still plastic—usually by punching a hole in the side of the bowl, inserting the handle end, and smoothing over the point of contact. Although the painted ornamentation merely repeated that on food bowls of the period, imagination was often unleashed when the

[45] During room excavations we recovered 10 bowl-and-handle ladles, including 6 from which the handles had been broken, and 8 of them came from Late Bonitian houses. In contrast, of 13 scoops and sizeable fragments all but 5 were found in Old Bonitian dwellings and trash piles.

handles were fashioned. At first solid and cylindrical, these later became tubular; one or more small holes were punched through the top or sides; now and then a pellet was introduced to rattle when the dipper was used. Sometimes the handle was formed of two or more solid clay rolls, laid flat and pressed together or twisted ropewise; less frequently a long, slender roll was looped about and joined by one or two crossbars. The tip of a hollow handle often turned up or down; occasionally it was bifurcated or ringed as though for suspension. Fancies such as these were not readily applied to Old Bonitian ladles although we did find a few fragments with curled ends and two with flat strips bridging open, troughlike handles.

An eccentricity that looks like a ladle is illustrated on plate 62, figure *a*. It is slip-coated inside and out, carefully smoothed but not polished; its paint is dull black except at the forward right quarter and under the handle where overfiring has turned it brown. There is no trace of abrasion on the bowl edge. Part of a similar vessel, slipped over all, stone-polished but undecorated, came from Room 267 (fig. *c*). The fragment of a smaller, much shallower example was found above the stone and adobe fill in a large, square compartment at the east end of the east refuse mound (fig. *b*).

Pepper (1920, figs. 91 and 143) illustrates, from Rooms 51 and 141, two specimens very similar to our *a* and *c*. He describes them as "incense burners," a type of utensil known in Mexico and Central America but not in the Pueblo country. The first of his is accompanied by a lid whose external decoration almost duplicates that on a fragment we found in Room 315 (pl. 62, figs. *e, e'*). Half of a second cover, from Room 307-I, is shown in figures *d* and *d'*. Neither fragment has a seating groove on the inner edge; in neither case is the edge worn by attrition.

Pitchers, so-called from their resemblance to a familiar form in our own ceramic complex, were numerous at Pueblo Bonito. They were obviously designed for holding liquids, but it is not at all certain that they served as individual drinking vessels. We must confess we do not know the specific use to which pitchers were put in pre-Spanish Pueblo households. Their distribution is not uniform throughout the Anasazi area. While of common occurrence in ruins of the San Juan country, for example, they are generally lacking throughout the Rio Grande Valley. Among the historic Pueblos, I believe, liquids were not habitually drunk at mealtime until coffee and drinking cups were concurrently introduced.

Bonitian pitchers, like bowls and ladles, are separable by form, finish, or decoration into various groups. In the oldest style, the body

as a container was the important feature; in the latest, the neck received major attention and apparently for esthetic reasons only.

Transitional-type pitchers are round-bottomed, full-bodied, and rather squat; decoration is zoned, on body and neck. Handles, which are always decorated and sometimes represent animals, extend from the rim to the bottom of, or just below, the upper zone of decoration (pl. 57, figs. *c, f*). On the latest type (fig. *a*) the decoration likewise occurs in two encircling zones, but handles are attached entirely within the upper one; the neck is tall and cylindrical; the body, low and square-shouldered with a concave bottom in which a circle or other simple device frequently appears as superfluous embellishment.

Only the early form was represented in the old dump under the West Court. Even so, close examination of sherds from the several layers shows a succession of minor variations. Shoulders are gradually raised; neck curves are eliminated; walls develop a more uniform slope from shoulder to mouth. In addition, zoned decoration is largely discarded in favor of designs extending from top to bottom without interruption. This modified early form and this over-all style of ornamentation persist into the final period when square shoulders are again in vogue. Handles, sometimes transversely concave, are invariably attached a half-inch or more below the rim; the indented or recessed base becomes progressively more popular. These two late features, the indented base and the concave handle, both appear on a superb example decorated in Transitional style from Room 323 (U.S.N.M. No. 336422).

Including miniatures and major fragments, our list of Pueblo Bonito pitchers numbers 83. On the basis of form only, 42 of them are Old Bonitian, but, as with that last cited, a few combine early designs and late shapes. Rims are almost always painted and, with few exceptions, provided with a spirit path. The latter usually lies directly above or close to one side of the handle; occasionally it is emphasized by one or two vertical brush strokes inside the neck. Pitchers belonging to the Chaco–San Juan group have the dotted rim so characteristic of the northern area with the small, concave-based body and cylindrical neck typical of Late Bonitian pitchers, or a conical neck that, in shape and ornamentation, closely resembles the well-known "beer stein" mug of the Mesa Verde area (pl. 63, upper, figs. *a, c*). The paneled design on *b,* with its dotted negative squares, duplicates that on the fragment of a cylindrical-necked pitcher Fewkes collected in 1916 at the Mummy Lake site, Mesa Verde (No. 298851).

Our stratigraphic tests at Pueblo Bonito proved this small-bodied, cylindrical-necked type of pitcher belonged exclusively to the later

periods. It is of interest to note, therefore, that of 41 restorable examples 83 percent were recovered from four Old Bonitian burial rooms Nos. 320, 326, 329, 330. Of the remainder, one came from Room 226, a dwelling of fourth-type construction; one each from six third-period structures, including Kiva R. Many of those in the burial rooms were accompanied by sandstone covers, slightly larger in diameter than the vessel's mouth, in such a position as to indicate that they had slid off when the pitchers toppled from an upright position. No cover was actually found in place.

Three "duck-shaped" vessels may also be regarded as members of the class under consideration (pl. 63, lower, figs. *f-h*). The first comes from Room 323, next on the north of burial room No. 326, and is decorated in good Transitional style; *g*, from Room 330, bears a surface finish and a design in organic paint that, found in a lesser ruin, would readily identify it as of Pueblo I origin; *h* has a hollow handle and the concave base of Late Bonitian pitchers, but its design hatching is squiggled. The second specimen has a plain rim; the other two, painted rims with a line-break directly above the handle.

Water and storage jars.—As Kidder observed after only superficial examination of local rubbish heaps, large decorated ollas or water jars appear to be less common in Chaco Canyon than in other black-on-white areas (Kidder, 1924, p. 53). Why this should be remains a puzzle. Even though we assume that water was formerly more abundant and more accessible than now, each family had to carry its daily supply from source to kitchen. Earthen jars were the means of transportation.

One of the most pleasing sights at any modern pueblo is a young woman returning from well or river with an olla gracefully balanced upon her head (pl. 59, right). Within her home she places the vessel on a bench beside the wall, safe from careless feet, perhaps protecting its contents with a piece of board or the end of a packing box. In like manner Pueblo women have always carried and stored water for household use.

When the Rodriguez Expedition in 1581 stopped at a Tigua pueblo near present-day Albuquerque, Hernán Gallegos observed that the villagers made "earthen jars in which they carry and keep their water. They are very large, and they cover them with lids of the same material. . . . They make a palm knee-cushion similar to those of Old Castile, put it on the head, and on top of it they place and carry the water" (Hammond and Rey, 1927, p. 266).

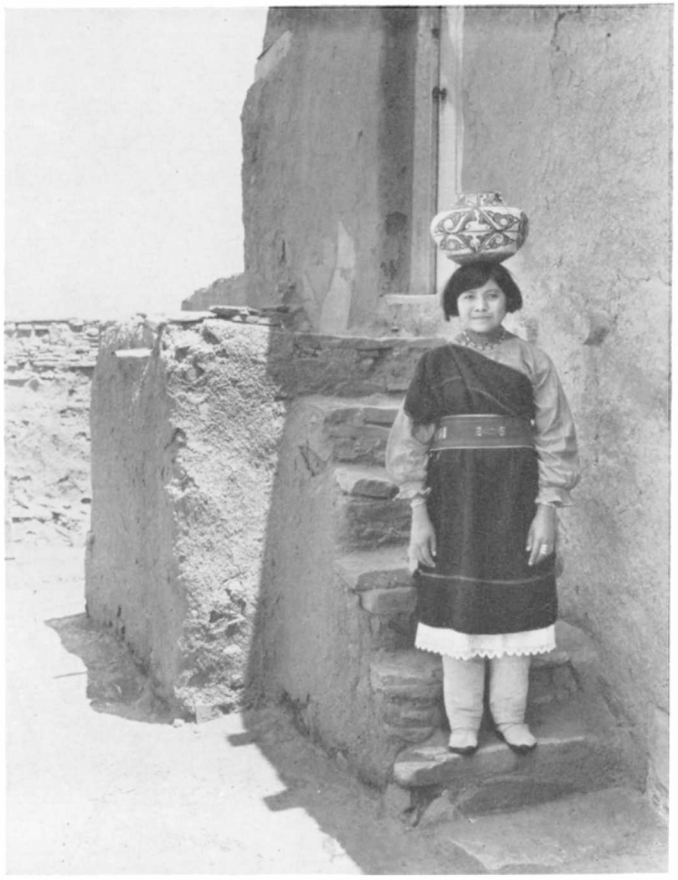
So, too, at Pueblo Bonito. From well or reservoir housewives daily replenished their supply of water for cooking and drinking. This was



PLATE 58.—a-c, Bowls from the Mesa Verde area; d-h, small jars of early and late types; i-n, six foreign bowls restored from fragments found in Room 266.



"Black Bottom," a regular camp visitor. (Photograph by Neil M. Judd, 1927.)



A school girl at Zuñi dresses up for the camera on her way to the village well. (Photograph by Neil M. Judd, 1926.)

PLATE 59



PLATE 60.—A Zuñi grandmother gives a lesson in pottery decoration. (Photograph by Charles Martin, 1920.)

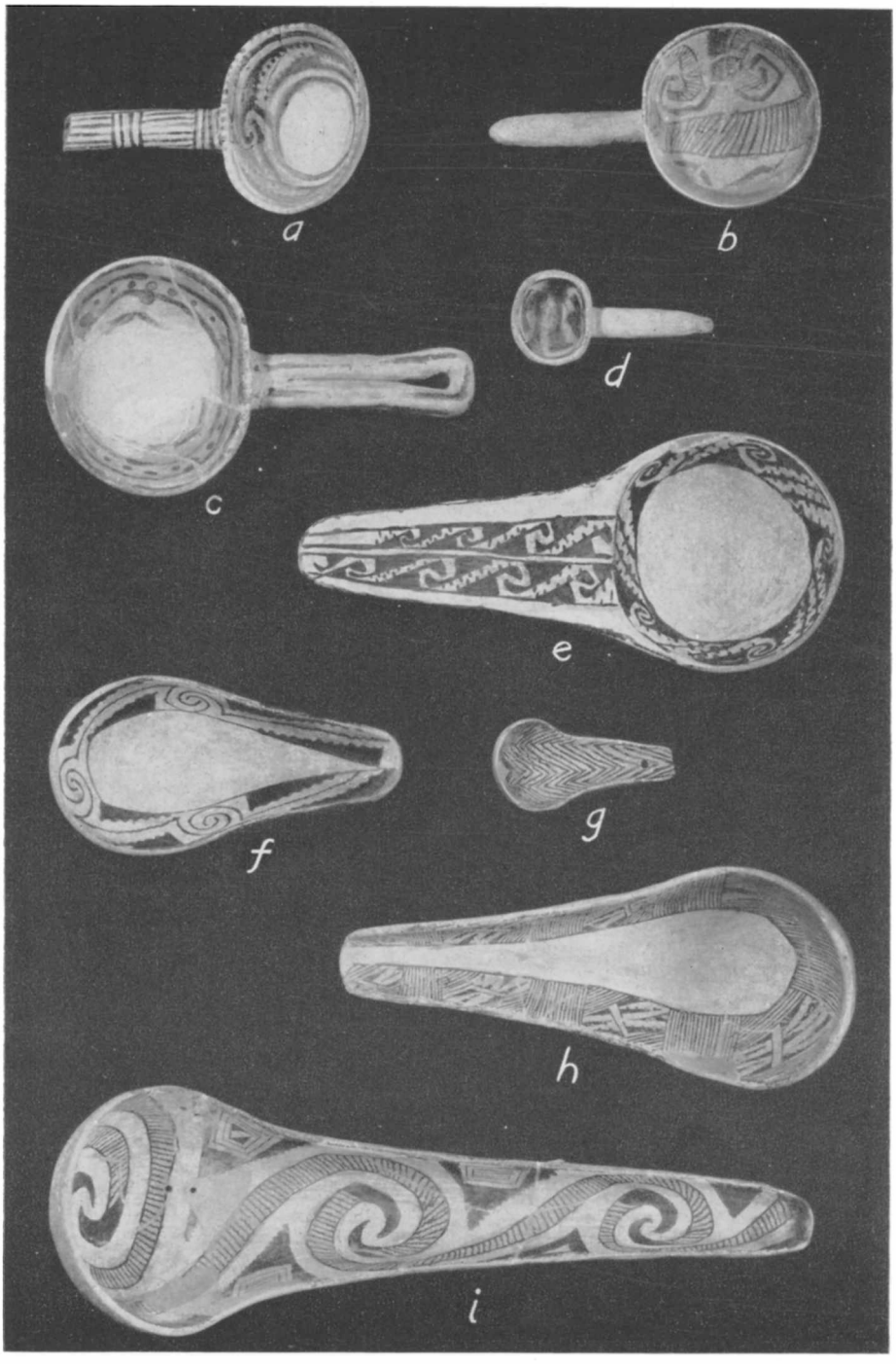


PLATE 61.—Late Bonitian (*a-d*) and Old Bonitian (*e-i*) ladles.

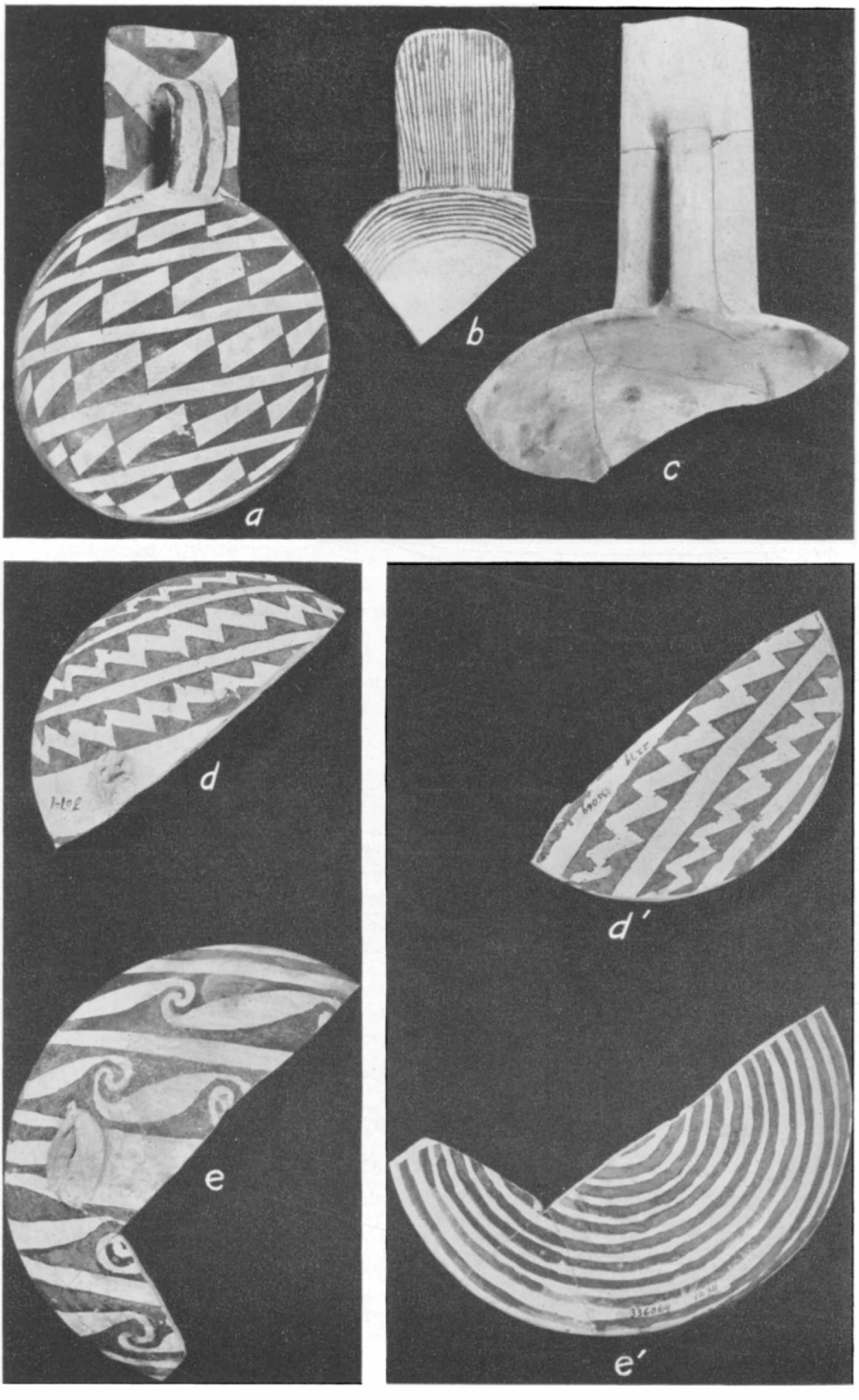


PLATE 62.—Ladlelike vessels of unknown purpose (*a-c*), and fragments of covers, obverse (*d*, *e*) and reverse (*d′*, *e′*), for similar vessels.

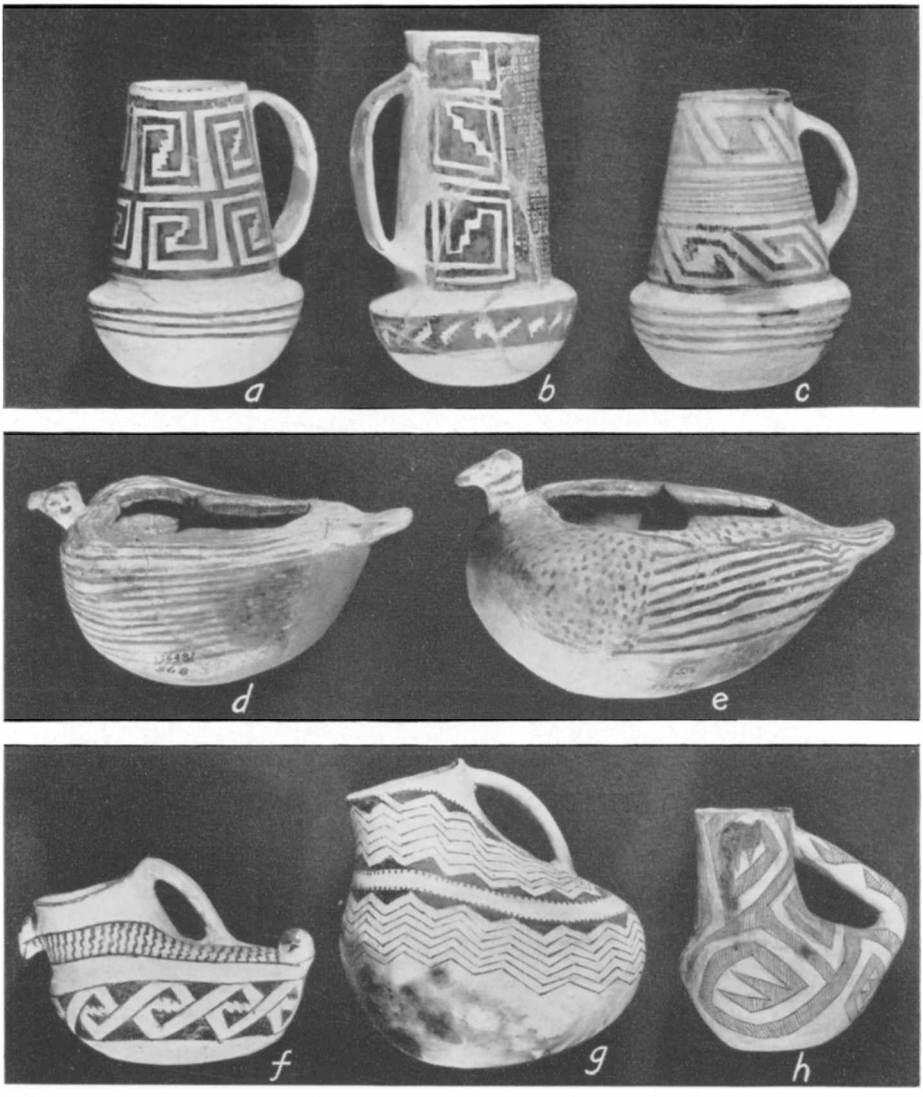


PLATE 63.—*a-c*, Three Late Bonitian pitchers that show northern influences; *d*, *e*, bird-shaped bowls with T-openings; and "duck-shaped" pitchers with Old Bonitian (*f*, *g*) and Late Bonitian (*h*) ornamentation.

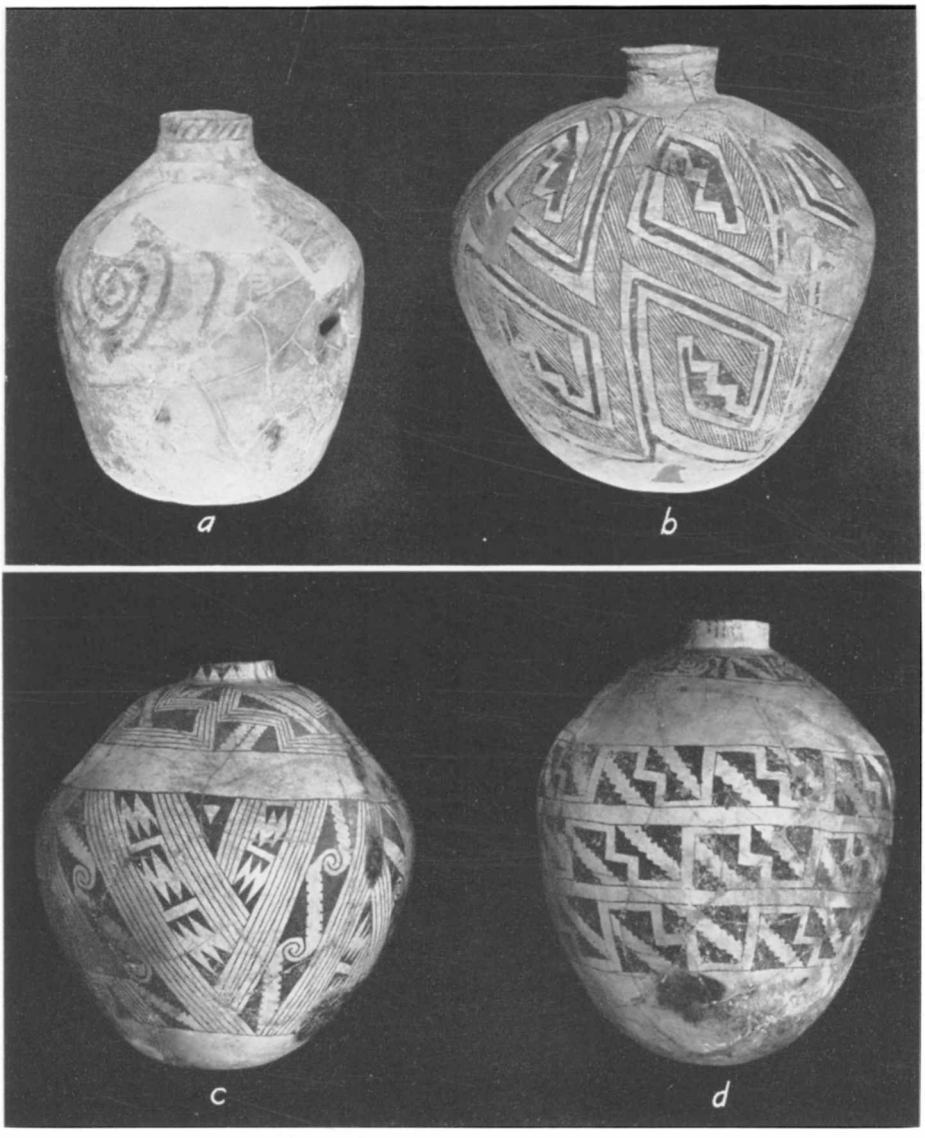


PLATE 64.—Ollas, or water jars, from Late Bonitian rooms (*a, b*), and two (*c, d*) from Old Bonitian Room 326.

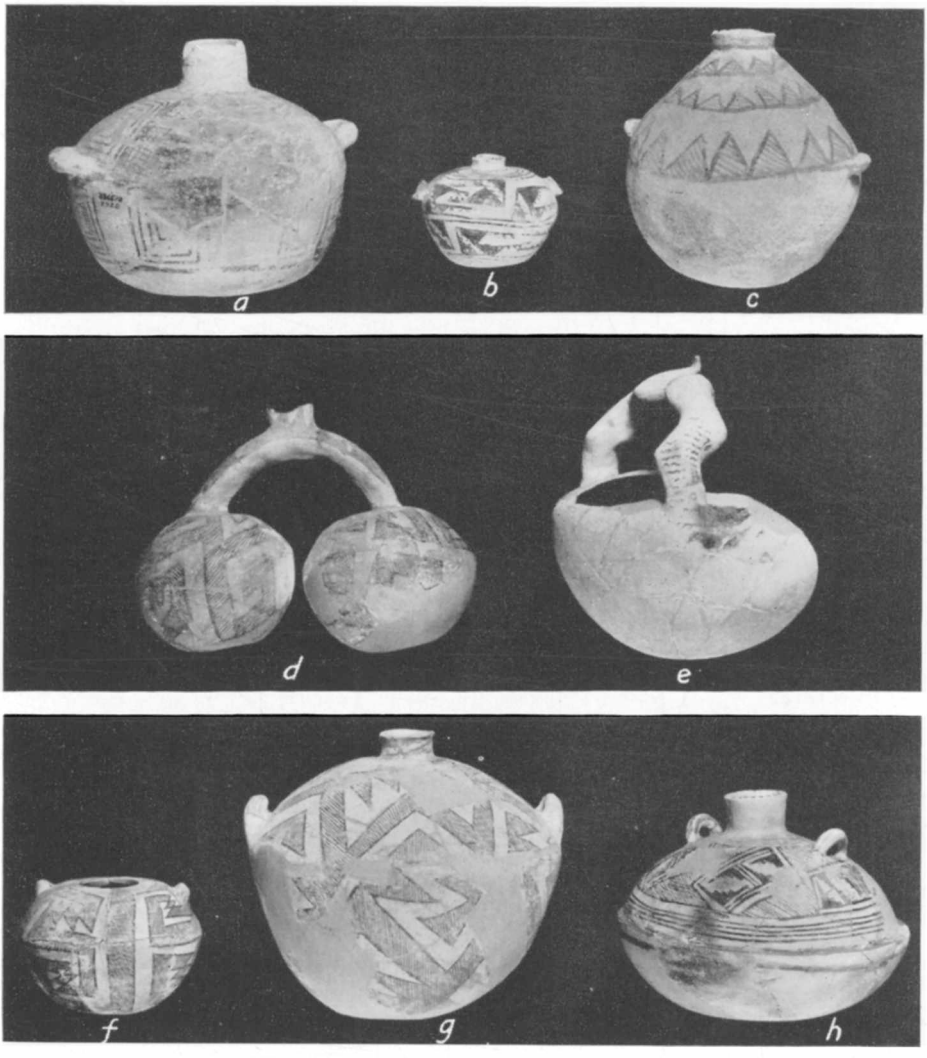


PLATE 65.—Canteens are invariably provided with small orifices and, usually, with lug handles perforated for insertion of a carrying cord.

carried in large small-mouthed jars whose round bottoms necessitated discoidal rests or cushions for upright transportation and placement. We unearthed fragments of such vessels in all parts of the ruin, in every rubbish pile, but they seemed at the time noticeably few in comparison with sherds of other vessel types. And our collection supports this early impression. In contrast to our 29 cooking pots, we recovered only four restorable water jars from Pueblo Bonito.

Two of these (pl. 64, lower) came from Room 326, that on the right being one of the burial offerings with Skeleton 12, a female. Both jars are round-bottomed; both carry two zones of decoration, painted in the old Transitional style. The first illustrates very clearly the secondary shoulder bulge frequently noted on olla sherds of that period. It is comparable in all respects to an olla Pepper found in the east corner of Room 78 half buried in the floor and covered by a stone lid (Pepper, 1920, fig. 108, p. 261). Like Room 326, Room 78 was an Old Bonitian dwelling but its southeast end had been replaced by the Late Bonitians during their initial local building program and further altered during reconstruction activities a few years later.

We do not know precisely when these three Old Bonitian ollas were made, but we can approximate the ages of the houses in which they were found. Room 326 unquestionably was built at the same time as its immediate neighbors, Rooms 320 and 325, from which we recovered five datable timbers, all cut in A.D. 919. Two ceiling beams from Room 296, adjoining Room 78 on the north, were cut in 932 and 1047, the second possibly marking the period of reconstruction referred to above.

With these construction years in mind let us recall two water jars salvaged in 1922 from a Pueblo I pit house 1 mile east of Pueblo Bonito—a lone, midvalley dwelling whose roofing poles were felled in A.D. 777 (Judd, 1924a, p. 408, pl. 4; Douglass, 1936, p. 30). Despite their greater age, 142 years at the very least, these pit-house ollas are indisputably and directly related to those from the older part of Pueblo Bonito. The two from Room 326 have higher shoulders; their slip is less chalky and definitely stone-polished; they have secondary zones of decoration on the upper shoulder instead of unframed interlocking scrolls and each has a round mouth with low, circular neck instead of an oval orifice with no neck at all. But most of these features appear among miscellaneous sherds from our Pueblo I pit house—stone-polished slips, framed shoulder ornamentation, round mouths with just the suggestion of neck, and perhaps a flat, slightly projecting rim lug. And every design element on these Pueblo I sherds, including

the waved composing line, occurs repeatedly on fragments from Old Bonitian dumps.

Interlocking scrolls or volutes comprise the principal decoration for a queer-looking olla we restored from fragments found in Room 262 (pl. 64, fig. *a*). Lesser scrolls above the inset handles join larger ones on either side; in the spaces at left and right of the two larger scrolls are indistinct figures that apparently represent, respectively, a bear's footprint and a human with limbs at right angles to the body, forearms upraised and legs downturned.

The unorthodox shape of this vessel and its relative crudity of execution evidence lack of skill on the part of the potter rather than unusual age. Indeed, it was probably made fairly late in the history of Pueblo Bonito, for locally the inset jar handle occurred most frequently with the later pottery types. Although occasional examples bearing squiggled or other early designs were noted elsewhere, only one inset handle was found in our two stratigraphic cuts through Old Bonitian rubbish under the West Court and that came from Stratum C (3′-3′ 8″ below the surface) of Section I, 13 feet deep. Furthermore, Room 262 was a Late Bonitian dwelling, originally built of second-type masonry and subsequently twice altered. Its original floor lay 6′ 5″ below the latest; the latter was covered mainly by fallen masonry among which the olla fragments were found.

The shapely water jar shown as figure *b*, same plate, doubtless was in use at the same time as that last considered. We retrieved its fragments from a pile of household rubbish dumped into Room 266, which stands only two doors away and which underwent the same postconstruction alterations as Room 262. The jar lacks handles and its smallish base is slightly flattened, but it has the small neck, high shoulders, and ornamentation of Late Bonitian ollas.

Only five other vessels in our Pueblo Bonito collection could possibly be assigned to this category and the three smallest probably were never intended for carrying water (pl. 58, figs. *d-h*).[46] Figure *f*, plate 58, somewhat uncertain in execution, has a slightly concave base, a McElmo-like ornamentation, downraking loop handles indented in the middle—all northern San Juan features—and a rim worn by friction of a stone lid. The other four are round-bottomed and handleless; *e*, with its old-style decoration, had suffered a broken neck, but the rough edges were rubbed smooth and the jar continued in service.

[46] On the other hand, Col. James Stevenson (1884, pp. 531, 532) twice lists among collections gathered at Zuñi in 1881 an undersized olla as a "small girl's water jug."

It contained a quantity of potter's clay when we unearthed it. Holes for a carrying cord were punched through the outflaring rim of *g*.

As if to counteract our Pueblo Bonito impression, Pueblo del Arroyo gave up 13 restorable water jars, a goodly proportion. Two of these are small, of four- and five-quart capacities, have concave bases, and lack handles. The other 11 average $15\frac{1}{4}$ inches in diameter by $13\frac{1}{4}$ inches to base of neck. They will be described more fully in the Pueblo del Arroyo report, but we may note that three possess inset handles, two have loop handles, one has downraking flat lug handles $2\frac{1}{2}$ inches wide, and one bears, just under its outflaring rim, opposing conical lugs bent right so the tip touches the vessel wall. The wide mouth of this latter specimen, $9\frac{1}{4}$ inches from lip to lip, is as foreign to Chaco Canyon as its decoration. Largest of the series, a once magnificent vessel $19\frac{3}{4}$ inches in diameter by 18 inches to the base of its neck, exhibits no trace of a handhold, and while it is possible such formerly existed in sections we have restored, it is noted that the next-largest example has no handle of any sort. Eight of the eleven possess whole or nearly complete bases and these are all concave.

Canteens, like water jars, are unaccountably few in our Pueblo Bonito collection. We found only 11 that warranted restoration. Their capacity varies from about half a pint to nearly one gallon. Each has a small orifice, easily plugged with a corncob or wad of cedar bark; each has a pair of rounded loop handles or lugs vertically perforated for attachment of a carrying cord. Some have rounded or flattish bottoms (pl. 65, figs. *a-c*); others, generally with cord attachments placed high on the shoulder, have concave bases (figs. *f-h*). On canteens, as on pitchers and ollas, a concave base marks the vessel as late. A "doorknob" canteen lug still wrapped with a 3-ply yucca carrying cord was found in the rubbish fill of Kiva B.

Of those figured, *f* had lost its neck, but the opening was reamed out and the jar continued in use. Specimen *h,* with its northern-style decoration, simulates a canteen resting in a black-rimmed bowl; the lip of the canteen is flat and ticked with black paint while the bowl's bottom, almost wholly restored, appears to have been flatly rounded. This culturally late example and the little one with "doorknob" lugs (*b*), came from Old Bonitian dwellings; the other four, from houses architecturally later. Specimens *c* and *f* were found in Late Bonitian rubbish.

Canteens modeled in the form of a gourd, with a round, rimless orifice high on the curved stem handle, are generally regarded as peculiar to the Pueblo I culture period. I do not recall a single reference to one from a later ruin, and yet we found several stem ends

in the Old Bonitian dump under the West Court. Pepper illustrates a whole vessel, an excellent example, from Room 28 in which a large number of cylindrical vases had been piled (Pepper, 1920, fig. 47, *b*).

That Bonitian potters occasionally essayed the unusual in canteens is evidenced by figures *d* and *e*. Straight-line hatching and a concave base identify the first as of Late Bonitian origin and it was actually found in a late dwelling, Room 327.[47] The second specimen, unfortunately incomplete, came from Room 325, an old house adjoining Room 327 on the west. Of its decoration all has been lost except a few squiggled lines and traces of thin parallel lines bordering ticked triangles—elements typical of Old Bonitian designs. But on its bottom is a shallow depression, the size of a silver dollar, that hints of late manufacture. Three hollow, angular pipes or arms connected the body of the vessel with a single orifice, rimmed by the customary low, cylindrical neck. Our sherd collection includes fragments of two other, multiple-pipe canteens.[48]

Figure 52 illustrates a 4-armed, solid handle. Although the convex surface is slipped and stone-polished, the under side is unslipped and retains the potter's thumb prints. Body portions at the base of the two complete arms show a heavily slipped, stone-polished interior, which fact proves that the vessel was a bowl rather than a canteen.

Seed jars are so called only because examples containing seeds have been found in cliff dwellings. They would have served admirably for storage of seed corn, beans, etc., but we have no reason to suppose this was their sole intended function. Their distinguishing feature is a flattish top with constricted orifice often slightly depressed.

We recovered three restorable seed jars at Pueblo Bonito, all from household rubbish in abandoned rooms (pl. 66, A, *a-c*). The little

[47] Comparable examples, collected at Zuñi and Acoma in 1879, are illustrated by Stevenson in the 2d Ann. Rep. Bur. Amer. Ethnol., 1883.

[48] An unusually fine Pueblo II canteen from a cave at the head of Montezuma Canyon, southeastern Utah, is in the Colorado College Museum, Colorado Springs. The body is globular and closed at the top by a dome, reminiscent of the neck "bulge" on our Old Bonitian water jars. From opposite sides at the base of this dome the handle rises as a hollow stirrup with a small orifice at its crest. The black-on-white decoration, which includes interlocking scrolls on stepped triangles, pennant figures, etc., encircles the body and dome in two zones and adorns the outer curve of the handle. The specimen bears No. 405 of the Lang-Bixby collection, made in 1897-98.

Among the fanciful canteens collected in Pueblo villages by Stevenson in 1879-81 are several with stirrup handle; others, two-lobed with hollow connecting bar and a single mouth. Holmes (1903, pl. 18) figures a stirrup-handled bottle from Arkansas; the form is a common one among ancient Peruvian pottery.

one, very thinly slipped if at all, was smoothed by wet fingers and fired to a cream color. Its rim line was painted on top, at the lip's edge, rather than within the orifice as in the first example. The third, clearly the work of a beginner, apparently was decorated with organic,

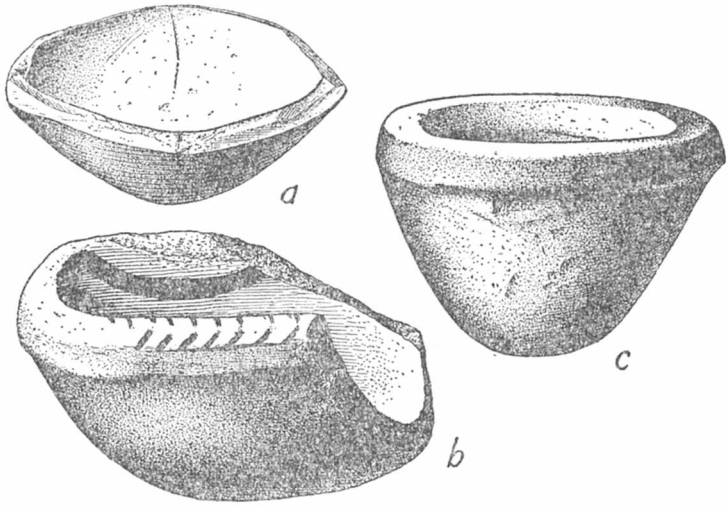


FIG. 51.—Potsherds used as toy dishes.

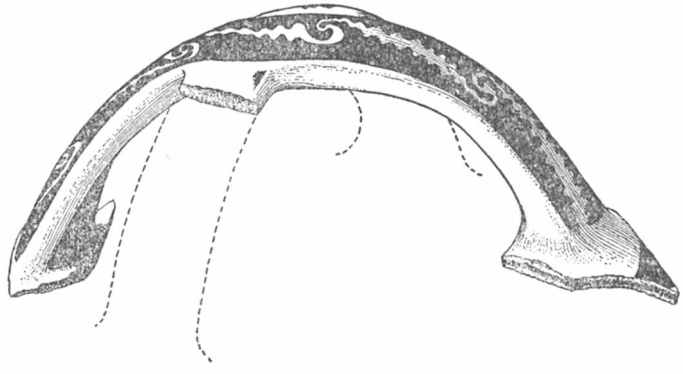


FIG. 52.—A four-armed bowl handle.

rather than mineral, paint. Its thin slip has been worn through, bordering the opening, as though by a stone lid and completely effaced from the base in consequence of long use. An almost imperceptible concavity marks the base of *a;* the other two have flat bottoms.

From Room 32, Pepper (1920, p. 124, fig. 48, *b*) illustrates a low-rimmed "kiva jar," a type well known from Pueblo II-III ruins north

of the San Juan. Our excavations disclosed only fragments of like vessels and relatively few at that.

Cylindrical vases have contributed in no small measure to the fame of Bonitian potters. Their uniqueness in the Pueblo country and their graceful lines have focused attention upon them. Because the cylindrical vase in one form or another was a familiar utensil in pre-Spanish times from the Valley of Mexico, through Guatemala, Honduras, and El Salvador southward as far as Peru, archeologists have assumed the concept was introduced at Pueblo Bonito by Mexican vendors of macaws and copper bells. But there is reason to believe that the idea reached the Southwest, or originated there independently, at an earlier date, for Roberts (1930, p. 106) has found a small cylindrical vase in a Pueblo I ruin in southwestern Colorado. Another, belonging to the next following culture period, is in the New Mexico State Museum at Santa Fe.

This latter, provenience unknown, bears on its white slip a characteristic Pueblo II design of stepped and ticked triangles bordered by thin parallel lines. Its base is rounded; its rim flares slightly and is marked within by a band of four parallel zigzag lines—the only instance, to my knowledge, of interior decoration on a cylindrical vase. A second Santa Fe specimen, from Puyé, is straight-sided with a convex base and incised, over-all design in two zones separated and bordered top and bottom by bands of four encircling lines. Each zone is divided into triangles by a zigzag line and the triangles are variously hatched. There may be others, but these three are the only Southwestern cylindrical vases known to me that did not come from Chaco Canyon. Two tall examples with slightly constricted bases, in the Wetherill collection, Field Museum of Natural History, Chicago, are said to have been found near Pueblo Alto. All others are credited to Pueblo Bonito.

Cylindrical vases provide three of the many ceramic puzzles at Pueblo Bonito. Who made them; when did they come into use; what specific purpose did they serve? Because most of those he exhumed were found in, or adjacent to, rooms containing stored ceremonial paraphernalia, Pepper (1920, p. 377) suggested the vases were altar supports for ceremonial sticks. Among those we collected, nothing indicative of such usage was observed.

Of nearly 200 cylindrical vases recorded from Pueblo Bonito[49] all

[49] Hyde's table 2 (Pepper, 1920, pp. 359-362) lists 165 examples but includes only 111 from R. 28, whereas Pepper (ibid., p. 121) counts 114. Both overlook the 8 partially restored examples from the second story of R. 28 (ibid., p. 122). Hyde erroneously lists R. 36 instead of R. 33 as source of two. (See Pepper,

but 17 were found in Old Bonitian dwellings, yet none is decorated with characteristic Old Bonitian designs. Not a single fragment of one was exposed by our cuts through Old Bonitian rubbish underlying the West Court. Technique of manufacture, ornamentation, and stratigraphic evidence unite in correlating cylindrical vases with the later phases of Bonitian history. Nevertheless, differences are to be noted among those recovered by the Society's expeditions.

Of our 17, the three with constricted orifices (pl. 67, figs. *e-g*) are stone-polished externally, including the base; the large example with base missing (*a*), salvaged from household debris dumped through the southwest door of Room 251, is likewise stone-polished. All the others are hand-smoothed and thinly slipped; only two (pl. 68, figs. *a, c*) are slip-washed on the bottom. Excepting figure *d* on plate 67, figure *k* on plate 68, and the three with constricted mouths, all exhibit a casual band of slip paint from 1 to 4 inches wide on the inner lip. With the same five exceptions, plus figure *a*, plate 67, all have black-painted rims; the line break is evident in all but one, and here a third of the rim is missing. Perhaps in a moment of supercaution the potter who painted the vase shown in figure *l*, plate 68, provided two line breaks, one opposite the other, for escape of the vessel's spirit. Squiggled composing lines appear in the designs on fully half the specimens.

Fifteen of our 17 vases are flat-bottomed, and unquestionably that from Room 251 was also. Only one (pl. 67, fig. *e*) has a base so rounded it cannot stand without support. Handles would, therefore, seem superfluous and yet all are equipped, $\frac{1}{4}$ to $2\frac{3}{4}$ inches below the rim, with loops, lugs, or punched holes. These may have been designed for suspension cords but, if so, why the flat bottoms?

Whatever their purpose, horizontal loops were preferred: Eight of our specimens are provided with four; two with three; and one with two only. Generally the loops are sharply upturned, but in two instances they lie at right angles to the vessel wall and are so small it was necessary, after attaching them, to enlarge the opening with an awl or stick. One vase has four vertical loops. The fragmentary example from Room 251, with drilled holes near the rim evidencing ancient repairs, is equipped with four lugs, horizontally punched. Our second white-slipped, undecorated specimen likewise has four lugs, but they are punched vertically. The three with constricted orifice were pro-

1909, pp. 212, 221, pl. 3; 1920, p. 164, fig. 70.) The National Geographic Society recovered 17. A double vase is illustrated by Moorehead (1906, p. 45, fig. 10). He lists it (p. 34) as from "a small cemetery about one mile from the principal ruin"; describes it (p. 41) as from "one of the underground rooms" of Pueblo Bonito. The latter source is deemed correct.

vided, not with lugs or loops, but with paired holes about half an inch apart, punched through near the lip while the clay was still moist. That shown as figure *f*, plate 67, has four pairs; the others, two pairs each.

If these cylindrical vases are of Late Bonitian manufacture, how shall we explain their presence in Old Bonitian dwellings? Of the 17 recovered by the Society's representatives, 16 came from Rooms 320, 326, 329, and 330. In these four Bonitian rooms 68 bodies had been interred, most of them to be disturbed within a few years. Although none of our vases lay closely associated with a body, I have no doubt all were burial offerings and on a plane with other vessels from the same rooms (plates 96, right; 97, upper; 99, upper).

Hyde's list (Pepper, 1920, pp. 359-362) of 165 cylindrical vases represents 14 rooms, 7 of which I regard as Old Bonitian structures. From 3 of the latter, ground-floor Rooms 32, 33, and 53, 6 or more vases and at least 17 skeletons were removed. No vase is reported from Room 56, adjoining, in which several bodies were interred; no body is reported from Room 28 in which 111 vases were found. Eight broken vases were recovered in 28B; 39 are listed from the second story of Room 39b and from Room 52. One hundred sixty-four cylindrical vases from seven adjacent Old Bonitian houses!

Room 52, from which Hyde catalogs 20 vases, is the second story of Room 32. The latter is described by Pepper (ibid., pp. 129-163) as a small, sand-filled chamber that contained one disarticulated skeleton, over 300 ceremonial sticks, and numerous other objects including three or five cylindrical vases.[50] On the floor of the second story of Room 39b, apparently grouped in three piles, were 19 vases and a bowl, all broken (ibid., pp. 198-199, fig. 87). The other artifacts reported from the two houses are, with the possible exception of a cylindrical pipe and an elkbone club, implements and utensils of everyday use.

Room 28 offers an entirely different problem. Here, according to Hyde's tables (Pepper, 1920, pp. 359-372), were found 111 cylindrical vases, 39 bowls, 24 pitchers, an earthenware effigy and a vessel of animal form; 75 stone jar covers and 2 stone knives; 3 bone implements; 2 pieces of worked wood; 5 shell beads; and 2 bracelets. Pepper (ibid., pp. 112-126) notes the presence of numerous items not listed by Hyde, including shell beads of various types, turquoise beads and pendants.

But we are less concerned at the moment with the diversity and multiplicity of artifacts from Room 28 than with the number of

[50] Hyde lists three, but Pepper's text indicates five.

cylindrical vases. Hyde lists 111, while Pepper gives the total as 114. The difference between the two figures is of little consequence, but why should 114, or even 111, cylindrical vases be in a single room? Three of them, together with four pitchers, twenty-six bowls, and two or three coiled baskets, lay in the northeast corner, fronting the open door into Room 51a. Opposite, a fourth vase and an accompanying pitcher stood a few inches from the west jamb of the south door (Pepper print No. 115, herein pl. 7, upper). On the same level but a couple of steps farther west were 8 bowls, 18 pitchers, and 110 cylindrical vases piled on "an area of twenty square feet."

At first glance, Pepper's photographs of this remarkable assemblage show a more or less heterogeneous mass of pottery, but closer examination reveals a majority of the vases lying in rows. Those in the middle and at the left generally face north, while four of those at the north margin of the pile face south, two face north, and one stands upright. There can be no question that the whole lot had been intentionally placed where Pepper found it.

The motive behind this grouping of 136 vessels is not to be discovered in Pepper's published field notes. If they were being reserved for ceremonial use, as Pepper believed, greater care surely would have been taken to place them close to a wall for protection, or behind a ceiling prop, as was done with the materials left in nearby rooms.

Most of the vases visible in Pepper's illustrations and most of those we unearthed are decorated with the obliquely hatched, geometric designs peculiar to Late Bonitian potters. None bears ornamentation I would attribute to the Old Bonitians. No fragment of a cylindrical vase appeared in our two stratigraphic columns through Old Bonitian rubbish under the West Court—two tests that included 225 cubic feet of previously undisturbed household waste. We may only conclude, therefore, that the 110 cylindrical vases piled on the middle floor of Room 28, together with their associated bowls and pitchers, were produced and stored there by the Late Bonitian builders and rebuilders of second-story Rooms 28B, 55, and 57. Otherwise it is necessary to assume that all those vessels were the acquisition of some Old Bonitian family retaining occupancy rights to Room 28.

The latter alternative is supported, however weakly, by two facts: (1) A passageway at the east end of Room 28 afforded access to Old Bonitian houses next on the north even after the west half of the room was partly filled with debris of reconstruction; (2) the 35 earthenware vessels at or slightly above sill level of the two open doors at either end of that passage included several bowls bearing typical Old Bonitian decoration (Pepper, 1920, p. 116, fig. 44).

Pepper reports no fewer than 47 vases from second-story rooms 28B, 52, and that over 39b. Room 28B was of Late Bonitian construction, one of the last built in the village, and 52 may have been remodeled at the same time. Room 39b, however, is one of eight with quite un-Bonitian masonry right in the middle of Old Bonito. It is not unlikely that this block of houses was erected by immigrants from beyond the San Juan and thus a logical source for the Mesa Verde-like mugs Pepper found in Room 32 (Pepper, 1920, fig. 47, *a, c;* herein, pl. 7, lower).

Scraps of Mesa Verde pottery were found only in the uppermost layers of household sweepings at Pueblo Bonito, a fact that places such ware relatively late in local history. The pottery hoard on the middle floor of Room 28 was overlain by debris of reconstruction dumped in when the room above was repaired and partially rebuilt with masonry of the fourth, and last, type developed here. We do not know how many years that pottery had lain there undisturbed, but it was long enough, according to Pepper, to allow 10 inches of blown sand to settle about the pile before it was covered by constructional waste.

Among the cylindrical vases from Room 28 was one of red ware, burnished but without painted decoration. Because it was unique in the lot, Pepper speculated upon its place of origin and even ventured the thought that it might have been brought "from some other part of the country to serve as a model for the potters in making their whiteware" (Pepper, 1920, p. 120). The description and dimensions of this vessel agree closely with three red-ware vases we restored from fragments found in Room 15, Pueblo del Arroyo, one of which is shown on plate 67, figure *c*. As with that noted by Pepper, absence of handles plus a conical shape—each has a flat base the diameter of which is about half that at the lip—set these three apart from our other vases. They may indeed be foreign to Chaco Canyon but only expert analysis of the paste could determine this point. Each is stone-polished, the strokes being lengthwise of the vessel externally; each has a thin tapering rim that varies from round to flat and lacks the familiar black line of local wares. Tempering agents, identified under a hand lens, are sand, pulverized rock, and a substance that looks like bits of white clay, these being predominant in at least one vessel.

Miniature vessels duplicate, or seek to duplicate, the form and ornamentation of normal vessels. Of those illustrated (pl. 69), several conceivably were designed as children's toys. Larger examples are included only because they happen to be among the smallest of their class in our Pueblo Bonito collection. Since the gradation between

presumed toys and useful utensils is imperceptible it is quite impossible to say where one group leaves off and the other begins.

The fragmentary pitcher, plate 69, figure *i*, was made of bands, not coils. After its current height was attained, its walls were thickened to increase their external regularity and carried upward perhaps another inch; a vertical loop handle was attached without riveting; the outside was heavily slipped and inexpertly polished. Abrasion has worn through the slip on the base, which is centrally cupped. In keeping with its shape and decoration, the bottom of figure *k* is likewise concave. Figure *l* was found in Old Bonitian rubbish 35 feet north of Room 135 during the digging of our West Court exploratory trench.

To the little bowl, *c*, additional clay was applied in an effort to improve its basal contour. But the added material was too dry and eventually scaled off, revealing the original base, crosshatched by a sharp instrument in a vain effort to insure adhesion. Bowl *f*, of Chaco–San Juan workmanship and decoration, was found in debris filling the second-story door between Rooms 13 and 14-85. Pepper (1920, p. 67) observes that a number of like bowls lay near floor level in Room 13.

Our two small ladles, *a, b*, are both of the old-fashioned, half-gourd type. The first, unslipped and undecorated, came from Room 350, one of two adjoining subterranean structures at the south end of the West Court. Neither the nondescript masonry of the two rooms nor the few objects found in them, including fragments with late hatching, gave a certain clue to the builders. The second ladle is that found with a very amateurish bowl in Old Bonitian Room 307 (see fig. *g*, pl. 53). Our smallest bowl-and-handle ladle is illustrated on plate 61, figure *d*.

The foregoing may have been made to serve either as toys or as lessons in technique for youthful potters. Contrasted with them, are the six miniatures shown in figure 53. All are from household rubbish; all are relatively crude, unsurfaced, unslipped, and unpainted. The two smallest bowls were modeled over the end of thumb or finger. Miss Bartlett (1934, p. 53) describes comparable miniatures from Pueblo II sites in the San Francisco Mountain region and notes that modern Hopi potters make like examples as offerings to be left at clay pits. And I have heard it stated these same potters make and fire miniatures to insure successful manufacture of standard earthenware vessels, just as Hopi men plant effigies in their fields as a sort of objective prayer for bountiful crops of corn, squashes, melons, etc.; just as men of the Hopi and other Southwestern tribes deposit effigies

of domestic animals in corrals and on the range as prayers for herd increase.[51]

Among reworked potsherds, we have several inset jar handles, their broken edges smoothed by abrasion. It is quite possible that these also were utilized as toy dishes by small girls (fig. 51).

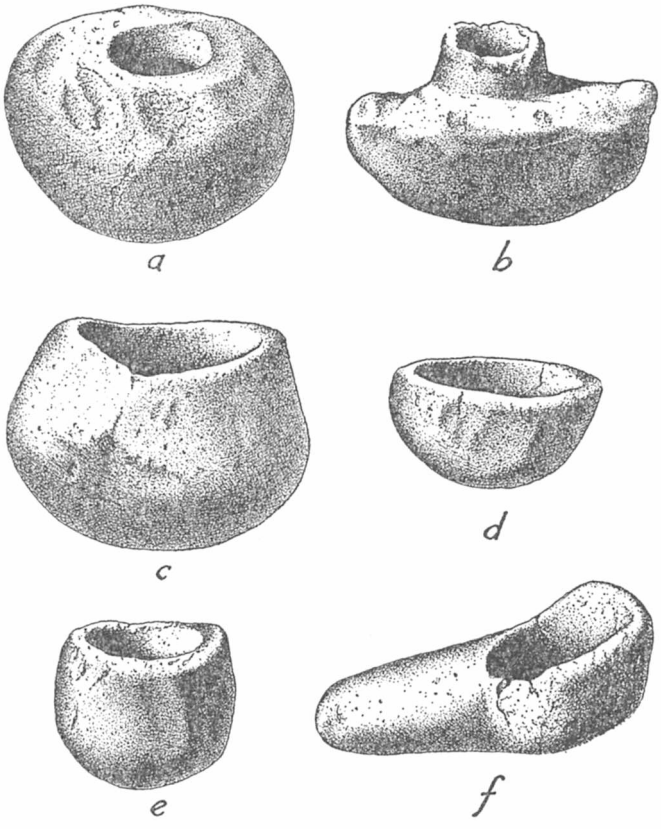


FIG. 53.—Crude miniature vessels.

Effigy vessels.—In contrast to the Toltec, Zapotec, Maya, and other tribes of Middle America, the prehistoric Pueblos did not make special funerary vases. Their pottery was almost wholly utilitarian. But,

[51] Under a shallow ledge in upper Chaco Canyon and inside a "corral" of sandstone spalls, I found a number of rude, unfired clay models of sheep, cattle, and horses, some of the latter bearing saddles, placed there by one of our Navaho workmen who grazed his stock in that part of the valley. His explanation was that the models protected his animals from lightning when he was away. (U.S.N.M. Nos. 334415-334416.)

like their living descendants, they occasionally ventured forms utterly impractical (from my point of view) as household utensils. Some of these represent birds or human beings, deer, and other mammals. Fragments of effigy vessels were recovered from every trash heap and from exploratory trenches here and there. A majority of such fragments are of Old Bonitian origin.

Mention has already been made of animal figures painted on bowls; as sculptured handles on pitchers, canteens, and small jars. Those now before us are more ambitious attempts at modeling since they were actual containers that individually portrayed a creature the potter had seen or fancied. Their possible purpose is suggested in Stevenson's discussion of the diverse objects purchased in Pueblo villages in 1879 wherein it is stated that representations of animals were "made hollow for use as drinking vessels" (Stevenson, 1883, p. 334).

Bird bowls were perhaps most common among effigy vessels at Pueblo Bonito. Two restored examples are illustrated on plate 63, middle). Both are thinly slipped outside; both have T-shaped openings, the inner edge of which is painted black. In the case of the smaller specimen, this edge line is broken by a "spirit path" directly behind the head; on the other, the break occurs slightly to one side. Both vessels have heads with protuberant eyes marked by central dots; on the smaller, these dots are ringed about—a frequent practice. Such heads, attached by the riveting process, are generally solid and faced front. Only one in our sherd series has its beak turned sidewise; only one, from a larger vessel, is hollow.

Most of our bird-bowl sherds are ornamented with straight-line hatching. In this, successive periods are represented. The series also includes a pinkish, stone-polished but undecorated fragment and two black-on-white body sherds each with a flattish back that was made separately and attached so its edge projects slightly.

To judge from sherds in hand, Bonitian bird vessels generally had a T-shaped orifice on the back and a small modeled head projecting from the upper breast. Exceptions, of course, are the so-called "duck" pitchers (pl. 63, lower). The fragment of one such, exhibiting a longer, broader back than usual, has two holes punched through the tail end at back level. The stub remaining is flat, solid, and an inch and a quarter wide. It suggests a handle that reached rearward and then toward the neck with more than customary freedom and flourish.

This fragment has further interest as one on which the potter clearly altered her planned ornamentation. Single lines as borders for hatched figures were first drawn from either side of the handle forward to meet in a sharp angle behind the neck. Then, with only two

lines painted in, the whole design was changed. Instead of elements curving forward from the rear, straight-hatched bars swept up from both sides to incorporate the extremes of the two lines initially drawn. Their unused portions had to be removed and this was accomplished by scraping off the paint, together with the thin underlying slip.

Next to birds, the ungulates seem most to have inspired Bonitian creators of effigy vessels. A goat clearly is represented in figure 54, *a*, but what kind of goat? Found in Old Bonitian Room 323, the fragment possesses the nose and beard of modern Navaho and Pueblo goats—descendants of Spanish flocks first introduced into the Southwest no less than 400 years after Pueblo Bonito was abandoned. The modeling is skillfully done; the ornamentation appears typically Bonitian; the broken edge has been rubbed. There is no native animal with like beard and nose known to the Southwest.

Still puzzled over this sherd, as I was while reviewing these paragraphs in 1945, I sent a small fragment to Miss Shepard and asked her opinion. She replied: "The chip has a sherd-tempered, dense, buff-burning paste which is perfectly typical of Chaco. This type of paste, however, is not limited to Chaco because buff-burning cretaceous clays are widely distributed in the San Juan and the practice of using sherd temper was also common. Composition of paint and quality of finish might help to localize the piece." The fragment remains, for me, entirely enigmatic.

We found bones of mule deer, pronghorn, elk, and mountain sheep in local rubbish piles and there is probably no reason why the potters of Pueblo Bonito should not have modeled all four species. But it is quite impossible to recognize any of them among the sherds before us. Head fragments show a more or less bovine face; horns, without exception, curve to the rear and outward. The head may be hollow, but the horns are always solid and painted black, striped, or spotted. Branched antlers are not indicated. Legs are usually solid and cloven-footed.

Ruminants are also suggested by the three fragments of small-mouthed containers illustrated by figures 55, *a-c*. The butt of a flattish handle remains at the back of the first head (*a*) (field No. 2206-misc.); the third (*c*) is provided with a small, semiround loop. This latter fragment, from which ears or horns have been broken, apparently served as a toy after its fractured lower edge was smoothed by abrasion. Our goat-head fragment was similarly treated. Part of a fourth vessel, the constricted orifice of which features an animal, is shown in figure 56.

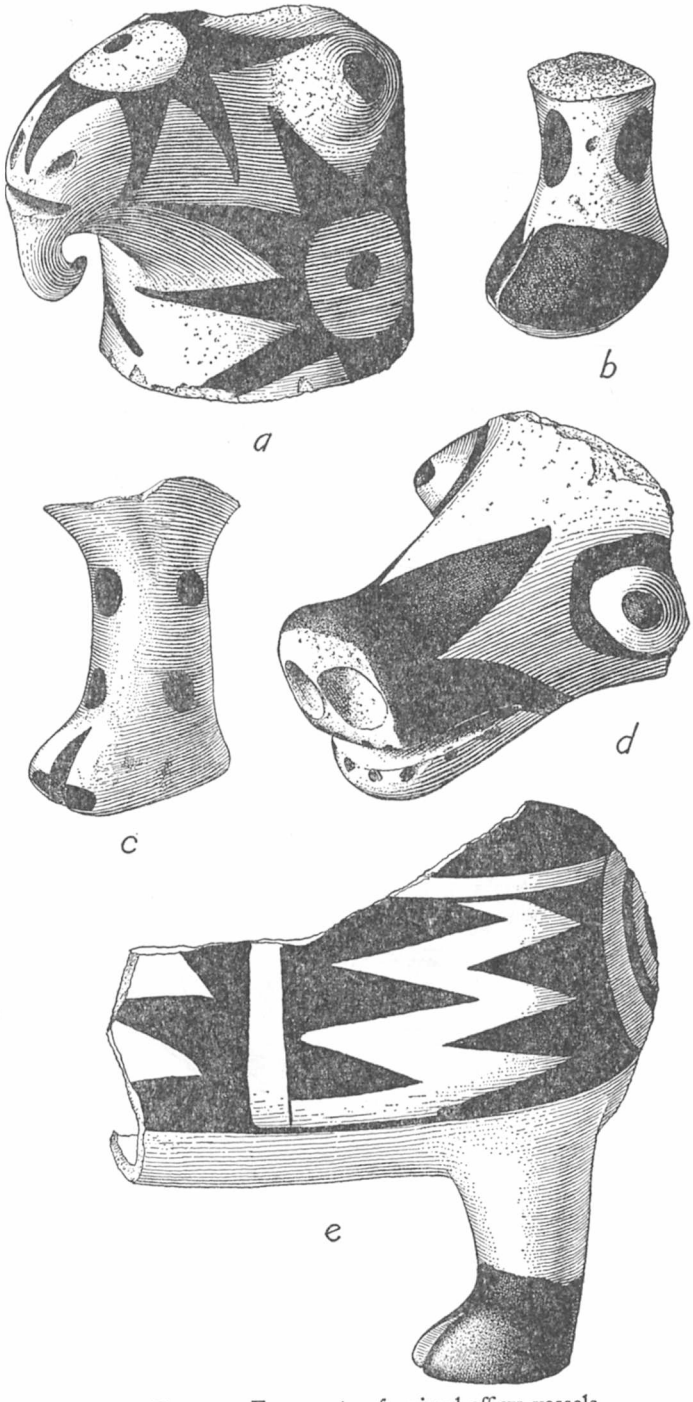


FIG. 54.—Fragments of animal-effigy vessels.

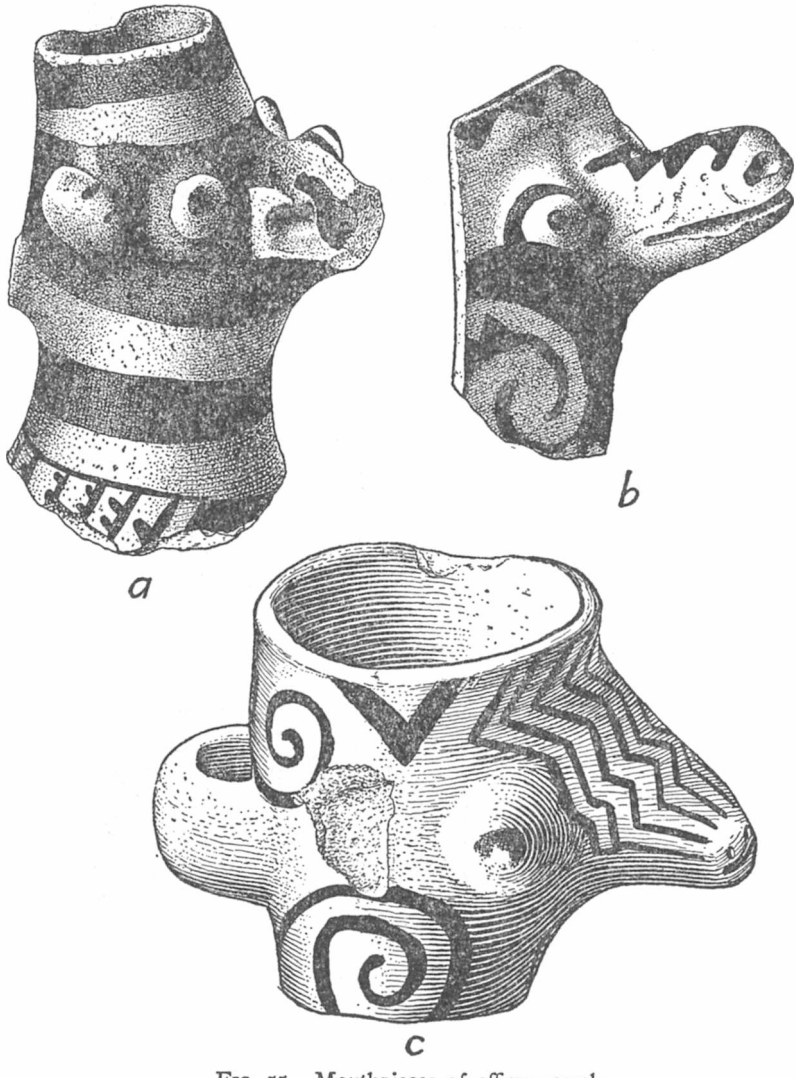


FIG. 55.—Mouthpieces of effigy vessels.

Bear effigies surely are represented by two broad-soled feet (fig. 57). On the second of these, painted black except for sole and heel, claws are incised and painted; the bare sole is marked by four lines incised heelward from between the toes and ending midway at the second of two subsequently scratched cross lines. In 1925, Gus Griffin,

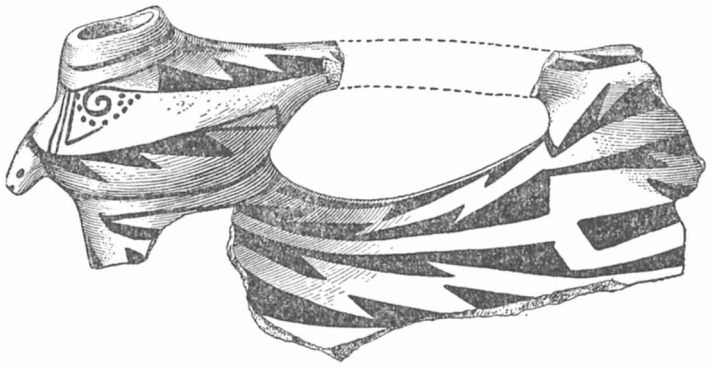


FIG. 56.—The orifice and back of an effigy vessel.

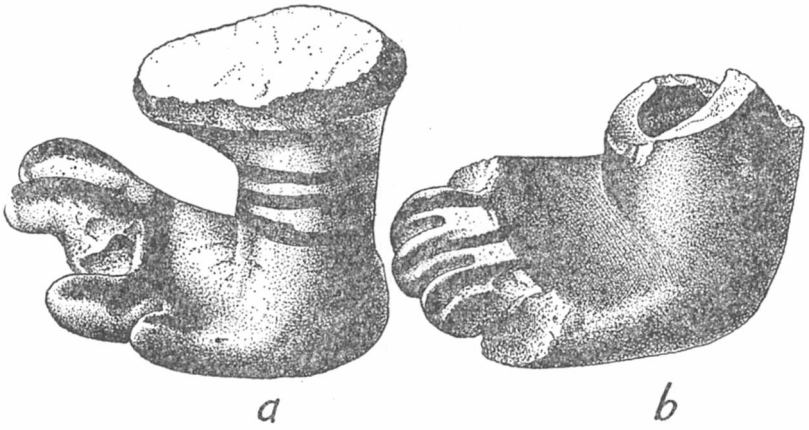


FIG. 57.—Fragments of bear-effigy vessels.

then custodian of Chaco Canyon National Monument, had in his possession the major portion of a bear effigy, of stone-polished but unpainted red ware, said to have been found near Pueblo Bonito (pl. 66, C).

We recovered only two sherds of black-on-red effigy vessels: Part of a broad, flat-soled foot from a bear or human figurine and a fragment of what probably was a "duck"-shaped pitcher. Color and sur-

face treatment of both are of early type. Quartz sand is visible as a tempering agent in the first; pulverized potsherds, in the second.

Because of its length and high hock, the leg shown in figure 58 is very likely from a mountain-lion effigy—the left hind leg.

That lower forms of life occasionally furnished themes for Bonitian potters is evident from head fragments representing, respectively, a

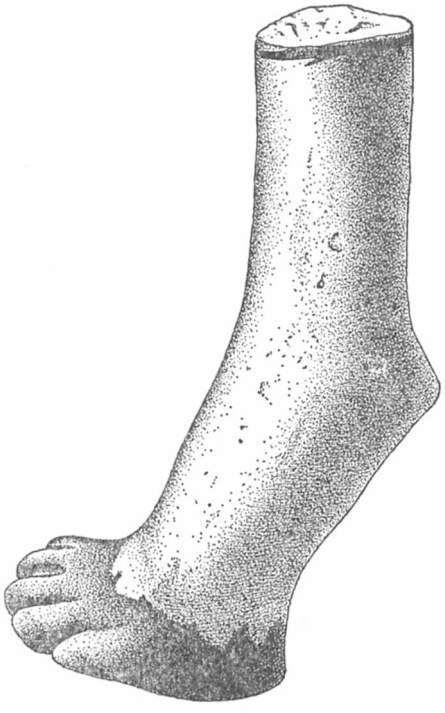


FIG. 58.—Fragment of a cougar effigy.

turtle- or tortoise-shaped container and one in the form of a toad (fig. 59). A third fragment shows a toad as subject for a pitcher handle. Among the present-day Hopi and Zuñi, toads are associated with water; they bring rain.

Human-effigy bottles seemingly were more common at Pueblo Bonito than at other southwestern ruins. Our collection includes fragments of 41 distinct vessels and a half dozen additional questionable pieces. Of this total, three were recovered from as many kivas; eight from six separate dwellings; and the remainder chiefly during the course of trenching operations in the two courts and the south refuse

mounds. One, possibly two, of the kivas and four of the dwellings had been abandoned and utilized as communal dumping places; lesser amounts of debris were indicated in the other structures. Thus all our human-effigy fragments may be regarded as sherds of vessels broken and casually tossed aside. And the same is apparently true of those Pepper found below the floor of Room 25 and in the fill of Room 38 (Pepper, 1920, pp. 100, 192).

Although the drawings herewith are offered in lieu of detailed description, a few general observations may add to their interest. Both standing and seated figures are represented; among the latter, a squatting position with knees elevated and feet flat upon the ground is

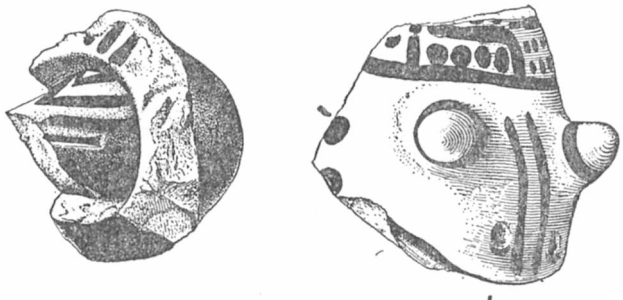


FIG. 59.—Head fragments of tortoise- and toad-effigy vessels.

most common. We note only one example in which the knees actually touch. In one instance only the left shin crosses behind and against the right calf. Our lone example in which the lower legs and heels are modeled against the body is illustrated by figure 60. Forearms, when present, are shown in the round, with hands resting on knee, calf, or shin.

Our six forearm fragments are all solid; of 20 lower leg fragments, 15 are solid. Ordinarily the inside ankle joint, if shown at all, is less prominent than its opposite; the calf bulge is rarely represented. A partially polished but undecorated pair (field No. 2257) possess solid calves, hollow thighs; they are two of the five effigy fragments unearthed while digging our West Court trench. Limb ornamentation, when present, depicts arm bands and bracelets, anklets and sandals (fig. 61). On one fragment a sandal is represented by oblique, painted lines on the sole while, above, crossed tie cords lead from the ankle forward to pass outside the second and third toes and twice around the two. One small foot has six toes. The only sherd in the whole lot evidencing re-use is a braceleted forearm ground off at the upper

end (fig. 61, *b*). One left leg fragment is unique for two reasons: It was modeled over a round, ¼-inch stick that, withdrawn, left a cylindrical tube through the leg and out the bottom; a hand, presumably the right, reached backward to rest against the inner calf. The inside front quarter of this leg is only partially smoothed and slipped, showing that the posture of the figure interfered with its modeling.

Three of the six head fragments retain portions of the small, direct-rimmed orifice that led me to classify as "bottles" all the effigy

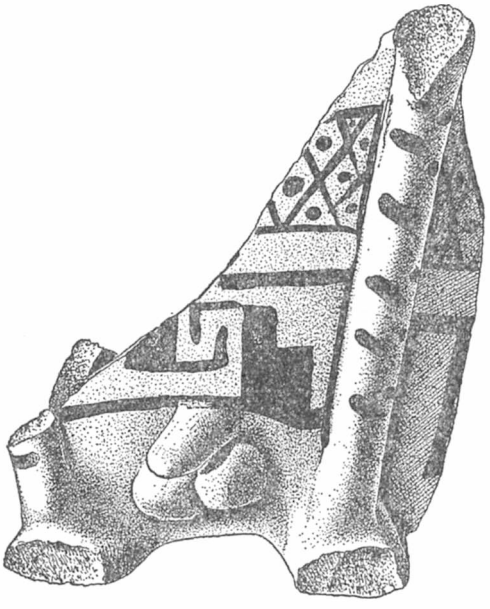


FIG. 60.—Body fragment from a human-effigy vessel.

vessels here represented (fig. 62). A like opening is to be seen on a head from Room 38 and on the only complete human effigy from Chaco Canyon of which I have record (Pepper, 1906, pls. 28, 29). This latter portrays a squatting hunchback with elbows on knees, hands crossing on chest. Morris (1919a, pp. 82-83), who found fragments of at least six human effigies in Aztec Ruin, illustrates the torso of one seated with arms crossed and hands resting on knees.

As might be expected, unequal skill in modeling facial features is evident in our series. Faces are rather flat, eyes and mouth usually represented by incised lines. On two specimens, the ears were pierced during the manufacturing process; the nose of another (fig. 62, *d*), with painted dots for nostrils, was drilled transversely sometime after

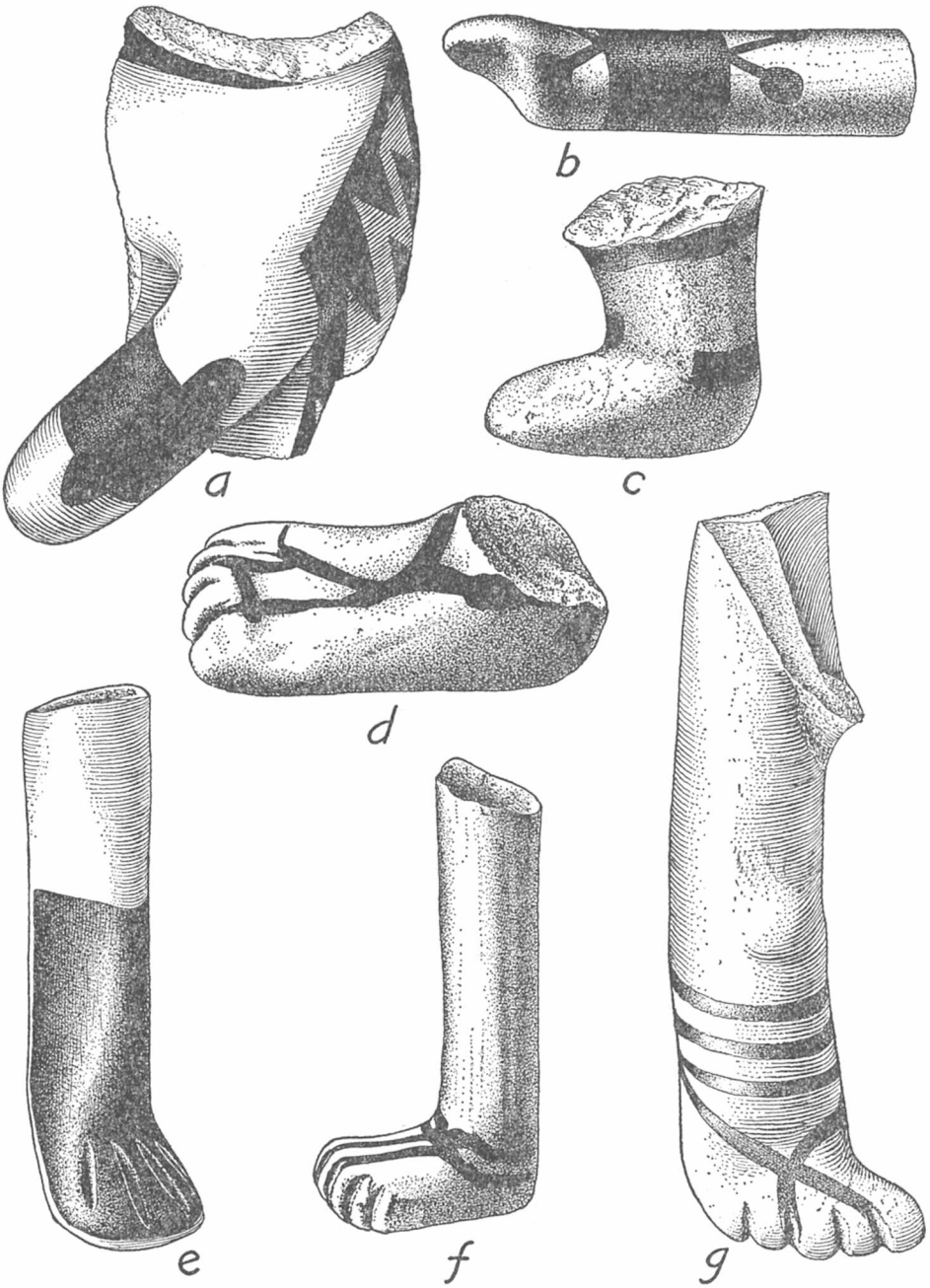


FIG. 61.—Arm and leg fragments from human-effigy vessels.

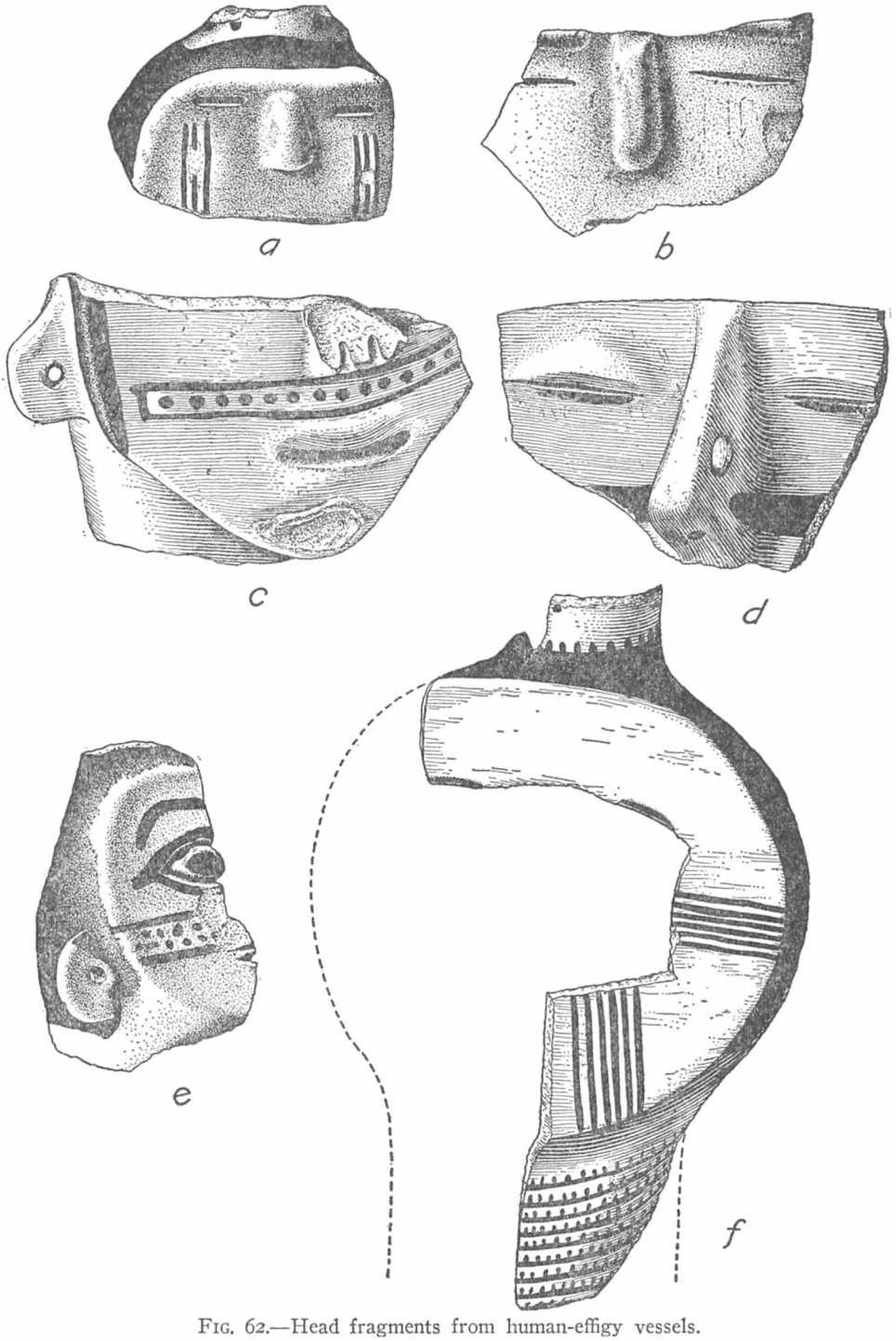


FIG. 62.—Head fragments from human-effigy vessels.

firing. Painted decoration on cheek or upper lip may represent tatooing or mere space filling.

The original purpose of these human-effigy vessels remains unknown. As containers they were of limited utilitarian value. We have no fact to justify belief in their ceremonial import. Nevertheless it is quite possible they served in unknown rituals just as bird and animal figures serve on certain modern Pueblo altars. Stone "idols" of the recent past are better known. Chroniclers of the Conquest period repeatedly refer to them and to the "idolatry" of the Indians. Mrs. Stevenson (1904, pp. 428-429) reported that one of the Zuñi fraternities, between 1880 and 1890, guarded and periodically employed as an altar piece a rude stone carving of a female, 10 inches high. Nelson (1914, p. 91) found a sculptured figure and other objects on an altar platform in Pueblo Blanco, a Galisteo Basin ruin. Kidder (1932, pp. 86-89) exhumed four human effigies of stone at Pecos, one of them seated with elbows on knees and hands on chest. But nowhere do I find record of an *earthenware* figure, male or female, unquestionably associated with Pueblo religion, past or present.

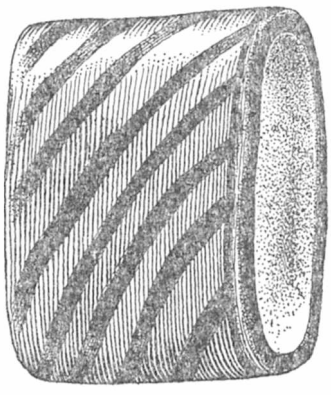


FIG. 63.—"Napkin ring."

"Napkin rings."—The Bonitians assuredly never dreamed of tablecloths and napkins. They had no need for napkin rings and yet the earthenware object represented in figure 63 resembles one more closely than anything else. It was one of the funerary offerings buried with a woman (Skeleton 5) in Room 326 (pl. 94, right). It is oval in shape, red-slipped, and decorated with thin black paint. Marks of the polishing stone lie at right angles to the longer dimension. Both edges, right and left, are rounded and unpainted. That on the right is bordered by a black line; that on the left is perceptibly thinner except at its curved ends, the reduction being entirely on the inside wall. On the left side only, the edge at each end has been worn away as if a slight projection were purposely eliminated. This fact, together with the black border opposite, suggests that our specimen was designed to stand on what I have described as the left side, perhaps attached above the mouth of a canteen or comparable vessel.

Pepper (1920, p. 101) likewise was reminded of a napkin ring when he found a jar neck, the broken edge of which had been smoothed by abrasion.

Potrests (?).—On plate 53, upper, are shown neck portions of two cooking pots which might have been utilized as supports for water jars or other round-bottomed vessels. That on the left is a typical example of Late Bonitian corrugated-coil from third-period Room 285; both upper and lower edges have been evened by chipping. The other is the coiled neck of a smooth-bodied Pueblo II pot, broken where the two parts joined. Its deeply indented design was formed with a blunt instrument as the coils were laid down. The fragment came from Old Bonitian Room 326.

Re-used vessel fragments.—The vast quantities of sherds unearthed during the course of our explorations evidence a high mortality rate for earthenware vessels at Pueblo Bonito. However, fragments large enough to serve some household purpose were not always discarded. We have several ladle bowls, for instance, that were continued in use after the stub of a broken handle had been rubbed away with a piece of sandstone. And there is the bottom of a pitcher whose broken edge had been smoothed by abrasion to leave a shallow, if lop-sided, dish (U.S.N.M. No. 336315); half of a small proto-Mesa Verde bowl that long served as a scoop or ladle (No. 336375).

Pottery scrapers.—In the two principal refuse mounds south of the ruin and in every lesser accumulation of household debris we encountered numbers of purposely shaped fragments of earthenware. A majority of these, from their form and worn edges, are identifiable as potters' tools—scrapers for thinning and smoothing the walls of vessels during the manufacturing process. Two typical examples are illustrated in figure 47. On smaller ones, two or even three edges show use, the wear being more abrupt and usually toward the concave face.

Sherds of culinary wares were apparently never utilized as pottery scrapers. Bowls and ollas only are represented among the specimens before me. Black-on-white scrapers naturally predominate, with proportionate numbers of black-on-red and polished-black-interior. One of them, found in Kiva H, was made from a fragment of proto-Kayenta polychrome.

Miscellaneous worked sherds.—Our collection includes a number of pottery fragments, their broken edges rubbed in greater or less degree, for which we have no explanation. Many doubtless are the work of children and perhaps served as toys. Thus the body fragment of a small pitcher (fig. 51, *a*), and two inset olla handles (*b* and *c*) could have answered small girls as bowls for imaginary housekeeping.

Pottery disks are commonly found about Pueblo ruins and have been described as "gaming disks" or "unfinished spindle whorls."

Those we recovered at Pueblo Bonito range in diameter from ¾ to 2½ inches; their edges are usually rubbed but rarely do the results evidence a serious effort toward symmetry. In a few instances the middle of the convex side or the rim of the concave face, rarely both, have been abraded as though to flatten the disk. Culin (1907, pp. 799-800) calls attention to the resemblance of such disks, both drilled and undrilled, to those employed in a Zuñi game of "stone warriors," described by Cushing.

Pendants made from colorful potsherds have been considered under ornaments.

Earthenware stamps.—The two broken objects illustrated in figure 64 are undeniably stamps, but we have no clue to the materials on which they left an imprint; neither can we determine whether they were made locally or imported. They are unique, I believe, in the Pueblo area. Both are made of a whitish clay containing much calcium carbonate and a little fine sand, elements not sufficiently distinctive to identify the place of origin. The first has a smoothly puddled surface, while tool marks remain on the second. The carved design on this latter is still partially filled with the dried remnants of a liquid clay the same color as the stamp itself. Both were lightly fired, if at all, since a thumbnail scratches the surface. Both are too soft to have impressed anything more resistant than moist clay, cloth, or the human skin. There is no trace of attrition on either; no object bearing their imprint was found in all our digging.

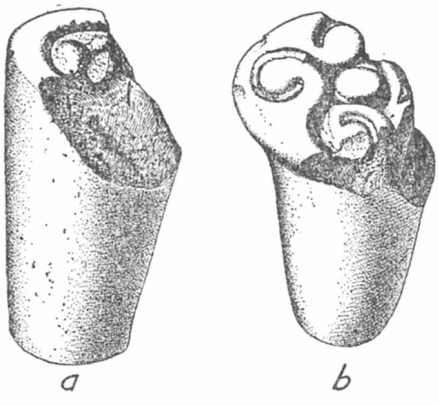


FIG. 64.—Earthenware stamps.

The first is one of nine artifacts, mostly fragmentary, recovered from Room 200, a formerly sealed ground-floor chamber of second-type masonry in the outermost northern tier. Its lesser end, eleven-sixteenths inch in diameter, may also have been a stamp, for it has been ringed to a depth of one-eighth inch leaving a centered flattish cone whose apex lies flush with the rounded rim. Our second specimen was found in debris of occupation that overlay 3 feet of sand in Room 248, a reconstructed dwelling on the east side of the village. I have no published record of like stamps from the Southwest, including Chihuahua and Sonora.

Cloisonné work.—Pepper describes one fragment as sandstone, painted in black, red, yellow, and white, and adds that "a similar specimen was found in another part of the ruin" (Pepper, 1920, pp. 51-52). Other writers have referred to these important pieces both as sandstone and as pottery; have suggested their probable source as late Toltec ruins in the states of Zacatecas or Jalisco, west-central Mexico. My own memorandum, written in 1921 while viewing the fragments as then exhibited at the American Museum of Natural History, is annoyingly incomplete at this moment. It notes two pieces: H-12742, cloisonné on pottery or sandstone (through the glass I could not be sure) from a room in the northern section; H-12743, cloisonné on sandstone found 2 feet below the surface in the southwestern corner of Room 9. This second fragment is clearly that described and figured by Pepper; it is undoubtedly the one Vaillant had before him when he wrote: "The cloisonné specimen found at Pueblo Bonito is not pottery but sandstone, and there is a strong possibility of its being of local manufacture" (Vaillant, 1932, p. 9). The Society's representatives unearthed fragments of painted wood and gourd rind but nothing comparable to the bit of incised, painted sandstone described by Pepper.

Jar stopper.—Our one complete clay jar stopper, unfired, bears on its lower side several angular imprints as though the mud had been pressed down upon a quantity, say, of turquoise matrix (U.S.N.M. No. 336082).

Several other miscellaneous objects of clay or earthenware might have been paraded herein, but I believe we have seen enough—except for those described in chapter VII as having some possible religious connection. Let us turn, then, briefly to review our findings regarding Pueblo Bonito ceramics.

RECAPITULATION

Many of the earthenware vessels recovered by the National Geographic Society were burial offerings; others were casualties of the kitchen. All, irrespective of their fate, are separable into various categories on the basis of shape, ornamentation, and technique of manufacture. The stratigraphic studies and sherd analyses conducted by Roberts and Amsden produced conclusive evidence that local pottery styles changed repeatedly during occupancy of Pueblo Bonito.

Stratigraphy revealed the cultural unity of fragments in previously undisturbed old rubbish underlying the West Court. Only in the upper layers were late sherds encountered and they were propor-

tionally few. Elsewhere, in the two great rubbish piles south of the pueblo and in debris-filled rooms, fragments of early and late pottery were intermixed. The fact that the one group of wares stood alone during the period required for 8 feet of household debris to accumulate, and thereafter invariably occurred in association with wares of the second group, seems to me contributory proof that Pueblo Bonito at its height was the product of two culturally unequal but contemporaneous peoples, the Old Bonitians and the Late Bonitians.

The older ceramic assemblage comprised plain-bodied, banded- or coiled-neck cooking pots and painted vessels whose design elements included ticked and waved lines, interlocking whorls, squiggled hatching chiefly in curvilinear figures, and thin parallel lines often bordering stepped triangles. Among the earlier bowls in this group are those slipped inside and out and often stone-polished. But time brought a decreasing interest in surface finish; a moist hand or gourd scraper replaced the polishing stone.

Most conspicuous among Late Bonitian pottery were new vessel forms ornamented largely with straight-line hatching, over-all corrugated-coil culinary ware, and a black-on-white organic paint variety Amsden and Roberts designated the "Chaco–San Juan." Our exmination of stratified rubbish underlying the West Court showed that while squiggled hatching occurred in practically all layers, straight-line hatching appeared in Strata A-C only (the upper 4′ 2″) of Test II and not at all in Test I. So, too, with the Chaco–San Juan group: Not a single sherd was found in Test I, although 31 fragments were recovered from the three uppermost layers of Test II. Corrugated-coil appeared only in Stratum A, Test I; in A-D of Test II. The lower 8 feet contained fragments of Old Bonitian wares only.

Whether the Chaco–San Juan ware was manufactured at Pueblo Bonito by potters migrant from the San Juan country or imported from the north is a question our studies do not answer. Its style of decoration and its use of organic paint were contrary to local practice, but its treatment of bowl exteriors, even to the slip band at rim, was in the Chaco tradition. The ware made its appearance at Pueblo Bonito suddenly, about the same time as straight-line hatching and before pottery of Mesa Verde kinship was introduced; it continued to be used in Bonitian households after the village had passed its prime and while the population gradually dwindled and dispersed. Fragments of it, comprising 6.6 percent of all tabulated sherds from rooms excavated, occurred most frequently in the rubbish fill of later-type dwellings but were not entirely wanting among Old Boni-

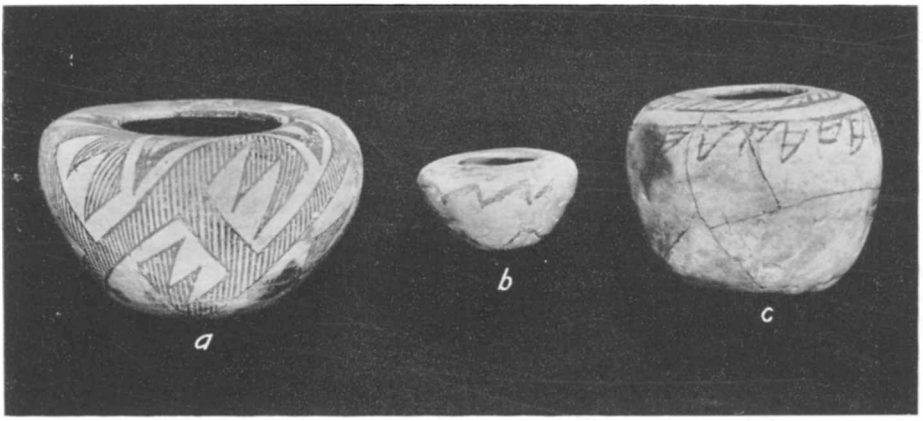
tian debris. We collected fragments of it underneath the floor of Old Bonitian Room 307 and under several Late Bonitian rooms of third-period construction. The presumption is, therefore, that Chaco–San Juan ware came in with the Late Bonitians, introducers of our second-type masonry.

Earthenware vessels hereinbefore described as "Mesa Verde" constitute our largest intrusive group. But they originated in some of the earlier and less spectacular ruins of southwestern Colorado and southeastern Utah, rather than in the famous Mesa Verde cliff dwellings, for beam dates indicate most of these latter were constructed in the twelth and thirteenth centuries whereas sherds of what we have called Mesa Verde ware actually were found underneath Bonitian structures erected before 1100.

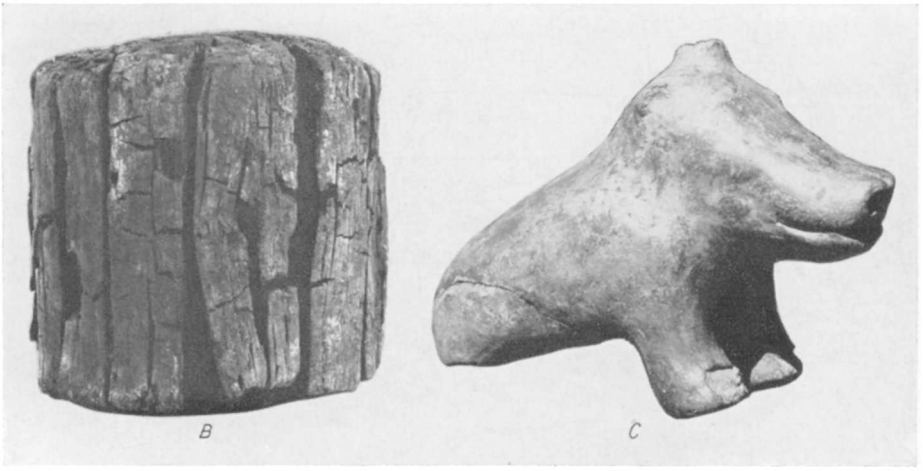
Reporting upon his 1916 examination of the two rubbish mounds fronting Pueblo Bonito, Nelson (1920, pp. 384-385) observes that he first encountered typical Mesa Verde sherds in the middle strata; that fewer of them appeared in the upper layers. Our own inquiries provide corroborative evidence as to the relative recency of Mesa Verde pottery at Pueblo Bonito but no suggestion of any reduction in numbers. We found only one sherd of it in our two stratigraphic sections through old household debris under the West Court and that was in Test II, layer B, 18 to 24 inches below the surface. The proportion of like fragments gathered in excavated rooms (0.4 percent) indicates that importations from the Mesa Verde district were never numerous. A few vessels filtered in before Kivas A, T, and V were built; the majority arrived while the village was at maximum development.

Of the 36 rooms from which we recovered Mesa Verde sherds, six had been Old Bonitian dwellings; the rest, Late Bonitian houses of which five (Rooms 153, 226, 244, 249, 256) were constructed of fourth-type masonry. Of these five, only two had clearly served as neighborhood dumps. A majority of our Mesa Verde fragments came from buildings of third-period stonework in the east and southwest quarters of the village. Two restored bowls and part of a third are shown on plate 58, upper. The bowl and mugs found in Burial Room 32 and the two small mugs from Room 36 (Pepper, 1920, pp. 129-130, 183) prove that these Old Bonitian structures were not sealed until trade with the Mesa Verde district had become established, somewhere around the end of the eleventh century or the beginning of the twelfth.

Commerce with other culture areas was less frequent, if we judge correctly from recovered fragments of their distinctive earthenware.



A, So-called seed jars were provided with constricted orifices that could be covered by stone disks.



B, Wooden stool; *C*, bear effigy.

PLATE 66

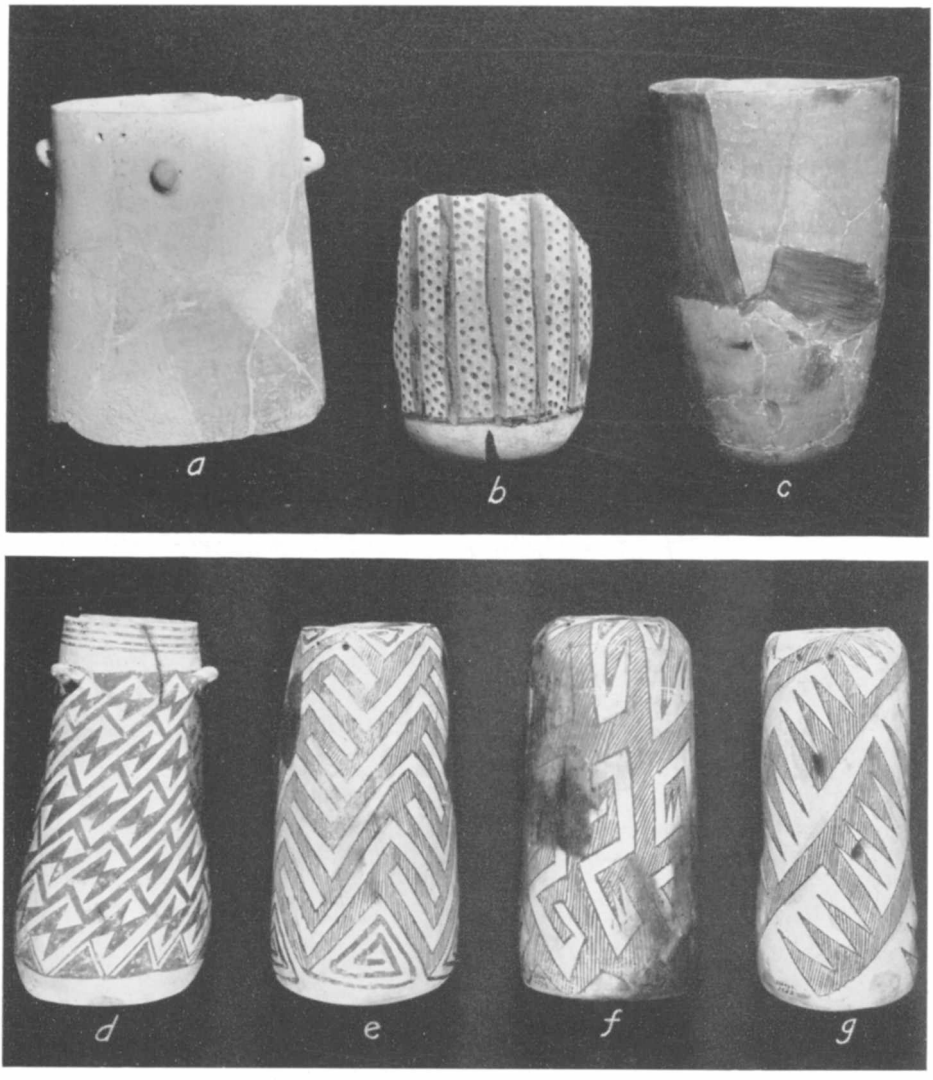


PLATE 67.—Cylindrical vases and fragments.

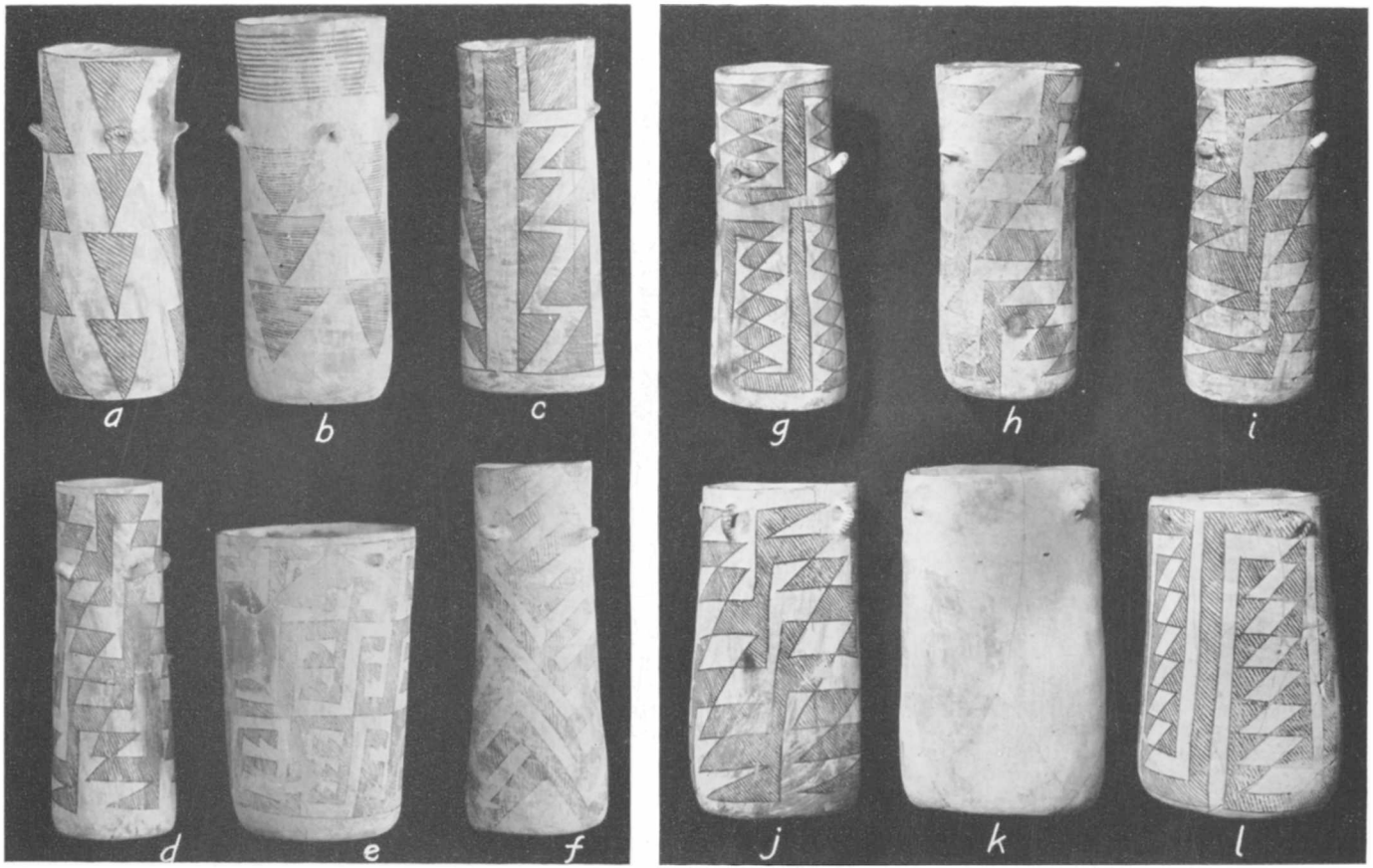


PLATE 68.—Cylindrical vases from burial rooms 329 and 330.



PLATE 69.—Miniature bowls, ladles, and pitchers—probably toy dishes for little Bonitian girls.

Of more than 200,000 sherds tabulated, less than a hundred were recognized as from the Kayenta and Houck districts, eastern Arizona. Proto-Kayenta black-on-red and polychrome are both included. Classic Kayenta is wanting, as would be expected, since Pueblo Bonito was abandoned approximately a century before Betatakin, Keet Seel, and their contemporaries were built. A few fragments of Tularosa ware evidence an occasional traveler from southwestern New Mexico. Although it is reasonable to assume most of these foreign pieces were acquired through trade, others doubtless were left by visitors.

Listing the artifacts he obtained from Pueblo villages in 1879, Stevenson (1883, pp. 307-465) repeatedly directs attention to vessels he suspects originated in villages other than those in which his purchases were made. Jeancon (1923, p. 34), remarking upon the diversity of foreign pottery he unearthed at Poshu, added: "It is still the custom of the Pueblo people to carry gifts of pottery to their friends in other villages where they go to visit." And I distinctly recall that several San Ildefonso acquaintances I met at the Santo Domingo Green Corn Dance in 1920 had some of their own native pottery with them.

Now what is meant when one refers to "typical" Chaco Canyon pottery? At Pueblo Bonito, the only ruin with which we are herein concerned, earthenware divides itself into two principal classifications: Old Bonitian and Late Bonitian. The first of these, on the basis of form, technique, and ornamentation, is readily identified as Pueblo II. Gladwin (1945, pp. 56, 95) remarks its similarity to pottery of his Red Mesa and Wingate Phases. Miss Hawley (1936) and other investigators have each suggested other names.

Geometric designs of straight-line hatching within somewhat heavier frames have long been regarded the earmark of Bonitian ceramics. It is true that pottery so ornamented reached its greatest perfection at Pueblo Bonito, but our studies prove it was not known locally until the village was well along in years, and that it never became preponderant. Early and late types of straight-line hatching together comprised only 8.9 percent of the 203,188 sherds tabulated from rooms excavated. The two principal varieties of Old Bonitian black-on-white ware, Transitional and Degenerate Transitional, formed practically the same proportion (9.3 percent) of the total. Fragments of Old Bonitian culinary pots made up 14.7 percent of the sherds tabulated; corrugated-coil, 33.5 percent. So the older pottery complex is just as typical of Pueblo Bonito as the later. Both early and late vessels are, in large measure, sherd-tempered and decorated with mineral paint.

Straight-line hatching and every design element that distinguishes

our Transitional ware are to be seen also on pottery from Pueblo II–III ruins in southwestern Colorado and in southeastern Utah. They provide the "Chaco-like" quality various students have noted in pottery from that area. This resemblance, together with a not-infrequent Chaco-like quality in both domestic and kiva architecture, have been attributed by some investigators to influence from Chaco Canyon. Although I have made no recent first-hand observations north of the San Juan, the same evidence, it seems to me, points more strongly in the opposite direction. My own observations in Chaco Canyon and my interpretation of the data published by others lead to the conclusion that Old Bonitian pottery developed out of Pueblo I practices inherited from beyond the San Juan; that the more spectacular ceramic art of the Late Bonitians likewise drew its inspiration from the north and attained perfection in Chaco Canyon.

Since the National Geographic Society's Pueblo Bonito investigations were concluded, Dr. Earl H. Morris has published his voluminous study of La Plata Valley archeology, accompanied by Miss Shepard's analysis of the pottery (Morris, 1939). Our immediate interest in these two important reports lies in the fact that both incorporate a few comparative notes on the pottery and ruins of Chaco Canyon. Morris—and there is no one more intimately acquainted with the prehistory of the entire San Juan basin—observes a varying degree of "Chacoesqueness" in much of the early Pueblo III earthenware he unearthed north of the San Juan; he regards as trade pieces the rare pure Chaco pottery encountered, and considers the still rarer Chaco-type ruins evidence of migrant colonists from the southern center. He believes (pp. 205-206) pure Chaco, Chaco-like, and non-Chaco pottery contemporaneous in La Plata Valley and perhaps throughout the entire northern district, and that Mesa Verde ware came into being just as the pure Chaco made its last appearance. This latter conviction is quite in harmony with our deductions at Pueblo Bonito.

Miss Shepard analyzes pastes, paints, and firing methods. She learns that La Plata Valley potters varied their ceramic practices from time to time; that they favored iron oxide paint throughout one period, organic paint in another. Powdered igneous rock was long preferred as a tempering agent only to be partially displaced by pulverized potsherds or a mixture of sherd and rock. Relying upon geological data, Miss Shepard points out the probable places of origin indicated by minerals in the paste. She believes the presence of andesite in earthenware found in Chaco Canyon indicates trade from the La Plata where andesite continued a prominent temper from

Basket Maker III to late Pueblo III times; she believes sanidine basalt in the sherd temper of Chaco-like vessels exhumed in the La Plata country evidences trade from the Chaco, since inclusions of this rock frequently occur in Bonitian sherd-tempered pottery but are not found in La Plata sherd-tempered types (ibid., pp. 279-281).

Now there is something of archeological heresy in all this. Heretofore, lacking precise analytical methods, we had no reason to suspect an extensive prehistoric commerce in pottery and especially in culinary ware. But sanidine basalt was an important and increasingly popular temper in cooking pots used at Pueblo Bonito and the only known accessible source of the rock lies at Washington Pass, in the Chuska Mountains, 50 air miles to the west. Bonitian women either walked that distance and back to get the rock or they imported pots in which it was the temper, unless a nearer outcropping remains to be discovered. At the moment, importation seems the more logical explanation; especially so since sanidine basalt is the strongly dominant temper in cooking-pot fragments from ruins in the vicinity of the rock's known source.

With every confidence in Miss Shepard and her methods of analysis, I sincerely regret that circumstances prevented her thorough inquiry into the makeup of Pueblo Bonito pottery. For me, the whole problem still hangs in midair; I feel certain significant factors still lie hidden. The sherd samples I placed before Miss Shepard in 1936 seemed at the time to offer a trustworthy cross section of local ceramic history. But I am now dubious; I believe a larger, broader sample should have been examined. I find myself hesitating to believe, for example, that andesite in Chaco Canyon pottery always indicates trade from north of the Rio San Juan. Andesite was the temper in 1 out of 18 mineral-paint sherds in a sample of 43 from a Basket Maker III site in upper Chaco Canyon; it was a minor tempering agent in both culinary ware and mineral-paint black-on-white sherds from bottom to top of Test II, through 12 feet of Old Bonitian household waste under the West Court at Pueblo Bonito.

So, too, with the sanidine basalt which Miss Shepard believes may indicate traffic in cooking pots from the Bennett Peak district at Washington Pass to Pueblo Bonito and the subsequent utilization of fragments of those pots as temper in Bonitian earthenware. Because there are, to me, so many pertinent questions not quite convincingly answered by these technological analyses, I should like to see them extended to a larger representation of the successive Chaco Canyon ware. And I should like very much to have Miss Shepard conduct those analyses.

After reading my paragraphs summarizing the data she derived from samples of our Pueblo Bonito sherds, Miss Shepard generously submitted the following in rebuttal:

The sanidine basalt and the andesite found in Bonito pottery present two distinct problems relating to trade, for each kind of rock occurs in particular types of pottery and each is the characteristic temper of a separate region. Mr. Judd questions the postulate that pottery from Bonito with either of these tempers is intrusive. Although trade seems to me to offer the most logical explanation of the facts we now possess, I thoroughly agree with Mr. Judd that conclusions should be deferred until further studies are made. Obviously temper analysis gives only circumstantial evidence, not proof, of origin because the presence in pottery of foreign temper does not reveal whether the material itself or the pottery was imported. Furthermore, after we have located possible sources of a rock we cannot be certain that there were not other and nearer sources unknown to us. It is not generally practicable so thoroughly to comb the area under consideration that we can say with finality that we have located all outcrops of the rock, even though the results of reconnaissance considered in the light of known facts of rock genesis may in some instances indicate occurrences with a high degree of probability. However, this limitation of geological knowledge is not as great a handicap as it seems because the geographic distribution of pottery tempered with a given rock gives more direct evidence of the center of usage of the temper than does the natural occurrence of the rock. Thus we are dependent primarily on thorough archeological survey and excavation, and the correlation of the various classes of technological and stylistic data. These enable us to build up a body of circumstantial evidence relating to trade and sources of influence.

Sanidine basalt, which is a rare and unusual rock, has been found as the principal temper only in the Bennett Peak district east of the Chuska Mountains; also, the only reported outcrops of the rock near ruins are in this locality. Important sites between the Chuska area and the Chaco are not known, therefore our comparison must be between Chuska and Chaco pottery. Mr. Judd doubts that Bonito sherds containing sanidine basalt are trade wares from the Bennett Peak district because it is not generally supposed that pottery was obtained in quantity from distances as great as 50 miles. On the other hand, the theory that sanidine basalt was used by Bonito potters is not supported by occurrences. It is a significant fact that this temper is extremely rare if not entirely absent in Bonito pottery with typical black-on-white hatching. Thin sections of these types clearly show that the rare inclusions of sanidine basalt were introduced through sherd temper, since fragments of the rock occur within the sherd particles. In a sample of 106 sherds of the variously hatched types examined with the binocular microscope, sanidine basalt was found in only one, and without petrographic analysis it is not certain that this was not associated with sherd.

Sanidine basalt occurred in only 3 percent of the total mineral-paint, black-on-white sherds in tests II and IV (layers A to D only) whereas it was present in 58 percent of the organic paint sherds in these tests. The use of organic paint is not a Chaco trait, and only 10 percent of the total black-on-white ware in the two tests has organic paint. Therefore, aside from the improbability that potters would go beyond the confines of the canyon and immediately adjacent territory for temper, the relation of temper to stylistic types is not consistent with the theory of local usage of sanidine basalt. Likewise the possibility that sanidine

basalt was used by an immigrant group in Chaco who retained their original technique would be difficult to defend because the organic paint types with sanidine basalt occur over such a long period, maintained their distinctiveness, and increased in proportion.

Probably the most important question to be answered is how Bonito and Chuska sanidine-basalt-tempered pottery compares in features such as finish, type of clay, and particularly painted design. If systematic comparison should prove that the two are identical in these respects, the trade theory would seem the most logical explanation of the Chaco occurrences, but if Chaco influence can be found in the Bonito organic paint, sanidine-basalt-tempered specimens, the theory of production in Bonito, or at least in villages nearer Bonito than the Chuskas, would be favored. These remarks apply primarily to black-on-white types but it is perhaps the large percentage of corrugated ware with sanidine basalt temper which makes the trade theory difficult to accept. The theory seems most unreasonable when we think of corrugated ware in terms of cook pots of indifferent workmanship which are unlikely articles of trade. The fact should therefore be kept in mind that corrugated vessels required skill and fine workmanship no less than painted vessels, as anyone who has attempted to reproduce them will testify. It is not unreasonable to suppose that there were potters who excelled in the art of making corrugated ware and possibly certain villages led in its production. In this connection Mr. Morris's observation that sites of the Bennett Peak district show great variety and extremely high development of corrugated pottery is significant, and suggests an attack on the question of trade by correlation of stylistic and technological data.

Andesite is far less common in sherds of the Bonito tests than sanidine basalt. There was 4 percent of andesite in the total sherds of tests II and IV as compared with 22 percent of sanidine basalt. Moreover the principal occurrence of andesite in Bonito pottery is in Mesa Verde black-on-white sherds which have, on stylistic grounds, been recognized as intrusive. Thirty percent of a sample of 54 Mesa Verde type sherds was andesite-tempered. Therefore both style and temper support the theory of trade although temper gives us somewhat more specific evidence of place of origin than style. Temper analysis of surface survey sherds collected in connection with Mr. Morris's study of La Plata Valley archeology showed that andesite temper characterizes Mesa Verde type sherds from sites in the La Plata Valley where andesite occurs as river drift.

The sporadic andesite-tempered sherds of earlier mineral-paint black-on-white types in Bonito may also be intrusive from the La Plata because the combination of andesite temper and mineral paint occurs both in Pueblo II and early Pueblo III in the La Plata Valley. On the other hand, Mr. Judd calls attention to an outcrop within 15 miles of Bonito of the McDermott formation in some parts of which andesitic debris occurs. The type locality of the McDermott formation is in the La Plata district, and this exposure was examined at the time the La Plata study was made. It was dismissed as a probable source of La Plata andesite temper since the cobbles of the river drift were more conspicuous and also more easily obtained. In regard to the lithologic character of the McDermott formation Reeside says, "beds of purely andesitic debris do not occur west of La Plata River in New Mexico . . ." and further, "South of San Juan River the McDermott formation is a thin assemblage of brown sandstone, and purple and gray shale just beneath the Ojo Alamo sandstone. . . . These beds, however, contain detritus from andesites." [Reeside, 1924, p. 25.]

Until the exposure near Chaco Canyon is examined we cannot be certain that it would have supplied andesite of the type found in the pottery. A comparison of the stylistic features of the Bonito mineral-paint, andesite-tempered sherds with those of La Plata types is also suggested. It is unfortunate that I did not record stylistic features of sherds from the Bonito tests at the time I made the temper identifications. Also larger sherd lots should be examined in order to obtain a reliable estimate of frequency of occurrence. Many of the lots studied contained only between 25 and 50 sherds, therefore considerable error may be involved in the percentages based upon them, although there is marked consistency in these percentages. Doubtless the most convincing evidence of origin of the rock-tempered types in Bonito will be obtained by a study of fully developed Pueblo III types because these have the most localized stylistic features and although neither style nor material alone can prove the source of pottery, each feature gives supplementary evidence and when studied together, material, technique, and style give a much firmer basis for theory than any one of them alone can furnish.

VI. IMPLEMENTS OF THE FIELD AND CHASE

We are accustomed to think of stone tools as peculiar to Ancient Man; as something that passed out of existence with the advent of the Bronze Age nearly 4,000 years ago. But our American Indians were still living in the Stone Age when the Pilgrims landed on Plymouth Rock, and they continued in the Stone Age until metal acquired from Colonial homes or fur traders replaced stone for toolmaking.

In the southwestern United States stone implements were in common use as late as 1881. Most of the timbers then visible in Hopi houses had been cut with stone axes (Bourke, 1884, pp. 251, 307). Forty-seven years later some of those same stone-cut logs contributed indirectly to the dating of Pueblo Bonito (Douglass, 1929, p. 754).

Hundreds of stone tools gathered from old ruins were being utilized at Zuñi, Walpi, and other Pueblo villages in 1879 when Stevenson purchased them for the national collections (Stevenson, 1883, p. 320). Not only were they materially useful but also they possessed an acknowledged market value. A gift to Captain Bourke at a trading post west of Fort Defiance reminded an elderly Navaho that before white men came to Arizona a stone ax would buy a wife (Bourke, 1884, p. 70).

Axes.—It is a curious paradox that in Chaco Canyon, where literally thousands of pines were felled for building purposes, few stone axes have been recovered. Pepper lists but eight from his four seasons at Pueblo Bonito. The National Geographic Society's explorations in the same ruin disclosed only four (pl. 70, middle) with fragments of three others, and one of these latter, a grooved sandstone pebble (U.S.N.M. No. 335866) half again as large as a man's thumb, doubtless met some youngster's plea for an ax like father's. All are from Late Bonitian rooms or rubbish.

Pueblo Bonito axes are not only rare but comparatively rude. In this they agree with stone axes from other sections of the San Juan basin. They were made from water-worn cobbles of igneous rock—diorite, hornblendite, rhyolite, felsite—brought from a distance and reduced to the desired form by pecking with hammerstones. Notched on the edges or grooved about for attachment of a withe handle, sharpened by rubbing on sandstone (the cliff back of Pueblo Bonito is deeply scored through whetting of axes), one of these rocks became a fairly effective cutting implement.

Of the four specimens illustrated (pl. 70), *d* came, doubtless through trade, from southwestern New Mexico or southeastern Arizona, for it was originally made with the straight edge and interrupted groove characteristic of axes from that region. But its Bonitian owner subsequently continued the groove all around to permit the type of hafting preferred in Chaco Canyon. When in due course its blade had been dulled and blunted, this once-treasured implement was relegated to lowly service as a maul, the ultimate end of many a good ax. In Room 282 we found the fragment of another reworked southern ax, a large fragment used in dressing stone (U.S.N.M. No. 335858).

From neighboring Pueblo del Arroyo we retrieved eight additional axes and ax fragments. One of these, figure *g*, remains unfinished and thus provides a visual lesson in methods of ax manufacturing. Shaped and grooved by hammerstones, it awaits only the smoothing touch of an abrader.

A near relative of the ax is figure *h*. Shaped with a minimum of pecking from a rhyolite cobblestone, triangular in cross section, its corners are notched and one face slightly grooved as a seating for the customary willow handle. Its narrow bit is unmarred while the poll evidences passing use as a maul.

Axlike implements roughly flaked from tough rocks are not uncommon in southwestern ruins, especially those of the upper Rio Grande. Our Pueblo Bonito collections include only one of this type, a rude specimen made from a thin slab of indurated, altered volcanic ash. Its edges are notched; one corner of the blade shows incipient shaping through attrition (U.S.N.M. No. 335864).

Mauls (pl. 24, *c*).—Although well known from earlier ruins throughout the Southwest, mauls at Pueblo Bonito are even rarer than axes. Of the half dozen we recovered, three are discarded ax heads broken and bruised by use in stonework. With so few grooved mauls in evidence, one is led to believe the Bonitians preferred hand hammers in making metates and in dressing sandstone blocks for building purposes.

The largest of the three illustrated was more likely a club head, for it is made of friable yellow sandstone, a rock so soft that it would readily shatter on anything harder than the average cranium.

Two implements made from water-worn cobbles may also be mentioned. One, found in the refill of Room 168, is of quartzite and weighs $5\frac{3}{4}$ pounds (U.S.N.M. No. 335861). On each edge is a broad medial notch; two small flakes have been thrown from one end as though by as many blows against another rock. The second specimen

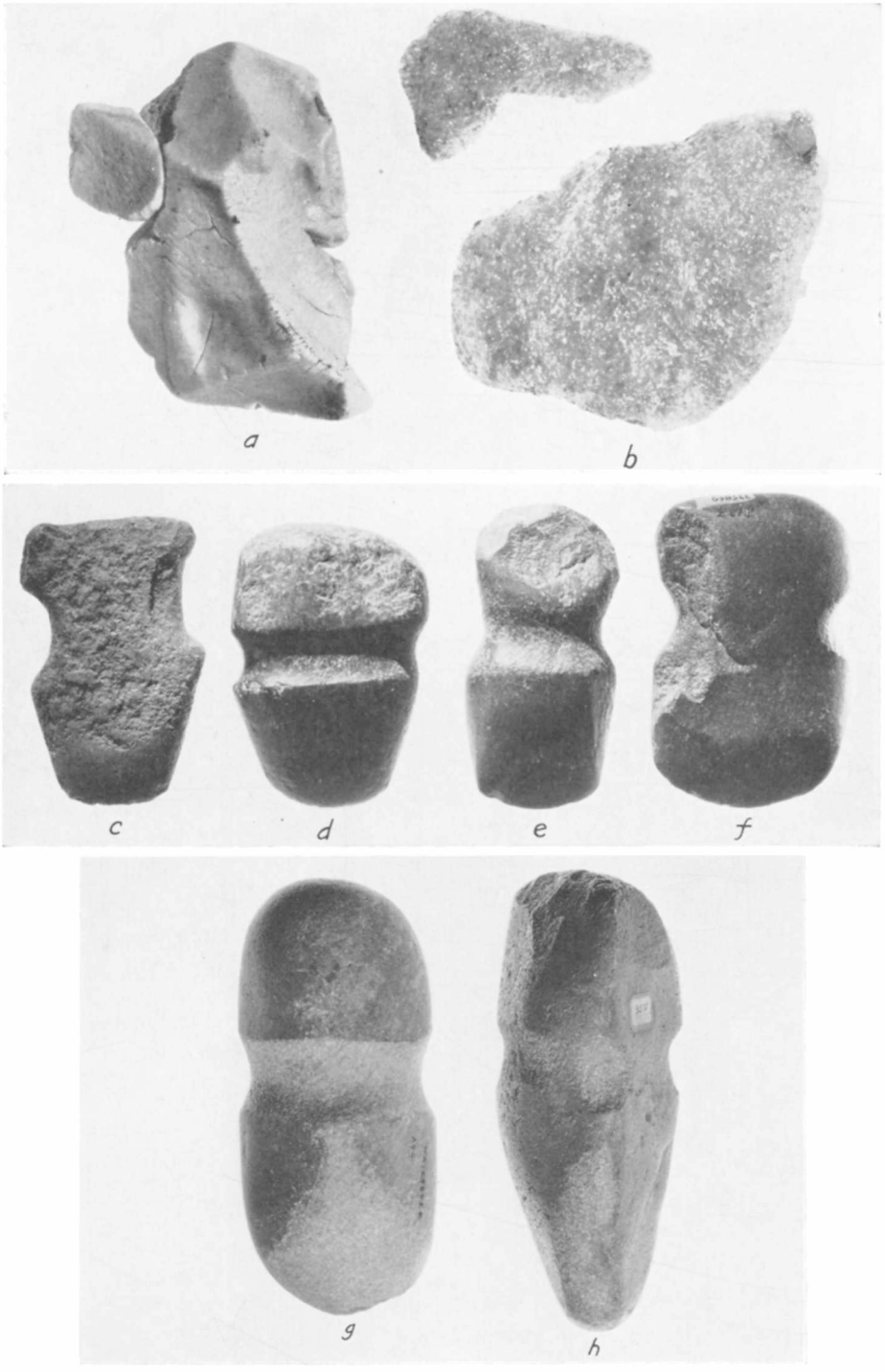


PLATE 70.—*a*, *b*, Pieces of volcanic pumice found in kivas; *c-g*, grooved stone axes; and *h*, a picklike implement.

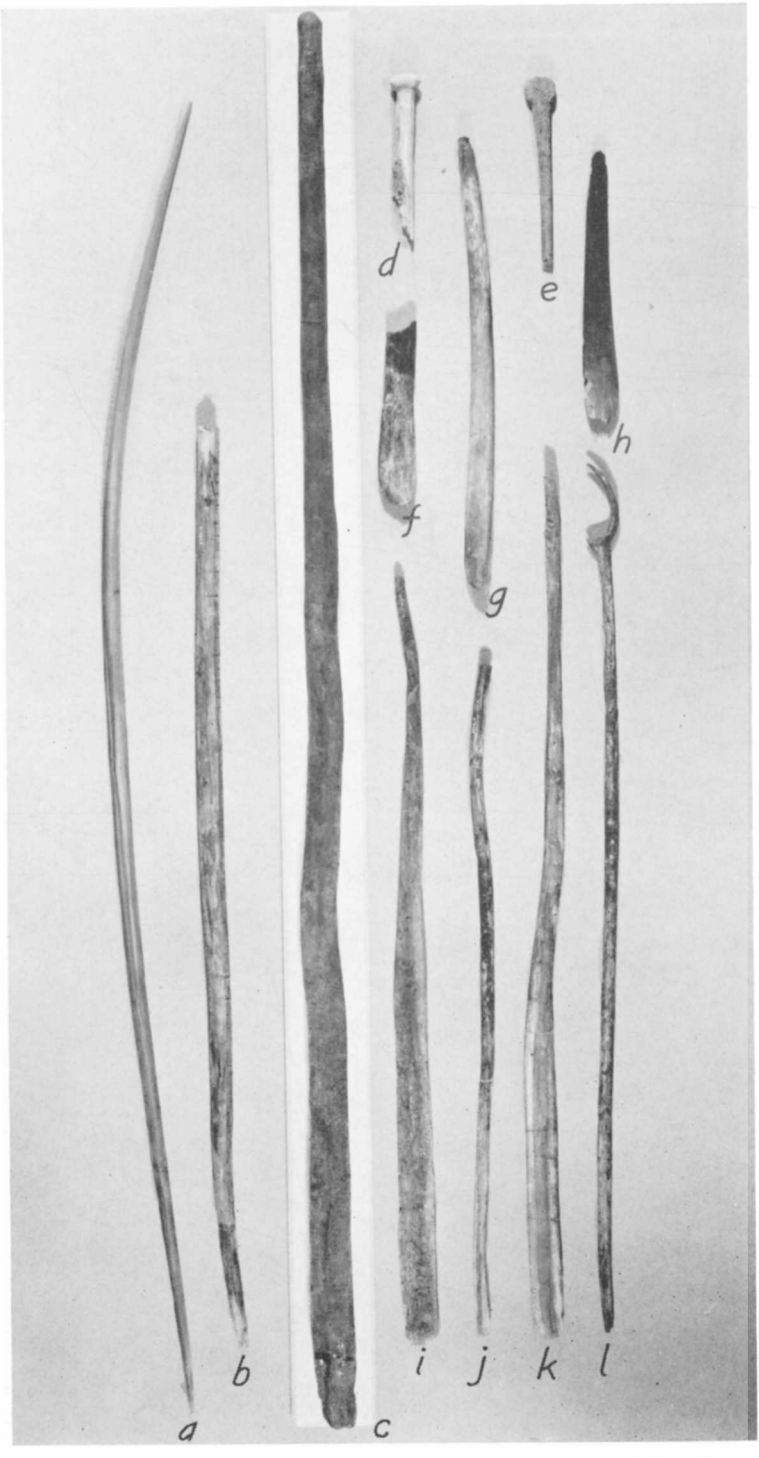
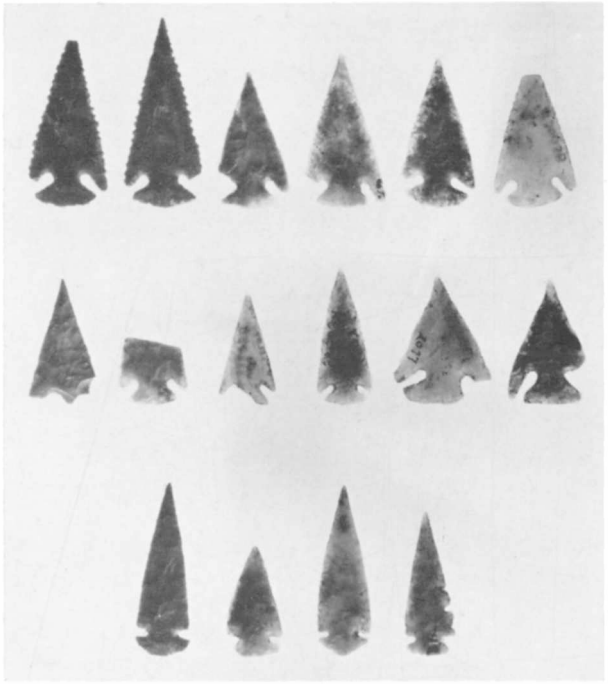


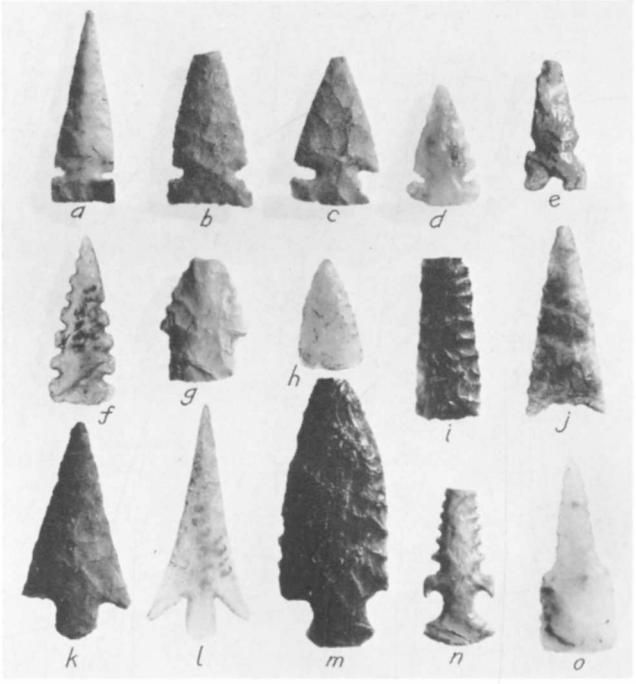
PLATE 71.—Wooden bows, agricultural tools, and a ceremonial staff or "crook."



PLATE 72.—Undersized bows (*a-d*), perhaps used by small boys, ceremonial staves (*e-g*), and a pair of loom bars (*h, i*).



A, Arrowheads and fragments from a quiver of arrows under the hips of Skeleton 10, Room 330.



B, Miscellaneous arrowheads, including those of aberrant form.

PLATE 73

(No. 335863), triangular in cross section and of dolerite-porphyry, shows absolutely no sign of use, but its three corners have been notched in readiness for a handle. It weighs 5¼ pounds and came from Room 318. Neither dolerite-porphyry nor quartzite is to be found in Chaco Canyon.

AGRICULTURAL TOOLS

Two simple wooden implements, the dibble and the digging stick, have met the needs of Pueblo men ever since they first became farmers. The one was used in planting; the other, in clearing land, in crop cultivation, and in loosening earth for diversion dams. Examples of both are still used in Hopi, Zuñi, and Navaho fields. They differ in no essential from those we unearthed at Pueblo Bonito or those previously recovered from Basket Maker caves and burial places. Although the heavy Spanish-type iron hoe has largely replaced the old wooden cultivator, no satisfactory substitute has yet been found for the dibble.

Planting sticks, or dibbles, have narrow, chisel-like blades. Our lone Bonitian specimen (pl. 71, fig. *j*) measures 32⅜ inches with a few more missing from the broken upper end. It is made from an oak sapling and the lower 6 inches are beveled from opposite sides to form the blade, five-eighths inch wide.

With such a simple tool as this the Pueblos have always planted their maize, beans, and pumpkins. To be sure, the planting sticks we saw in Hopi hands were a bit wider and sturdier, but the manner of their use has been handed down from the long ago. Grasping his stick at the middle, the planter chops out a narrow hole 10 to 15 inches deep, drops in a dozen or more kernels of corn, refills the hole, and proceeds to the next. He may work kneeling on one or both knees, chopping and drawing toward him with a rotary motion of the arms and body. He digs down to sand of a satisfactory moisture content and is careful to pack damp sand in upon his seeds, leaving the drier for the top fill. Holes are dug 6 or 8 feet apart, alternating with plantings in the previous row. Unhurried workers calmly step the distance, but one young man we saw, undoubtedly with an eye to his audience, sprang from a one-knee crouch two long paces to light in the same position and with his dibble upraised for the first stroke.

Digging sticks, so-called, are an inch or two wider and somewhat longer than planting sticks. The blade is an important feature. Pueblo digging sticks are generally straighter than those of Basket Maker origin and vary in length from 2 feet to over 6.

Digging sticks are primitive cultivators, a combination hoe and

shovel. With them bushes were uprooted, soil loosened, fields weeded. They were used in building dams and embankments; in guiding floodwater onto garden plots. Some are square-ended with a chisel-like bit; others have a more or less knifelike blade, long or short, thinned along its curved edge and tip. In either case the position of the cutting edge proves these implements were thrust forward and away from the worker as he hacked at massed roots or intrusive vegetation.

Eight of our ten Bonitian digging sticks and fragments are shown on plate 71. Only one, *c*, is really complete.[52] Specimens *i* and *k*, from which the tips were broken while still in use, are those elsewhere mentioned as found at the feet of Skeleton 8, a female, in Old Bonitian Room 326 (see pl. 94, left). Specimens *d* and *g* came from the adjoining structure, abandoned Room 325, the rubbish in which was dominantly Late Bonitian. The knob on *d* naturally prompts the question: Was this purely decorative feature a characteristic distinguishing Late Bonitian from Old Bonitian digging sticks? If so, then here may be another cultural difference between the two groups comprising the local population, for available data from other areas suggest that the digging-stick knob was a Pueblo III innovation. Two other end knobs, one of which had been detached with a flint knife, were recovered from Late Bonitian rubbish in Rooms 226 and 327 (U.S.N.M. Nos. 335221, 335226).

Fragment *e* may not belong in this series, since its knob is discoidal rather than globular and its shaft is only half an inch in diameter at the broken end. It is so heavy I suspect it is ironwood, an Upper Sonoran shrub native to the mountains of northwestern New Mexico. Its surface, once glossily polished, is now checked like an alligator-bark juniper. Specimen *h*, partially consumed in the fire that destroyed Room 298, has been tentatively identified as mountain mahogany (*Cercocarpus* sp.), a companion of ironwood (*Forestiera neomexicana*). Specimens *d*, *f*, *g*, *i*, and *k* are oak (*Quercus* sp.), and *c* appears to be also.

It will be noted that *c*, *i*, and *k* are equipped with square-ended blades that seem ill-advisedly long. For example, the exposed face of *c* has been flattened throughout the lower 25 inches although on the opposite side only the last 9 were altered, being beveled toward the cutting end. Specimen *i*, with a total length of $36\frac{5}{8}$ inches, has a blade 22 inches long reduced from both sides to a midway thickness of half an inch and to half that at a point 2 inches from the end. The cutting

[52] This specimen, broken in three pieces by collapse of the ceiling in Room 296, checked into innumerable short sections after removal. These have since been doweled and the whole mounted on an individual base for preservation.

edge is 1¾ inches wide. With so thin and slender a blade, even an oak implement would have had its limitations. It could have been used for little more than weeding.

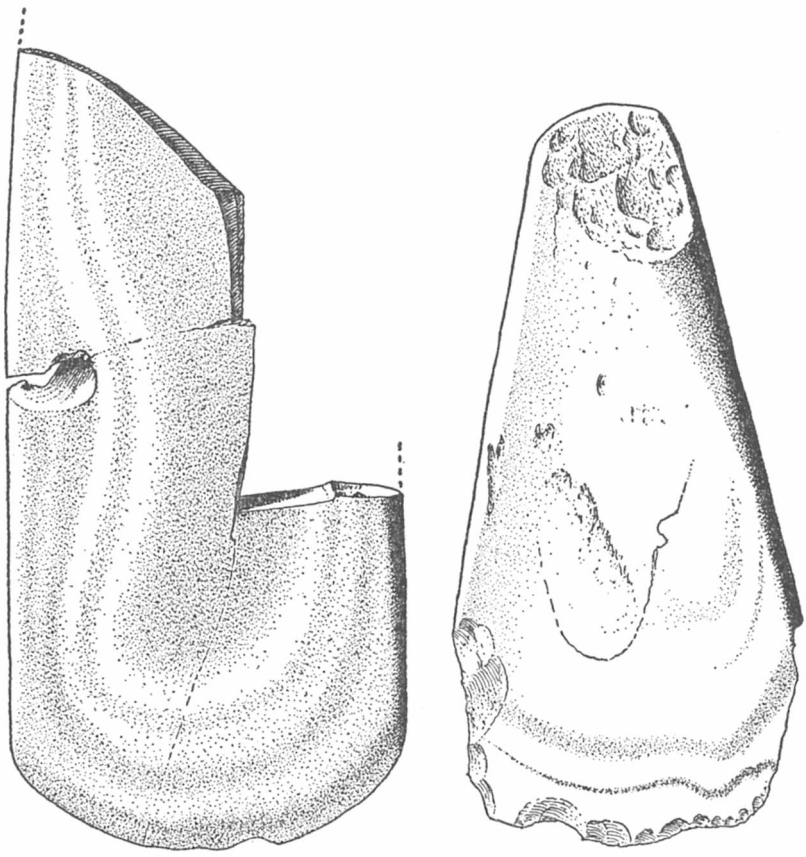
The three fragments with rounded ends (*f, g, h*) were likewise thinned from front and back though not to the same extent as those described above. They may, or may not, represent a separate form. They are sharpened at the end only and not along one edge. That illustrated as *g* saw other service after discard as a digging stick, for its blade is somewhat splintered and bent backward at the tip as though from levering rocks. This one came from Late Bonitian rubbish in Room 325; the other two, from Old Bonitian storerooms.

Hough (1919, p. 236) illustrates a "wooden hand trowel" with which the Hopi tend their plants. By implication it is a type implement and not a reworked fragment. The example figured, however, is clearly no more than a shortened model of the old, knife-edged variety of digging stick—one shortened for convenient use by a man working on his knees. We often overlook the fact that among the Hopi, as among other peoples, there are individuals clever enough to improvise tools or to copy those seen elsewhere. Take, for example, the foot-powered Zuñi cornplanter, a scythelike implement of hard wood, and the hoe fashioned from the shoulder blade of an elk as illustrated by Cushing (1920, pl. 3, *c, f, g*). All three are quite foreign to the pre-Spanish Southwest.

The shoulder-blade hoe is a Plains Indian type, but Cushing's specimen could have been made by a Zuñi using the most suitable local substitute for a buffalo scapula. A comparable Anasazi tool, invented by the Basket Makers, had a flattened section of mountain-sheep horn bound to the end of a wooden shaft as an extension of it. The result was a sort of scuffle hoe designed to be shoved, or thrust, by the operator; it should have proved more serviceable than wooden cultivators because horn takes a keener edge. The Early Pueblos adopted this spadelike implement but soon substituted stone for the mountain-sheep horn.

Stone hoes are represented in our collection by two specimens only (fig. 65). One, a fragment (*a*), is from a fine example that must originally have been 9 or 10 inches long. The material is an indurated fawn-colored and laminiferous shale—a rock much favored throughout the middle San Juan drainage by the makers of this specialized tool. Four nicks on the cutting edge were smoothed, and minute striations, the result of attrition in working the soil, were partly erased during the last resharpening operation.

Our second example (*b*), of calcareous shale, was exhumed from the fill between floors in Room 347. It is triangular, 5 inches long by 1 inch wide at the apex and 2 inches at its retouched bit. The latter has been irregularly spalled and chipped and reduced in width nearly a third by unskilled use of a hammerstone. The cutting edge, like that



a *b*

FIG. 65.—Stone hoes or tcamahias.

of its companion, lies at right angles to the longer dimension and thus agrees with a majority of our wooden cultivators.

A Pueblo del Arroyo specimen (U.S.N.M. No. 334817), its blade more to one side, was reworked at the upper end to provide a 2¼-inch "handle." In this respect it is reminiscent of several examples among the series of stone "skinning knives" that Powell and Stevenson purchased at the Hopi villages and at Zuñi in the late '70s. All belong

to the type under consideration, but several have had the apical third reshaped, narrowed, and even grooved to facilitate attachment.

According to the collectors, these ancient stone implements had previously been gathered from old Pueblo ruins by the Indians. Most, if not all, were being utilized at the time they were purchased; a few still bear traces of a blue-black pigment that suggests some ceremonial connection. Similar pieces are conspicuous on the altar of the Antelope Society at the Walpi Snake Dance, as Fewkes (1909, p. 39) remarks in noting those he unearthed at Spruce-tree House, Mesa Verde National Park.

A discoloration left by the binding thong is still plain upon a specimen Holmes found in 1875 in a bin of charred corn in a Mancos Canyon cliff house (Holmes, 1878, p. 407, pl. 46, fig. 3). I have seen others with like markings and one that preserved the outline of a round-ended shaft, flattened to fit the slight convexity of the implement. There is no doubt in my mind, therefore, that these stone "skinning knives" or "tcamahias" are Pueblo II–Pueblo III substitutes for the mountain-sheep-horn blades of Basket Maker shovel hoes. They are peculiar to the San Juan culture area although occasional examples are reported from outside it. Some clearly were mounted; others, broader toward the apex, may have been used unhafted as trowels or hand mattocks for grubbing about plants.

Since agriculture was the principal industry at Pueblo Bonito, the insignificant number of stone hoes unearthed there is astonishing. If, as explorations elsewhere suggest, such hoes were more numerous during Pueblo II times, we are left wondering whether Pueblo III farmers reverted, in part, to the ancestral-type wooden digging stick or adopted new agricultural practices. One wonders, too, whether some of the esoteric powers attributed to tcamahias by living Hopi were beginning to take form as early as Pueblo III.

Hyde's table of important stone objects (Pepper, 1920, pp. 363-365) lists five "celts" which I assume, lacking textual description, to be implements of the type under discussion. Two sandstone blades, shaped by percussion, are illustrated as hoes (ibid., p. 67).

Another Pueblo Bonito fragment (U.S.N.M. No. 335626) is mentioned at this time, not because it is part of a proved agricultural tool but because it is grooved longitudinally on both sides in the manner of stone long used in working the soil. The material is yellowish claystone with jasperlike qualities; the blade is unusually sharp and only $1\frac{1}{8}$ inches wide. Hoes of the type we have been considering are broadest at the cutting edge, but the sides of our fragment slope outward at angles that would give a butt-end width of $1\frac{7}{8}$ inches if the

implement were 6 inches long. The fragment was found in Room 318, adjoining Room 323 whose rubbish fill was dominantly Old Bonitian in character.

The men of Pueblo Bonito were farmers. They drew their living from the soil. They had a few simple wood and stone tools—all they really needed. Their annual aim, as with present-day Pueblos, was to harvest each fall a year's supply of maize and other plant products and have a small surplus for storage against the uncertain future. Farming was their livelihood but, like most farmers still, each welcomed the diversion of a little hunting now and then.

IMPLEMENTS OF THE CHASE

No group activity affords a Pueblo man more pleasure, more genuine fun, than a rabbit hunt. The mere announcement of it excites the whole village with anticipation. At the appointed hour a couple of dozen or a couple of hundred men and boys trot out across the valley to surround an indicated area and then gradually draw together to encircle a confusion of jack rabbits and cottontails and strike them down with clubs or rocks as they seek to escape. It is an occasion vibrant, electrifying, with action. It is a sportive occasion providing that in which the Pueblo most delights: a communal enterprise with its accompaniment of friendly banter, jesting, and exuberant good humor. A surround also provides an audience for display of individual agility and skill.

In 1597 or thereabouts members of Oñate's army were invited to participate in a Zuñi rabbit hunt (Espinosa, 1933, p. 168). Another was described by Fray Alonso de Benavides in 1630 (Ayer, 1916, p. 38). Lummis (1908, pp. 54-67) pictures the excitement of a surround at Isleta about 1890, while Parsons (1932) shows the close connection between rabbit drives and certain Isleta ceremonies.

Both cottontail and jack-rabbit bones were plentiful in the rubbish heaps at Pueblo Bonito. Thus, since hunting was rarely a personal adventure, we may be confident rabbit hunts were periodically organized at Pueblo Bonito as at other villages, before and since. We found no trace of trap or net; no fragment of a throwing club such as the Hopi employ (pl. 12, right).

From occupational debris we also recovered the bones of diverse other animals and of birds. Some of these creatures were killed for food while others were hunted only to fulfill ceremonial requirements. Beaglehole (1936) ably differentiates between Hopi ritual hunting and mere quest for meat. Current Hopi practices are patterned on those of the past. Thus we shall not go far astray if we guess that the

Bonitians also hunted deer and antelope by the surround method and by running the animals to exhaustion and then choking or smothering them. Birds whose feathers were needed for prayer sticks were trapped, not shot.

Old Wello (see pl. 3, left) told me the Navaho formerly had an antelope corral on Escavada Wash east of the Farmington road.[53] We can never know whether the Bonitians likewise drove antelope into a pen for slaughter, but we do know they killed an occasional pronghorn.

Hosteen Beyal, nonagenarian (pl. 3, right), stopped off in Chaco Canyon one late summer's day in 1927 on his way home from a squaw dance. At expedition expense I furnished the mutton, crackers, and canned peaches that induced him and a dozen relatives to spend the night with us. But after supper, when cigarettes were passed, the old man was too sleepy to talk. I learned only that he first crossed Chaco Canyon when, as a boy of ten, he and a sister had followed his father's pack horses on foot from the Orejas del Oso,[54] driving the family's five sheep.

Yes, then and later he had seen lots of game in the Chaco country. He had killed lots of antelope, and deer, and elk, and a kind of deer with big feet that runs like a horse and draws a sled, and caribou, and musk oxen—a complete recital, with details as to gait, manner of carrying the horns, color, feeding habits, etc., of all his grandchildren had told him of lessons learned from school geographies.

Deer, elk, pronghorn, and mountain-sheep bones were among those unearthed in the trash piles of Pueblo Bonito. These animals were at home within a few days' foot journey from Chaco Canyon. We may be sure their range and habits were known and that hunting parties periodically set forth at the proper season and after prescribed prayers. We may be reasonably certain that Bonitian hunters, like Hopi and Zuñi hunters a couple of generations ago, occasionally utilized game

[53] At that time, 1925, two uncertain roads led north from Pueblo Bonito by way of Rincon del Camino and Mockingbird Canyon. The old Wetherill road, which crossed at the mouth of the Escavada, had been abandoned a few years before on account of blown sand piling up across the Chaco at its junction with Escavada Wash.

[54] A prominent landmark at the south end of Elk Ridge, San Juan County, Utah. In 1907 the region between Elk Ridge and the Colorado line was Ute territory; neither then nor in 1923 (Judd, 1924b) did I see any evidence of Navaho life north of the San Juan except a few camps in the vicinity of Bluff. Unfortunately, I was never able to follow up my chance meeting with Hosteen Beyal in 1927 and check upon his knowledge of the Bear's Ears and vicinity. A middle-aged son, who acted as interpreter, gave his father's age as 93; thus, if the family actually moved south as stated, it must have been about 1844—before Simpson's time.

pits and corrals but depended in larger measure upon their own ability to outrun their intended victims. They practiced both provident hunting and ritual hunting. In the latter case, no implement that might injure the hide or cause external loss of blood was permitted.

When killing for food, hunters relied chiefly upon the bow and arrow. An arrow capable of bringing down a deer could as easily kill a man. We found in Pueblo Bonito arrowheads of diverse shapes and sizes but no fact to support the popular belief that bows and arrows used in warfare differed from those carried on the chase. As we know them historically, the Pueblo tribes are essentially peaceful; their wars were in large measure defensive.

Bows.—Our estimate of Bonitian bows must rest upon two specimens. Both were found in Old Bonitian storerooms and are made from Douglas fir (*Pseudotsuga taxifolia*) (pl. 71, *a* and *b*).[55]

The first, *a*, with several inches missing, measures 5 feet 3 inches long; at the grip it is $1\frac{3}{16}$ inches wide and three-fourths inch thick. Nearly half an inch has been cut and abraded from the back to leave it transversely convex throughout. This curvature is very slight, and the grain of the wood is so uniform a splinter three-fourths the entire length came off with the missing tip. The remaining end is not nocked; there is no trace of wrapping, incising, or painting of any kind. The maker shaped his bow to place the heartwood at the belly; the stronger sapwood, at the back.

Both belly and back were carefully abraded and smoothed, but the hand polish that comes with use is lacking. One wonders whether this bow might have been broken just as it neared completion; whether it was thereafter thrust between the ceiling poles of Room 298 to await the reshaping that never came. If its two limbs were reduced equally from the middle, then 10 or 11 inches are missing from the broken end. A 6-foot bow would be very unusual in the Pueblo country. Twenty-two Zuñi specimens in the U. S. National Museum average only $35\frac{3}{4}$ inches.

The second example, *b*, likewise was so shaped that the sapwood lay at the flattened back. Its maximum width was also $1\frac{3}{16}$ inches; maximum thickness, fifteen-sixteenths inch. If this area of maximum width and thickness be taken as the handgrip, not otherwise delimited, then the bow originally was about 58 inches long. On the other hand, if both limbs were reduced uniformly from the middle, only 11 inches are missing at the broken end. This would give an original length of but 55 inches, or 18 inches less than the assumed length of *a*.

[55] A severed bow end from Room 44, Pueblo del Arroyo, has been identified as Osage-orange (*Maclura pomifera* Schn.).

The remaining tip of this specimen was broken off at what is believed to have been the bowstring notch. No trace of ornamentation or reenforcement is visible. The fragment was found among the wreckage in Room 320 but not positively associated with either of the 10 females buried there.

Relatively few data are available on comparable Pueblo bows. Pope (1923, pp. 352, 391, pl. 52, fig. 3) describes one of juniper 4 feet 9½ inches long from an unknown cave ruin in Arizona or Colorado. It is slightly reflexed at the handle and bound with buckskin, from the edges of which red woodpecker feathers protrude. The limbs are wrapped at short intervals. Width at the grip, $1\frac{5}{16}$ inches; thickness, three-fourths inch.

An article by Stanley Wood in the *Great Divide,* February 1891, reprinted by C. H. Green in the "Catalogue of a Unique Collection of Cliff Dweller Relics" for his exhibit later that same year at the Art Institute Building, Chicago, describes a male skeleton found by the Wetherill brothers in Mancos Canyon, Colorado, and with it a broken bow "of great strength, 4 feet 8 inches long and wrapped with sinews." The partly wrapped end fragment of a cedar specimen from Aztec Ruin is noted by Morris (1919a, p. 60).

Guernsey (1931, pp. 99, 107) describes a 5-foot Pueblo I bow with sinew- or hide-wrapped handgrip and a 4-foot-6½-inch Pueblo III bow, also bound with sinew or hide at the handle. Both specimens are from northeastern Arizona cave ruins but the second, unlike the first, is flattened on the back and notched at the ends for a string. An unbound bow from Heaton Cave, on the east slope of Mount Trumbull, northwestern Arizona, measures 4 feet 5½ inches (Judd, 1926, p. 148).

A most unusual sacrificial deposit of bows and arrows was found in a small cliff house on the Middle Gila, New Mexico, and described by Frank C. Hibben (1938a). In the lot are 94 bows, all broken but two. They vary considerably in cross section and in length. The longest is just under 5 feet; the shortest, just over 3. Average length is "close to 4½ feet." Sixteen retain some of their original decoration, chiefly encircling red and black painted bands. None preserves evidence of leather handgrips. Oak appears most frequently in the series, but pinyon, pine, willow, mountain mahogany, and sycamore are also present.

From these comparative notes it is clear that our two Pueblo Bonito specimens are quite in keeping with bows from other southwestern ruins. The fact that they bear no evidence of sinew binding and no trace of ornamentation or handgrip demarcation is not exceptional.

Only one point remains in doubt—my estimate of over 6 feet for the length of *a*. That figure may be a few inches too long.

Part of a third bow (U.S.N.M. No. 335258) came to light while we were freeing Room 6 of its 25-year accumulation of blown sand. The fragment is 3¼ inches long by eleven-sixteenths inch in diameter. It comes from one end of the handle and shows that the latter remained round and unaltered while the belly of the limb was cut away to its heartwood.

Our specimens from Rooms 298 and 320, it will be recalled, were rounded to the heartwood on the belly and flattened on the back from tip to tip. These two have been identified as Douglas fir while the fragment in hand looks like willow. There is not much resilience in willow, and for this reason I am inclined to regard the fragment as the remnant of a boy's bow.

Boys' bows (?).—A perfectly preserved bow from Turkey Cave, Segi Canyon, is described by Guernsey (1931, p. 107) as probably that of a child. It is 3 feet 10 inches in length by five-eighths inch in diameter at the grip. The latter is sinew-wrapped, and there is another wrapping midway of one limb.

Indian boys are generally given bows and arrows almost as soon as they learn to walk. As they grow older, better implements are provided. At Zuñi I once saw three youngsters, the oldest not over six, intently stalking a neighbor's chickens. Whether they imagined their quarry deer or Navahos, they were plainly out for the kill. Adults still place an occasional small wager on their marksmanship; hunting rabbits with bow and arrow is still common among elders as well as adolescents.

The four bows, fragments of which are shown as figures *a-d*, plate 72, presumably were made for as many small boys. Measuring 17 to 22 inches, the fragments represent bows that probably were between 35 and 40 inches long when complete. All are of oak, species undetermined.

The first three (*a-c*) were fashioned from selected shoots that required only a minimum of abrading and knot leveling, while *d* was slightly flattened front and back. None is notched at the tip but a short section of sinew bowstring was wrapped around *a* when found. On the next, *b*, five longitudinal grooves were scratched on the surface with interruptions at unequal intervals forming plain encircling bands. The imprint of a fine, hard-twist thread 2½ inches from the tip evidences reenforcement. The unbroken end of this specimen is stained red, while *a* and *d* bear an over-all black dye.

On *c*, at what is probably one margin of the handgrip, a scrap of

tule leaf clings to the wood as the mark of a finely twisted string circles the shaft four or five times. A like imprint is noted midway between handle and tip. A tule grip wrapping, bound at the edges with sinew, is the dominant feature of *d,* but the mark of an encircling cord is also to be seen, 1 inch from the tip. These cord imprints suggest that the bows were made of green wood.

The fragment illustrated by figure 66 had been abraded along its belly until the hearting lay exposed. Its back was flattened just enough to give an oval cross section. The fragment is three-eighths inch wide, less than one-fourth inch thick, and 18 inches from end to end. Along its length seven sinew wrappings are evident. That at the tip binds half an inch of yucca thread, double-knotted at each end. Adjoining this feature a section of 2-ply sinew bowstring circles the shaft four times and leaves a frayed end projecting.

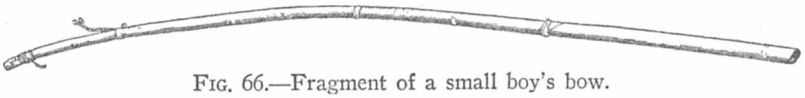


FIG. 66.—Fragment of a small boy's bow.

The sinew wrapping next below, $2\frac{1}{2}$ inches from the tip, likewise binds a knotted yucca string to the back of the bow. In this case, however, the string is a double one, each part consisting of two 4-fiber threads twisted together and the two parts then twined to form a single cord $1\frac{1}{4}$ inches long and knotted at the bound end. At the opposite or free end the two parts separate, each bearing a compound knot. One of these knots still holds sections of three, possibly four, tiny quills. Since its companion knot and the pair at the tip are all open longitudinally, we may assume they also formerly held feathers. If we reverse our analysis and begin with the four compound knots, their significance becomes clear—each represents a prayer plume attached to the bow by its maker to guide and protect the youthful hunter he favored.

Now it so happens these five "boys' bows" are the only ones of their kind we recovered at Pueblo Bonito. All five were found among the collapsed and partly burned ceiling timbers of Room 209A. These timbers lay upon stratified sand that had previously washed in and accumulated to a depth of 18 inches across the east end of the room, diminishing toward the west. Beneath the sand were two discarded manos, a hammerstone, part of a doorslab, and a handful of potsherds. With the bow fragments were the pieces of reed arrowshafts next to be considered and several curved sticks such as those described on page 271. All probably had been thrust between the ceiling poles, forgotten and left there when the room was abandoned and sealed.

Arrows.—Six fragments of reed arrowshafts were found with the broken bows in Room 209. Four preserve the forward part of the shaftment including a sinew wrapping one-fourth to three-eighths inch wide binding three quills. None retains the proximal end intact. The longest, measuring $21\frac{3}{4}$ inches, has a crushed rear end, but half of it is present and without evidence of a nock. Its forward feather binding lies $4\frac{3}{4}$ inches from the butt, and there is no trace of other binding between. So it is possible an inch or more has been detached here. The distal end is square-cut one-fourth inch below a node; since the latter is unperforated it could not have held a foreshaft. For all six specimens, the lower end of the growing reed was deliberately chosen as the distal end of the arrowshaft. Diameter ranges from a trifle under to a trifle over three-sixteenths inch.

From Late Bonitian rubbish in Room 226 seven other fragments were recovered (U.S.N.M. No. 335198). Two are butt ends one-fourth inch in diameter. Both are tightly fitted with a wooden plug, five-eighths and seven-eighths inch long, respectively; both are nocked through wood and reed; both had been reenforced by a sinew band three-eighths and three-fourths inch, respectively, from the end. Two of the remaining five fragments are rat-tail ends of wooden foreshafts; three are distal ends of arrows still holding part of the foreshaft. Two of these latter measure one-fourth inch in diameter; the third, five-sixteenths inch. All five pieces of reed shaft retain a more or less conspicuous coating of green paint, applied before the sinew binding. The one complete foreshaft tail is exactly 2 inches long.

Another arrowshaft fragment came from the rubbish fill of Room 255 (U.S.N.M. No. 335199). It is fitted with a nocked wooden plug, is one-fourth inch in diameter, and painted red forward of the rear sinew wrapping. A warped wooden foreshaft fragment from Room 226 measures $9\frac{5}{8}$ inches in length and one-fourth inch in diameter at the shoulder (No. 335201). At least an inch is missing from the tip, so we may guess from its length alone that it once carried a chipped point. Its tail is $3\frac{1}{2}$ inches long and, like the others, appears to have been coated with a resinous substance.

In figure 67 we illustrate a fragment of reed arrow with hardwood head. From the tip of the latter to its shoulder is $3\frac{11}{16}$ inches; from shoulder to end of broken tail, $2\frac{3}{16}$ inches. The head fits tightly and smoothly into a shaft five-sixteenths inch in diameter; between the end of the shaft and its first node is a 1-inch band of green paint. To prevent splitting, the shaft was probably reenforced midway of this painted zone, although traces of sinew binding are uncertain.

Wooden arrowheads were widely used throughout the ancient

Pueblo territory and no doubt were present at Pueblo Bonito in larger numbers than our data indicate. We recovered but the single example described above. Pepper (1920, p. 160) mentions four, all from Room 32 but quite detached from a large lot of arrows standing in the northwest corner, at least 81 of which were provided with foreshafts and stone points. The average over-all length of these is given as 77 cm. (30.3 inches).

Nordenskiöld (1893, pl. 42, fig. 1) illustrates an arrow, complete with feathers and hardwood point, from Ruin 9, Mesa Verde. Morris (1919a, p. 59) figures a similar specimen 32½ inches long from Aztec Ruin. Kidder and Guernsey (1919, p. 122) report that a majority of the wooden foreshafts they collected in northeastern Arizona ruins in 1914 and 1915 were plain, unnotched for stone points. Hibben (1938a, p. 38) counted only 11 notched foreshafts out of some 4,000 from a cave south of the Gila Cliff Dwellings National Monument, southwestern New Mexico.

Thus the longest arrowshaft fragment from Room 209, even with its proximal end restored, was too short and too light in weight for other than one of the boys' bows it accompanied. Diameters of one-fourth and five-sixteenth inch were more representative of adult hunting arrows. As to length, we have Morris's 32½ inches and Pepper's average of 30.3. The arrows, perhaps a quiverful, interred under the hips of Skeleton 10, Room 330 (pl. 98, lower), were too far gone for detailed examination but at least 16 had wooden foreshafts and stone heads. If wooden points in lieu of foreshafts were present, they were not noted.

Our data therefore indicate that Bonitian hunting arrows were provided with basal plugs to prevent splitting; that shafts probably were scratched lengthwise with "lightning" lines; that feathering was attached by binding rather than by gluing; that green or red paint was applied to the shaft ends prior to their reenforcement by sinew wrappings, and that the great majority were finished with hardwood foreshafts tipped with stone heads.

Projectile points.—Although a more meticulous student might recognize others, I see in the arrowheads from Pueblo Bonito only two principal types: (A) Those notched at right angles to the long axis of the blade, and (B) those notched at an angle of about 45°. Since notches



FIG. 67.—Wooden arrowhead.

were provided to facilitate lashing the point to its shaft, it is reasonable to suppose an individual archer would come to favor one type or the other. But we happen to know that, in one instance at least, arrowheads of both forms found place in the same quiver.

When the population of Pueblo Bonito had been reduced to a mere remnant stubbornly clinging to its ancestral home, the attacks of enemy raiding parties were less successfully met. Room 330, among others, became a sepulcher for those denied the companionship of clan burial places. One of those entombed here was the middle-aged warrior last mentioned (pl. 98, lower). He had been slain somewhere about the village, and his body, horribly grotesque in death, received belated interment. His quiver was buried beneath him, and although the reed shafts of his arrows had almost wholly decayed, the points with which 16 were tipped are available for our present study (pl. 73, A). Four of the 16 are notched at right angles to the median line; the remainder, at divers angles from the basal corners. Here was a man who obviously preferred points of our second type, although he had no scruple about using the other in time of need.

Between the outspread knees of this same warrior, and perhaps as a tribute to his prowess, was a burial offering of 28 arrowheads arranged in triangular pattern. These may have been contributed by relatives who participated in the burial rites, or, with equal probability, they were unmounted points belonging to the deceased. In either case, the broadest of the series (pl. 74, B), that with the serrated edges, duplicates both in shape and in material two of those from the dead man's quiver. Nearby, beneath the right knee of a headless skeleton (No. 9), were eight other points, as like as peas in a pod (pl. 74, A).

These three lots accompanied late burials in the older section of Pueblo Bonito. The builders of this section were ultraconservative, as we have seen especially from study of their architecture and ceramics. Their natural tendency would be to retain the ancestral form of arrowhead. That they were eventually influenced by arrowmakers among their neighbors is possible; that they occasionally used the product of these latter is reasonably certain. And this naturally brings up the question: Did each of the two unrelated peoples inhabiting Pueblo Bonito have its own preferred type of projectile point?

In an attempt to answer this, I have examined all specimens in our collection with special reference to the constructional period of the rooms from which they were actually recovered. Of the 317 in hand, 31 are fragments that cannot positively be identified as to type, 7 are reworked points without notches, and 91 were exposed during trench-

ing operations and the removal of debris. The remaining 188 arrowheads were distributed as follows:

Masonry type	1		2		3		4	
Classification	A	B	A	B	A	B	A	B
Number of points	31	59	2	4	66	12	14	0

From these figures it is plain that points notched at right angles to their long axis (A type) occurred most frequently in rooms of third-period construction; that 79 percent of all class-B points were recovered from dwellings of first-type masonry. If our separation be based on the character of any debris present rather than the stonework of the room containing that debris, we find that 75 percent of all A-type points and 24 percent of the B's came from Late Bonitian rooms and rubbish. There may or may not be significance in this distribution, but it explains an impression which prevailed throughout our explorations that barbed points were more closely associated with the older, more primitive element in the local population.

This impression has since found support in the writings of other observers. At Pecos, which welcomed Coronado in 1540, the typical arrowhead was small, triangular in shape, with notches at right angles to the long axis, and an expanding stem as wide as, or wider than, its shoulders (Kidder, 1932, p. 20). At Aztec, which fell into ruin a century or two before Pecos was founded, 275 out of 300 arrowheads were of the "square-shouldered" type with side notches (Morris, 1919a, p. 34). In his investigation of a Basket Maker III site in Chaco Canyon, Roberts (1929, p. 139) observed that "the characteristic and predominant form of arrowhead was one with long, sharp barbs." If further proof were needed as to the relative ages of these two classes of projectile points, it is to be found at Kiatuthlanna, eastern Arizona, where Roberts recovered arrowheads of our A type from the principal ruin, of Pueblo III age, and B-type points only from underlying Pueblo I pit houses (Roberts, 1931, p. 159).

How, then, can we account for the fact that both types were present in the quiver of the middle-aged warrior from Room 330? Twelve of the 16 are barbed, and 8 of the 12 are conspicuously broader, heavier, and more deeply notched than the majority of their class throughout the ruin. The four notched at right angles to their median line possess convex or inverted triangular bases—a feature of all A-type points found with burials in Room 330.

The sacrificial offering of 28 arrowheads accompanying this warrior's body likewise includes both forms. Those of A type vary in

length from 1.19 to 1.75 inches; in width, from 0.47 to 0.57 inch; in weight, from 1.31 to 1.53 grams. The B-type points have a variation of from 1.13 to 2.03 inches in length, 0.44 to 0.87 inch in width, and from 0.74 to 2.34 grams in weight. Considered together, the second group averages slightly longer and heavier than the first; and, as noted above, 76 percent of our B points came from Old Bonitian rooms and debris of occupation. Thus it does seem as though the two peoples inhabiting Pueblo Bonito really had preferences as to shapes of projectile points and that the conservatives in the course of time came partially to adopt, perhaps to imitate, the more slender, side-notched variety favored by their coresidents. Both peoples used the available suitable rocks—flint, chalcedony, jasper, and obsidian—without partiality.

Our A points could be separated into two classes. The chief reason they are not is because the two merge into each other; it is impossible to say where one ends and the other begins. Half of the A points from Late Bonitian rooms and rubbish have more conspicuous stems than those, for example, from Room 330. They are smaller and more delicate; their tangs are squared and jutting rather than retreating. Twenty-seven of them average 1.04 inches in length, 0.5 inch in width, and 0.26 gram in weight. Whether the base be straight, concave, or convex, the broader stem results in an arrowhead very close to, if not identical with, the dominant type at Aztec and one of the Pueblo III varieties at Kiatuthlanna. Both these ruins possess Chaco Canyon affinities and both are younger than Pueblo Bonito.

As is always the case, our collection includes a number of projectile points that do not fit readily into our classification. Most of these are no more than chance variations of the two principal forms—aberrancies due to accidents in the chipping process. Misdirected pressure of the flaking tool, for example, or a microscopic flaw in the stone could force changes in the intended shape of an arrowhead without causing its complete abandonment. If, for example, one tang of figure *c*, plate 73, B, had been broken during the course of manufacture, the natural reaction would have been to reduce the other proportionately and finish the point with a smaller stem—the reaction natural to me, that is; I can only guess at what the Indian maker of that point would have done. But most of our odd forms could be the product of just such minor alterations.

As further evidence that even Bonitian craftsmen sometimes let their minds wander from the task in hand, we have two points with forward-slanting notches (pl. 73, B, fig. *d*). Irrespective of direction, a shift of only one-sixteenth inch in notch placement gives a point an

entirely different aspect. Six B-type points have serrated edges; 12 of A type have one to five secondary notches on one edge, but only one (fig. *f*) is notched on both sides. These variations do not, in my opinion, warrant the setting up of separate types. And the series as a whole offers no support for the popular belief that the ancient Pueblos had one kind of arrowhead for hunting, another for war.

Despite the recurrent attacks of hostile raiding parties, only one human bone with an arrowhead actually embedded in it was recovered at Pueblo Bonito (fig. 68). This is a third lumbar vertebra belonging to one of the disarticulated skeletons in Room 330. The arrow had entered the body from above, slightly forward and to the left, as if

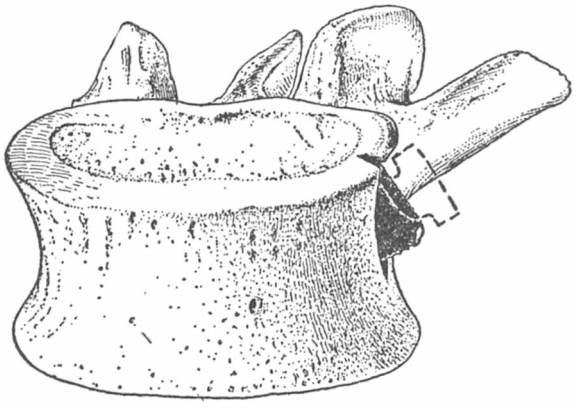


FIG. 68.—Vertebra with embedded arrowpoint.

fired from an elevation while the victim was in the act of drawing his bow for an upward shot. And the point with which that fatal arrow was fitted is of fine-grained quartzite, a material common at Aztec Ruin but infrequently represented in our series of A-type projectiles and by only two examples in those of class B. Since the blade is broken at the neck we may not be positive as to its notching, but I believe this to have been at right angles to the long axis.

Finally, there is a single bone arrowhead, from Late Bonitian rubbish in Room 334 (fig. 69). Its tip is splintered and one of its barbs broken and reground. The piece has the curve of a dog ulna, and as a projectile point it probably had little accuracy. Nevertheless, it reminds one of a sentence in Coronado's letter of August 3, 1540, to the Viceroy: "And . . . I send you samples of the weapons with which the natives of this country fight, a shield, a hammer, and a bow with some arrows, among which there are two with bone points, the

like of which have never been seen . . . [by Coronado]" (Winship, 1896, p. 563).

Wrist guards protect the wrist from the lash of the released bowstring. They are used by bowmen the world around. Materials naturally differ from country to country but in the Pueblo region of the southwestern United States tubular sections of bone were preferred.

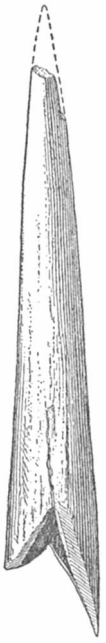


FIG. 69.—Bone arrowhead.

At Hawikuh, Hodge (1920, p. 126) found six guards on the wrists of as many skeletons. In each case the guard consisted of bone tubes an inch to an inch and a half long fastened side by side in numbers varying from 6 to 18. Morris (1919a, p. 42) mentions a desiccated body from southwestern New Mexico, on the left wrist of which was a leather bracelet with a pair of bone tubes fastened to it.

In the rubbish of Pueblo Bonito we unearthed numbers of sections of hollow bird and mammal bones. They are considered herein as bone beads, the most likely function of the majority, but some may at one time have been sewed to a band of cloth or tanned skin as a wrist guard. Others, like them in every outward respect, unquestionably were designed as bird calls (see Hodge, 1920, p. 128).

WEAPONS

The sample of Zuñi weapons Coronado sent from Hawikuh was not quite complete. He should have added half a bushel of assorted rocks and cobblestones. For rocks were one of the chief defensive weapons of the Pueblos, as Coronado himself had ample reason to know. Twice during the assault on Hawikuh he was floored by rocks thrown from the housetops and was saved only by his steel helmet and the prompt action of his army master (Winship, 1896, p. 557).

When a company of Spaniards under Vicente de Zaldívar stormed the stairway to Acoma in January 1599, according to witness Pérez de Villagrá (Espinosa, 1933, p. 236), the defenders "sent down a shower of arrows and stones . . . a veritable deluge of stones, clubs, and arrows." Some 250 years later the inhabitants of Mishongnovi turned back a Navaho attack by identical means (Bourke, 1884, p. 310).

Wherever we find record of Pueblo hostilities during the Spanish colonial period and later, only three weapons are mentioned: arrows, rocks, and clubs. Arms could scarcely be simpler. Thus there is only

the remotest possibility that Bonitian weapons differed, either in complexity or variety, from those Coronado seized at Hawikuh. We have already examined the remains of bows and arrows from Pueblo Bonito; we know the local supply of sandstone spalls was unlimited. Let us now turn to evidence of other weapons.

Clubs.—With a willow wrapped once around and extended to form a short handle, a grooved cobble was effective either in offense or defense. The lower three illustrated on plate 24, *c,* are igneous rocks, varying in weight from 8 to 16 ounces. The lesser end of one has been slightly modified by pecking, but otherwise it and the other two are quite unaltered except for the encircling groove. Castañeda and other chroniclers of the Conquest period testify that the Pueblo warrior, armed with a cudgel, was an antagonist to be respected in close combat. Wooden clubs have been found in pre-Spanish ruins throughout the Pueblo area and no doubt a hafted ax, maul, or grooved cobble proved an effective substitute upon occasion.

As mentioned elsewhere, the fragment shown as figure *e,* plate 71, could be part of a club as logically as the handle of a planting stick. Indeed, its slender, flexible shaft, its flattish head, and the fact that it is of a fine-grained, dark, heavy wood rather than oak, all weigh in favor of the first possibility.

Pepper (1920, pp. 161, 199) reports from Room 32 and the second story of 39b, respectively, an elk-antler club and one of elk bone. The former is 19 inches long with a hole for a thong drilled through the smaller end. Most of such specimens probably were used without embellishment but in the American Museum of Natural History, exhibited as from Cave 30, Allen Canyon, Grand Gulch, Utah, is a superb elk-antler club (H-13397) having a rounded butt, a long yucca wrist cord, and a buckskin-covered handgrip.

Daggers (?).—The longer, straighter bone awls like figure d_2, plate 33, are sometimes described as "daggers." They could have been so used, of course, but nowhere do I find convincing evidence that the Pueblos ever employed such an instrument. Daggers do not appear on Spanish lists of Indian weapons. The Pueblos were close fighters but not close enough for stabbing.

Spears (?).—The Coronado expedition in 1540 had opportunity to become acquainted with every instrument of warfare known to the Pueblos. Therefore, what the narrators of that expedition failed to mention probably did not exist at the time. Castañeda includes neither daggers nor spears in his enumeration of Pueblo arms.

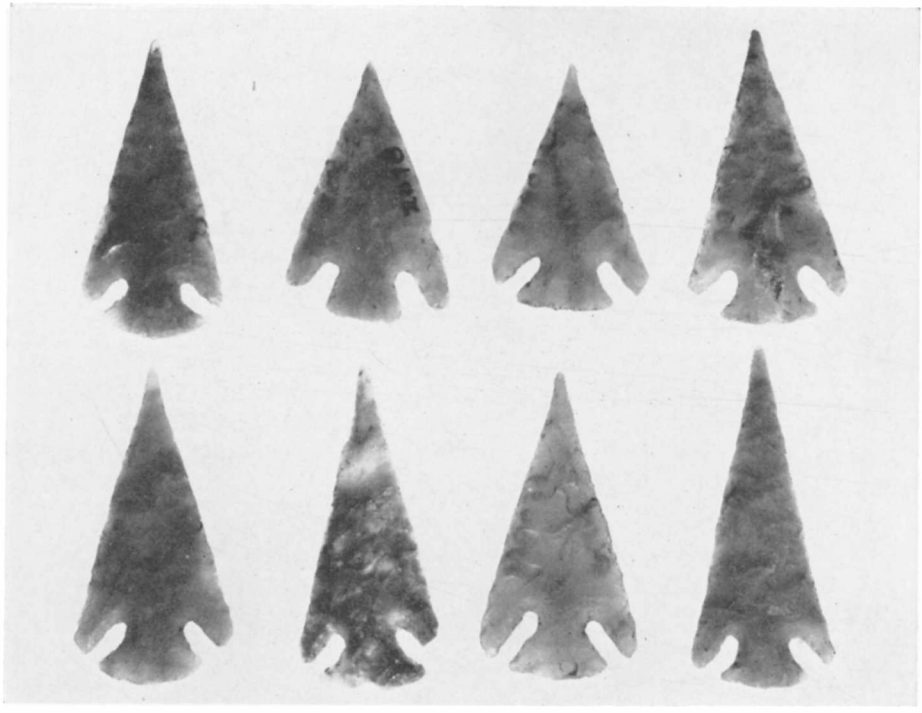
Blades of the size illustrated on plate 28, whether notched or unnotched, are popularly called "spearheads." Actually, they were knives.

The buffalo hunting tribes of the Great Plains employed spears and it is conceivable that the eastern Pueblos, trading and warring with those tribes, gradually adopted the weapon. In Canyon de Chelly on September 9, 1849, Lieutenant Simpson (1850, p. 108) saw a hundred or more Navaho warriors "armed with bows and lances." But a chipped spearhead mounted on a shaft for thrusting has never, so far as I am aware, been found in a Pueblo ruin. Thus it seems very likely that the illustrations in Simpson and other midnineteenth-century publications that represent Pueblo and Navaho men armed with lances reflect a post-Conquest borrowing from the Spanish or from Plains tribes.

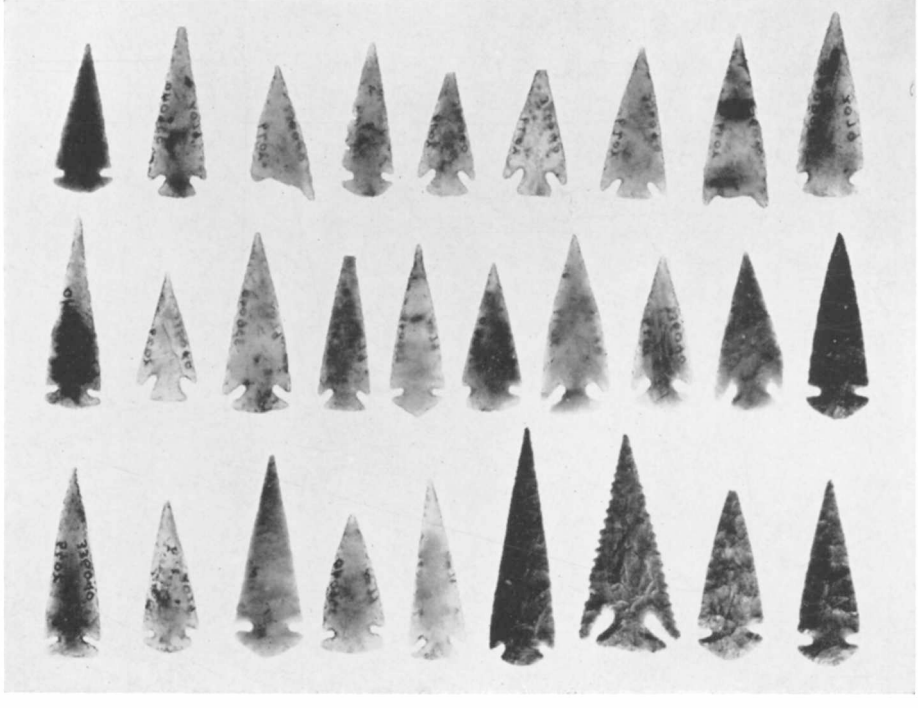
From these observations we once more infer that the Bonitians differed very little, if at all, from historic Pueblo peoples. In their fields and on the chase they used the same implements as the latter; they shared the same environment; their physical and economic problems were the same; their reactions to those problems and that environment were unquestionably identical.

When the Bonitians took to the warpath, if they ever did, they carried clubs, bows and arrows, and shields. In defense of their homes they used arrows, thrown rocks, and clubs. We have no historical record, no archeological evidence, of other Pueblo weapons. Late Bonitian shields were probably 30-inch basketry disks like those from Canyon del Muerto, Mesa Verde, and Aztec Ruin (Morris and Burgh, 1941, p. 51).

Bows and arrows and clubs were also employed on the chase. For ceremonial purposes animals had to be taken without external loss of blood, but the same beasts were run down and clubbed or shot with arrows when fresh meat was the prime objective. The Bonitians, we may be sure, also set various snares and traps for birds and small mammals. Feathers from diverse birds, and from different parts of the same bird, were always taken ritually; they had prescribed places on prayer plumes, altars, or the bodies of participants in ceremonials. Therefore, even though our excavations disclosed no recognizable fragment, traps of various kinds were surely made and used by the Bonitians just as such traps are known to have been made and used by Pueblo peoples during the past 400 years. Pueblo implements of the field and chase have always been simple of design and limited in diversification.



A, Eight chalcedony arrowpoints found beneath the right knee of Skeleton 9, Room 330.



B, Arrowheads comprising a burial offering accompanying Skeleton 10, Room 330.

PLATE 74



PLATE 75.—A ceremonial need for his feathers kept this macaw continually in a seminude condition. (Photograph by O. C. Havens, 1939.)

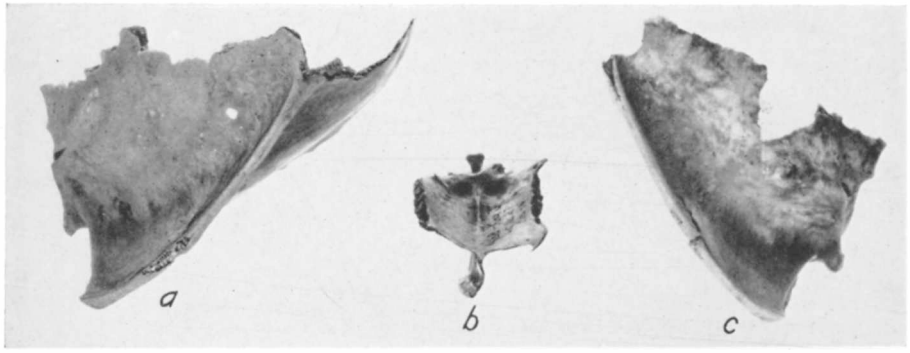






PLATE 76.—*Upper:* Breastbones of the golden eagle (*a*, *c*) and a macaw (*b*) showing injuries. *Middle:* Skeleton of a red-tailed hawk on the floor of Room 264 (photograph by Neil M. Judd, 1922). *Lower:* Skeleton of a macaw, killed when the ceiling of Room 249 collapsed (photograph by O. C. Havens, 1921).

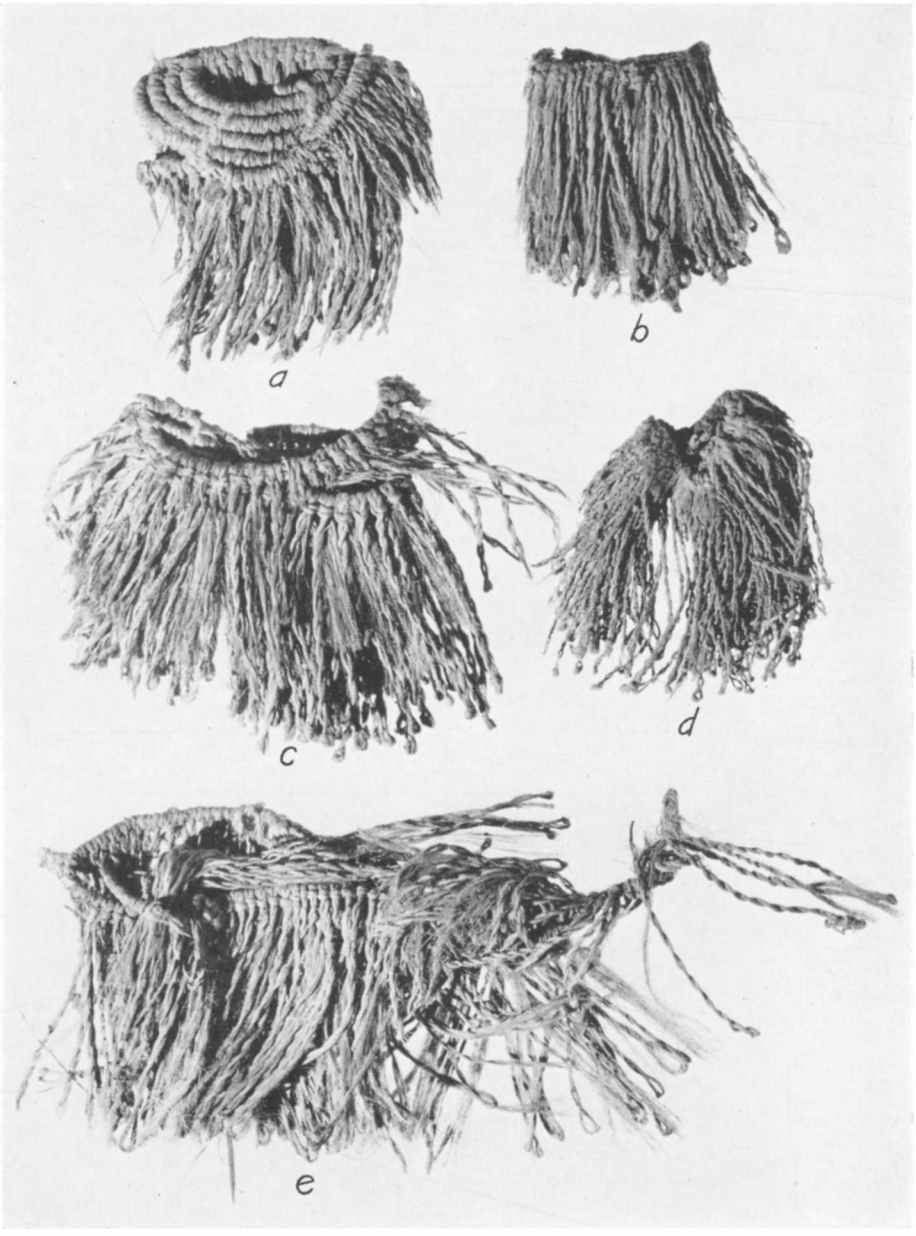


PLATE 77.—Coiled loops of yucca thread, presumably attached to altar sticks.

VII. OBJECTS OF RELIGIOUS IMPLICATION

Ritual is the mainspring of Pueblo society. It is the adhesive that binds Pueblo peoples together and holds them to the old ways. Individually and collectively the Pueblos live their religion—or did until very recently. Personal prayers are said daily, and offerings are made as need be to the Unseen Forces. That the group may survive, elaborate ceremonials are performed at stated intervals. "Their religion," wrote Benavides in 1630, "though it was not formal idolatry, was nearly so, since they made offerings for whatsoever action" (Ayer, 1916, p. 31).

After 300 years, Pueblo gifts to their gods remain the same as in Benavides' time—a song or a dance, a prayer stick or prayer feather, and cornmeal ground with bits of shell and turquoise. The orthodox Pueblo tosses a pinch of meal with his prayer to the rising sun each morning at daybreak. He sprinkles prayer meal on the Kachina dancers, on his prayer sticks when they are planted, on his fields and his irrigation ditch; with prayer meal he welcomes the newborn and makes a "road" for the deceased. An offering of prayer meal accompanies every act or action that recognizes the supernatural. For the Pueblo Indian personifies the elements and all animate and inanimate things and these he seeks to influence in his own behalf through gifts, including ritual and prayer.

Pueblo ceremonies are varied and often complex, but the great majority have a common purpose: control of the weather as a means of ensuring the health and material well-being of the community. There are rites designed to bring rain, to check the west winds, to cure disease and overcome magic, to win divine guidance and protection at gambling, or on the chase, or in pursuit of the enemy. For this multiplicity of forms and procedures, diverse materials are required—feathers, fossil shells, prayer sticks and crooks, cloud blowers, and stones that look like parts of antediluvian animals.

Some of these objects are so ordinary in appearance that laymen would never suspect the occult properties that lie within; some are so sacred that even the initiated look upon or touch them with foreboding. Some are discarded when they have served their purpose; some are hidden away against future need, and still others doubtless are buried with the persons responsible for their care.

Among our Pueblo Bonito collections are a number of items or

fragments of items that were, or might have been, utilized in local ceremonies. An occasional one has its counterpart on historic Pueblo altars; others are so utterly impractical for any conceivable utilitarian purpose their connection with esoteric practices may be surmised. I shall probably never completely escape from an early training that identified as "ceremonial" every queer or inexplicable object.

OBJECTS OF WOOD OR FIBER

Prayer sticks.—"The most important and valuable gift to the gods is the prayer stick" (Bunzel, 1932a, p. 499). To quote Parsons (1939, p. 270):

> Pueblo ceremonial consists of prayer-stick-making and offering together with prayer and other ritual. Buried in field or riverbank or riverbed; cast under shrub or tree or into pits; sunk in water, in springs, pools, lakes, river, or irrigation ditch; carried long distances to mountaintops; immured in house or kiva wall or closed-up niche; set under the floor or in the rafters, in cave or boulder or rock-built shrine; placed on altar or around image or corn fetish . . .; held in hand during ceremonial or cherished at home for a stated period or for life, prayer-sticks are used by members of all ceremonial groups. . . .
>
> At Zuñi, [the inhabitants] offer or "plant" prayer-sticks to the dead, after a death in the family, at Shalako and at the solstices when women plant to the Moon, and men to the Sun and kachina, all these solstice sticks being placed in the middle of one's cornfield. . . . In certain house walls and in the houses where they are entertained, the kachina themselves enshrine prayer-sticks. In every ceremony kachina impersonators plant to those beings they impersonate, and four days before a dance the kiva chief sends prayer-sticks to the kachina chief asking him to dispatch the kachina. Society members "plant" at the solstices and periodically throughout the year to deceased members, to their fetishes and patrons, to the War Brothers, the Ants, Rattlesnake, Spider, or the prey animals.

Prayer sticks are usually of willow and made from living wood. Dead wood is never utilized because prayer sticks are regarded as animate beings, as messengers. They vary in length and complexity of dress to meet the fixed requirements of the rite with which each kind is associated. They are specially made and are expended within a few hours or, at most, within a few days of manufacture. For these reasons one does not expect to find prayer sticks about a Pueblo village, historic or prehistoric.

The sections of peeled willow shown on plate 78, figs. *w* and *x*, and on plate 38, fig. *l*, might be leftovers from prayer-stick making. One end of the shorter specimen was rubbed smooth; the other three were left as severed, ringed about with a flint knife and then broken.

Each ritual has its own special kind of prayer stick. No two are precisely alike, but all or nearly all require feathers—feathers from designated parts of certain birds. Turkey feathers, and preferably

wild turkey, are utilized most frequently, yet I venture to guess that every other bird native to the Southwest except, possibly, three carrion-feeders—the crow, raven, and turkey buzzard—is likewise called upon.

So great was the demand for turkey feathers for prayer-stick making at Zuñi in the autumn of 1939 that I was repeatedly implored during a 2-hour visit the week before Thanksgiving to mail a quantity from the butcher shops of Gallup—"any kind of turkey feather."

Parrot and macaw feathers likewise were urgently needed. The truly handsome bird I gave the Macaw clan in 1924 was still alive, but it had been pretty thoroughly plucked. Brought from an inner room to be photographed, it protested bitterly and fluffed its ragged coat in an effort to multiply its scant protection (pl. 75).

The bird had been presented because, without conscious selection on our part, most of the Zuñi we took to Chaco Canyon were Macaw, and they told me a live macaw had not been seen in Zuñi within memory of their oldest men. The feathers they annually needed for prayer sticks and other purposes had been purchased from Santo Domingo where two macaws were privately owned. After plucking feathers, my informants said, the owners professed to control the new growth by rubbing over the empty follicles "paint" of the desired color.[56]

The Macaw group has long been numerically important at Zuñi. It was strong, too, at Pueblo Bonito. This is evidenced by the fact that we recovered no less than 10 articulated skeletons and a number of miscellaneous bones. Eight of the ten are *Ara macao;* the other two, *A. militaris*. Three had been buried in Room 306, one lay on the floor in the southwest alcove of Room 309, four were found under the wreckage in Room 249, and two were exposed during the cutting of our stratigraphic section through the east refuse mound. In addition, three articulated skeletons were unearthed during our explorations in Pueblo del Arroyo.

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[56] Dr. Herbert Friedmann, curator of birds, U. S. National Museum, directs my attention to "A Dictionary of Birds," by Alfred Newton (London, 1893-1896), p. 99, where it is stated that a common practice in Brazil is to change the head color of pet parrots from green to yellow by rubbing the budding feathers with the cutaneous secretion of a toad, *Bufo tinctorius*. Métraux (Journ. Washington Acad. Sci., vol. 34, No. 8, pp. 252-254, 1944) reports the rather widespread use in Brazil of vegetal or animal "ointments" to change the color of feathers.

In 1881 Bourke (1884, pp. 26-27) noted several macaws at Santo Domingo; none in the other pueblos he visited.

A sequel to my 1939 visit to Zuñi: Under date of March 21, 1946, the Sun Priest sent me an airmail, special delivery letter reading, "Yesterday my parrot fell over dead. Please think it over and see if you can get me another one."

Room 249, originally one with 248, had been separated from the latter by a rude partition and then divided by a flimsy floor introduced at a height of 7 feet. The uppermost of the two chambers so formed, 4 feet high and entered solely from the dwelling above, had but a single wall opening—a 11½-x-9-inch ventilator, close under the beams, which sloped up and outward to vent at the level of the terrace surrounding Kiva E. That ventilator, and the ceiling hatch when open, supplied such light as reached the upper chamber. From the latter a floor hatchway was the only means by which light and air filtered down into the lower chamber. And yet the lower chamber was designed and utilized as a cage for live macaws. Their excrement lay upon the floor and upon the remains of an adobe-surfaced shelf, 40 inches wide, which had extended across the east end of the room at a height of 3 feet 8 inches. Shelf, introduced floor, and the original first-story ceiling had all crashed down into the lower chamber with collapse of the second-story walls. Under this ruin, on or near the floor, lay four articulated skeletons of *Ara macao* and the skull of a fifth. One of the skeletons, in situ, is shown on plate 76, lower.

That these tropical birds had been confined some time in their dark, ill-ventilated quarters, into which no ray of sunlight could possibly penetrate, is evidenced by the fact that their breast bones were deformed, the sternal keel being bent to one side, as in figure *b,* plate 76, upper. From remains conspicuous among the room's debris, we know these captives were fed pinyon nuts, squash seeds, and roasted corn-on-the-cob. This fare could scarcely cause the deformity mentioned, but utter lack of sunlight might.

We recovered two other articulated bird skeletons—that of a red-tailed hawk, found on the floor at the south end of Room 264 (pl. 76, middle) and that of a thick-billed parrot, buried in Room 308. The skull of a second parrot of this same species was exposed by our east refuse-mound trench.

Since the known range of the thick-billed parrot—the pine belt in the mountains of middle and northern Mexico[57]—is nearer than that

[57] Thick-billed parrots (*Rhynchopsitta pachyrhyncha*) sporadically invade the mountains of southeastern Arizona and southwestern New Mexico. One such invasion occurred in 1917-18 when large numbers were reported at various places in Arizona from the Chiricahua Mountains westward into Santa Cruz County and north as far as the Galiuro Mountains, along the Pinal–Graham County border (A. Wetmore, Condor, vol. 37, 1935, pp. 18-21). On May 5, 1583, members of Espejo's expedition observed parrots much farther north, in a rugged canyon identified as Sycamore Creek but that might as likely be Oak Creek, southwest of Flagstaff (Hammond and Rey, 1929, p. 106).

of the macaws, one would naturally suppose that parrots were held captive at Pueblo Bonito more frequently than their larger cousins. But our data indicate the contrary. Or perhaps the ceremonial importance of macaw feathers outweighed the accessibility of parrot feathers. At any rate, we have record of only six parrots from the ruin—the two above mentioned and four skeletons, unidentified as to species, found by Pepper in Rooms 71 and 78. In contrast, the Hyde Expeditions and the National Geographic Expeditions together recovered 24 macaw skeletons, in addition to many detached bones. Of these skeletons, 16 are *Ara militaris,* the green macaw which lives in the highlands of Mexico from southern Sonora to northern Oaxaca, while 8 are *A. macao,* the gorgeous red, blue, and yellow species which ranges the hot tropical lowlands from southern Tamaulipas, on the east coast of Mexico, southward through Central America to Bolivia and Brazil.

Casual search of the archeological literature reveals no reference to parrot or macaw remains from a southwestern ruin earlier than Pueblo III. Tentatively, therefore, we may assume that Mexican buyers of Pueblo turquoise and buffalo hides introduced parrot and macaw feathers as a medium of exchange somewhere around the middle of the eleventh century. To this dead plumage live birds were soon added; we may picture them, protesting from cages on the backs of merchants trotting the long trails across mountain and desert, just as today we may hear other macaws complain from similar cages on trails in southern Mexico and Guatemala.

There was nothing novel in trade between Mexican tribes and those of the Southwest. It began in Basket Maker times or earlier; the shortest, most feasible routes were well known. Over these footpaths, native guides led various Spanish expeditions sent to the northwest frontier of New Galicia in search, first, of the mythical island of the Amazons and, later, of the fabulous "Seven Cities of Cíbola." It was the tale of an Indian trader's son—one who had accompanied his father into the back country to barter feathers for semiprecious stones —that spurred the notorious Nuño de Guzman in 1530 to his conquests northward along the Pacific coast. Six years later Cabeza de Vaca, safe after incredible adventures, told of having seen in Indian villages on the Río Sonora many turquoises which had been obtained, in exchange for skins and feathers of parrots, from populous pueblos farther north. As traders, the Opatas of Sonora were thoroughly familiar with the Pueblo country; they probably supplied, directly or indirectly, the thick-billed parrots and the macaws whose remains we uncovered at Pueblo Bonito.

Including those mentioned above, the following species have been identified among the bird bones gathered from Bonitian rubbish heaps:

Redhead duck (*Nyroca americana*)
Red-tailed hawk (*Buteo borealis*)
Swainson's hawk (*Buteo swainsoni*)
Ferruginous rough-legged hawk (*Buteo regalis*)
Golden eagle (*Aquila chrysaetos*)
Prairie falcon (*Falco mexicanus*)
Wild turkey (*Meleagris gallopavo*)
Sandhill crane (*Grus mexicana*)
Macaw (*Ara macao; A. militaris*)
Thick-billed parrot (*Rhynchopsitta pachyrhyncha*)
Great horned owl (*Bubo virginianus*)
Magpie (*Pica pica hudsonia*)
Raven (*Corvus corax*)

Presumably these were killed or kept captive for their feathers alone, since the Pueblos have always shunned winged creatures as a source of food.

The only preservable feathers unearthed during our explorations were four, from Old Bonitian Room 298 (fig. 70). They had been tied together; the proximal half of the vane, and a sliver of quill, had been cut away from both sides. The four are too altered and faded for positive identification but appear to be wing feathers of the blue macaw.

As might be expected, bones of the wild turkey were most numerous among our avian remains—expected, because the Pueblos had tamed this native American bird long previously. Turkey pens are frequently associated with cliff dwellings of the ninth century and later. Spanish writers of the Conquest period repeatedly mention flocks of turkeys about the Pueblo villages. At that time turkey feathers were utilized both for domestic and religious purposes. Today, when feather robes are no longer made, turkey feathers are still indispensable as prayer offerings.

Second numerically among the bird bones from Pueblo Bonito are those of the golden eagle. The Hopi, according to Fewkes (1900a), regard eagle feathers next in ceremonial importance to turkey feathers, recognize eagle nests as clan property, take young eagles from the nest, "purify" them by head washing, and kill them by pressure on the sternum.

It is said that in former times the Hopi hunter tied a rabbit on top of a brush-covered pit, concealed himself within, and seized the eagle by a leg as it dropped upon the prey. Bonitian hunters practiced a variation of this method by luring the bird within range and then

felling it with a club. We know this because a number of eagle and hawk sterna in our collection have keels dented by a single sharp blow struck more or less at right angles (figs. *a* and *c*, pl. 76, upper). Since these injuries had healed, it is manifest the priests of Pueblo Bonito kept the birds captive for a time, as Zuñi and Hopi priests do, and thus assured themselves of a ready supply of feathers.

Perhaps the first recorded reference to Pueblo prayer sticks is that of Castañeda, who observed at a spring near Acoma a cross-shaped offering "and many little sticks decorated with feathers around it, and numerous withered flowers . . ." (Winship, 1896, p. 544). At Acoma today, as in 1540, "all important occasions must be preceded by, or accompanied with, the making and depositing of prayer sticks. . . . They are made before all masked dances, the solstice ceremonies, at birth, and at death, for all important ceremonial occasions are intimately concerned with the supernatural world, and prayer sticks are the most formal and satisfactory means of establishing the desired rapport with the spirits" (White, 1932, p. 69).

Prayer feathers are downy feathers, bunched or tied individually to a string. They are offerings or gifts to the spirits in return for an expected favorable response to a prayer. Currently they are more widely made and more frequently used even than prayer sticks (Parsons, 1939, pp. 285-291). Being light and fragile as down, prayer feathers naturally could not survive long under ordinary conditions. We found none in the ruins of Pueblo Bonito but, knowing at least some of the birds captured there, we may be sure prayer feathers were also made and deposited.



FIG. 70.—Feathers from Room 298.

"Ceremonial sticks" is the term under which Pepper described certain long wooden artifacts he recovered in surprising numbers. About 375 were standing in the northwest corner of Room 32, nearly buried by accumulated sand. All were specially carved at one end and gradually tapering at the opposite. According to the nature of their specialization, Pepper (1920, p. 143) divided them into four classes:

1. With two knobs, the upper one sometimes perforated.
2. End shaped like a bear claw.

3. Broad, spatulate end.
4. Wedge-shaped, sometimes bound with buckskin and cord.

A cord was attached to the carved end of 14 specimens; pairs of small curved sticks were tied to three. In Room 33, adjoining, about 30 more ceremonial sticks were exposed, five of them having been thrust for safekeeping between ceiling poles (Pepper, 1909, p. 197).

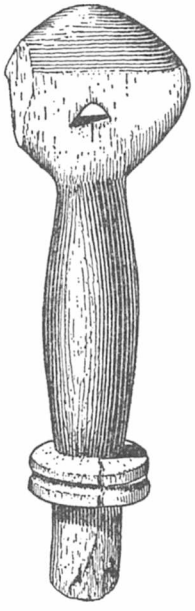


FIG. 71.—Fragment of a "ceremonial stick."

Only the first two types are represented among the 16 fragments unearthed during the Society's investigations. The six illustrated by figures *a-f*, plate 38, belong to type I, although *a*, less likely *b*, apparently lacked the lower knob. Specimen *e* is of special interest since it was not only hollow but tightly fitted inside with a wooden tube whose beveled end projects beyond the broken lower edge of the shaft. The spool-like knob on this fragment is the lowermost of the two that identify type I. It is present on five of our specimens; grooved around on four of them. The flattish end knob, preserved in four instances, is pierced by a semilunar hole in three cases. Only one fragment bears visible traces of paint—green at the tip, black between knobs (fig. 71).

Of our eight fragments in this group, five came from a Late Bonitian storeroom. No. 202; one each from Old Bonitian storerooms 298 and 299; one, figure *d*, plate 38, from a floor repository in Kiva N. Unfortunately, this latter fragment is all we salvaged from a dozen or more specimens standing in the hole. Several had knobs at or near one end; the opposite end was rounded or somewhat tapered. Of those measured, the longest was 15 inches but my notes fail to state whether or not it was complete. The repository, 11 inches in diameter by 23 inches deep, was plastered with adobe and floored with 2 inches of shale. In the plaster of the north side, one of the sticks had left its partial imprint.

A comparable storage place in Kiva R was lined with masonry. It measured, inside, 8½ by 11½ inches by 29 inches deep and abutted the face of an older bench immediately below the north bench recess. Although empty, the vault had been closed by a fitted slab, countersunk to floor level.

Three nearly complete examples of type-II ceremonial sticks are shown on plate 71, figure *l*, and plate 72, figures *e* and *f*, and five

fragments are represented in figure 72, *a-e*. Each was made from a forked shoot by cutting away one branch and flattening the other on the inside so that it could be bent over. None of the eight has been identified, but five look like greasewood and two may be cottonwood or willow.

Sticks crooked at one end find repeated place on modern Pueblo altars. They may lack the length and the "bear claw" hook of ours from Pueblo Bonito, but they at least suggest the function of the latter. Of 31 sticks surrounding the Antelope Fraternity's Snake Dance altar, 15 are about one-fourth inch in diameter by 18 inches long, bent at one end, and painted black. They represent deceased members of the fraternity (Fewkes, 1894, p. 23). So, too, with crooks on the altar of the Marau Society.

Voth (1901, p. 76) says: "The crook is in Hopi ceremoniology the symbol of life in its various stages." Parsons (1939, p. 163) is more explicit: "Crooks represent the wise old men bent with age; the long prayer sticks, the younger unbent members." At Acoma a crook is offered the traveler on the eve of his departure on a long journey, or one that seems long in the experience of his relatives (ibid., p. 307).

As a sort of standard, a large crook with feathers and an ear of corn attached is carried in certain Zuñi and Hopi ceremonies (Parsons, 1939, pp. 325, 328). Participants in races connected with a women's ceremony at Walpi touch with the palm of their hand a crook held upright by one of the priests (Fewkes and Owens, 1892, pp. 123, 126). Pautiwa, chief of the Kachina gods, distributes at the Zuñi winter solstice crooks of appointment to those who are to take a leading part in the principal ceremonies (Bunzel, 1932b, p. 909). It is thus obvious that crooks have a varied significance in the several pueblos but are always symbolic.

Our eight examples of type-II sticks were recovered in three separate rooms. Half came from two Late Bonitian storerooms, 203 and 304; half from Old Bonitian Room 320. On the floor in the southeast corner of this burial chamber lay specimen *l*, plate 71; elsewhere in the same room we found the three fragments, figures *a*, *b*, and *e*, figure 72. The largest of the three is all we saved of a ceremonial stick under the outstretched but displaced right hand of Skeleton 2 (pl. 91, upper). Fragments of like crooks were observed in the adjoining burial room, 326.

At Zuñi, perhaps also in other Pueblo villages, new homes are dedicated with an offering of prayer sticks and turquoise buried in the walls. It is an old custom, inherited from the past. Quite by accident we happened upon such an offering, including shell and turquoise,

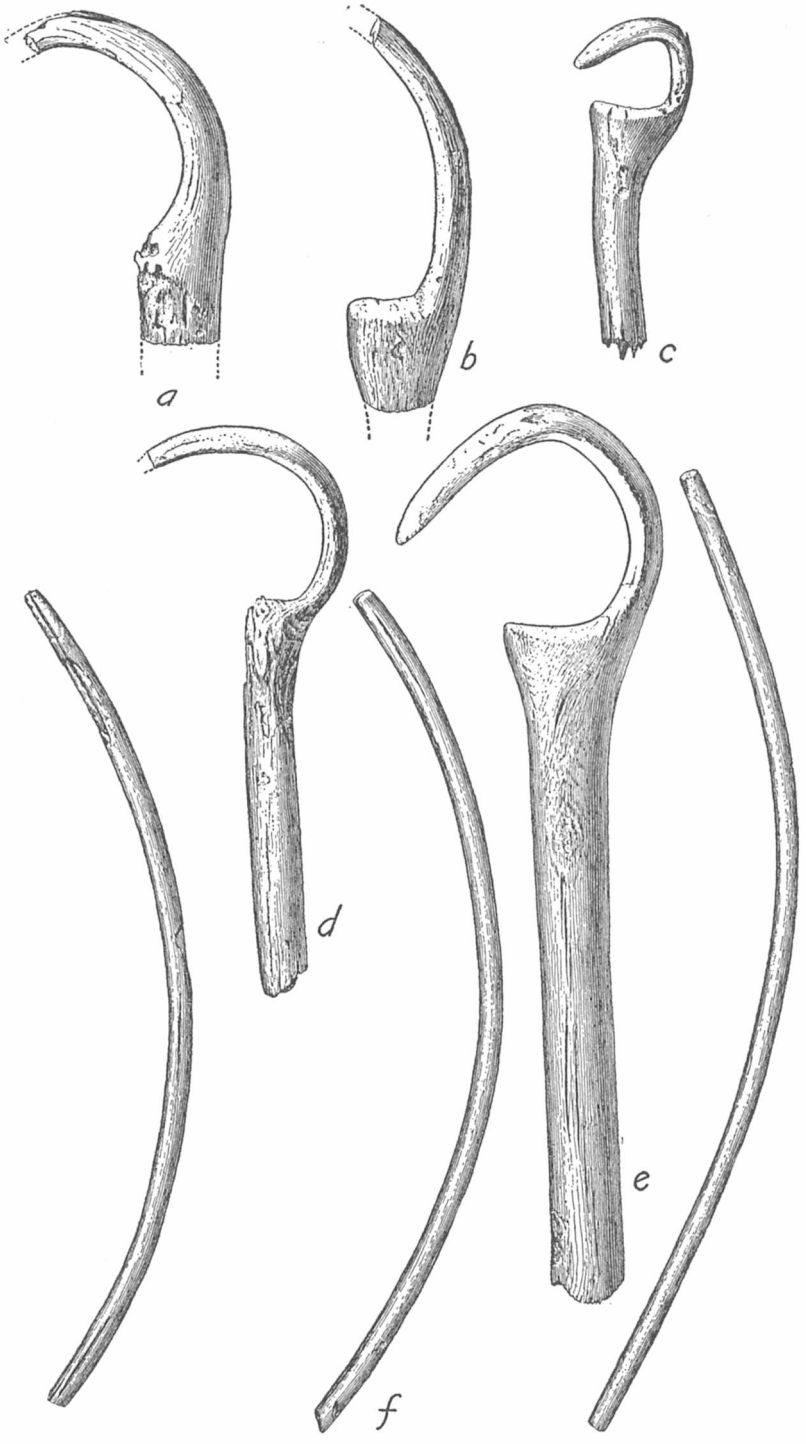


FIG. 72.—Fragments of ceremonial staves (*a-e*) and three staff attachments.

where the partition separating Rooms 89 and 98 abuts the north wall of Room 90.

Horizontal cavities a few inches square and long enough to hold ceremonial sticks of the types under discussion were provided at time of construction over at least three of the first-floor ventilators in the rear wall of third-period Bonito—that wall which abuts the outer northeast corner of Room 267 and extends thence northwest to Room 299 and southeast to 175.

Another such repository, perhaps, was indicated when the Braced-up-cliff back of Pueblo Bonito collapsed January 22, 1941, and partially destroyed several walls in the northeast section of the ruin. Among the wreckage of Room 293 Custodian Lewis T. McKinney found a type-I ceremonial stick 42½ inches long, and another inch, more or less, missing from the tip. The carved portion of this staff, shown in photographs kindly furnished by the National Park Service, is like that on our painted fragment (fig. 71) except that the end knob is more oval and its separation from the "handle" more sharply indicated. Also, the handle is considerably longer and the disk's periphery is shallowly concave rather than medially grooved. I do not know whether this fine example was encased in a prepared repository or embedded directly in the stonework.

At Mummy Cave Tower, Canyon del Muerto, Morris found our two types paired in the corner masonry and overlapping slightly as they extended from bottom to top of the three-story wall—"each unit consisting of a crook and a relatively sturdy member with carved end, to which were attached two tiny bow-shaped pieces." The two types were also paired for placement beneath each protruding ceiling timber of the second and third stories (Morris, 1941, p. 228).

We have no clue to the significance of the paired, bow-shaped pieces. Pepper (1920, p. 144) reported like pairs bound with yucca cord to three of his type-I sticks from Room 32. Those we unearthed were all found singly. The three illustrated as figure 72, *f*, are from Room 202; two others came from the adjoining storeroom, 203.

In the cases cited, it is quite evident that the "ceremonial sticks" were ritually employed. The two types were paired in Mummy Cave Tower and, like prayer sticks, placed under beams symbolically to strengthen the ceiling. Other pairs were embedded in corner masonry to bind the walls together. But the 400-odd from Rooms 32-33 obviously were among the paraphernalia of some society, stored against recurrent need.

Pepper's two types were widely distributed throughout the prehistoric Southwest. Nordenskiöld (1893, pl. 42) shows seven frag-

ments of type I from Long House, on the Mesa Verde, and Morris (1919b, pl. 44, *f*) figures one from nearby Johnson Canyon. Hough (1914) reports both types among the amazing variety of prayer offerings he unearthed in Bear Creek Cave, on Blue River. And Fewkes (1898, pls. 174, 175) reproduces a number of quite comparable fragments from Sikyatki, a Hopi village destroyed presumably in the fifteenth century.

Only from Pueblo Bonito do we have Pepper's third and fourth types of ceremonial stick. But neither here nor elsewhere do we find the slightest hint as to the manner of their use. Culin's suggestion (1907, p. 648) that all four types might have been employed for throwing yoke-shaped billets in a game may be dismissed; so, too, Cushing's implausible explanations as reported by Pepper (1905a, pp. 116-117; 1920, p. 145).

Altar-stick tassels (*?*).—On the floor of Room 299B were a number of what might have been tasseled attachments for altar sticks. With them were a few dressed willows from the ceiling, corncobs, and fragments of abraded boards, all covered by blown sand and masonry fallen from the third story.

Of the dozen fragmentary examples saved, five are shown on plate 77. Each consists of a principal cord, coiled counterclockwise, apparently in every instance, and crowded with short, pendent threads. The main or belt cord may be either yucca or cotton but the fringe strands are always yucca and from $1\frac{3}{4}$ to $2\frac{3}{4}$ inches long.

Each pendent element was made from a few yucca fibers 10 to 14 inches long, tied in the middle with a simple overhand knot, doubled back from the knot and loosely twisted into a 2-ply string that, in turn, was doubled over the belt cord and thrust through its own loop (fig. 73) or held in place by a running wrap stitch. The first method was employed on three-fourths of the fragments. On all but one (fig. *a*, pl. 77), the end loops lie on the outer, or visible, side of the coil.

In the second technique each 2-ply string was merely folded in the middle and hung over the belt cord. The resultant paired strands in one example are secured by a simple forward-two-back-one wrapped stitch, while three others employ a more complex tie. We may also note, in passing, that the latter three use a 2-ply main cord of yucca fiber and an *Apocynum* (?) binder, while the former, now lacking its belt cord, relies upon a cotton string for the wrapping element.

The drawing in figure 74 illustrates our most complete specimen. Here the main cord is of loosely twisted cotton, single-ply, about 34 inches long, and diminishing in diameter for the last few inches. The individual fringe strands, nine per inch, are attached by self-looping,

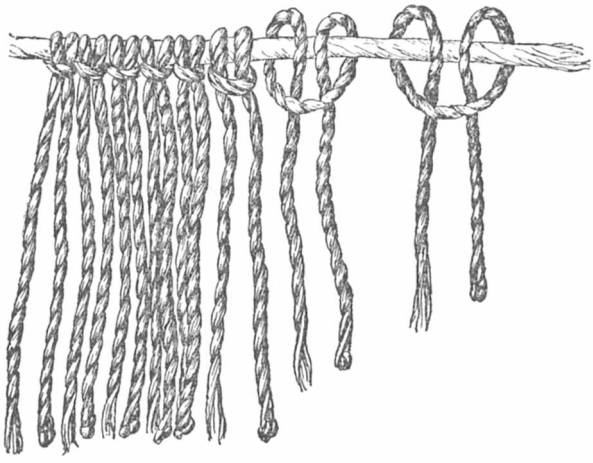


FIG. 73.—Technique of tassel tying.

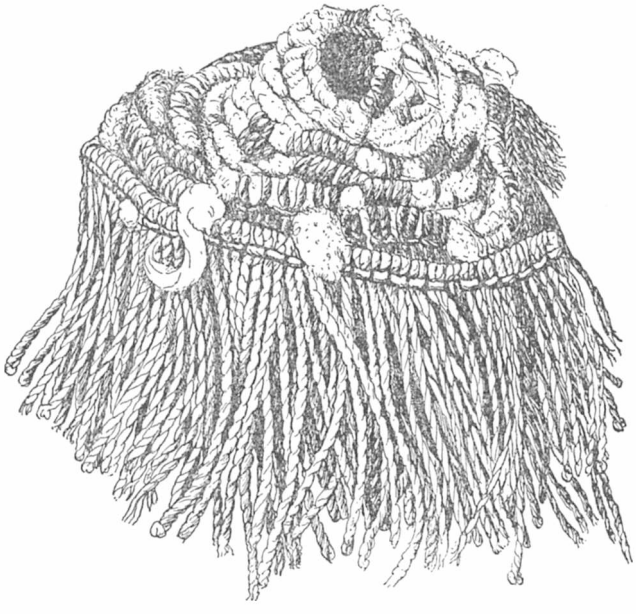


FIG. 74.—An altar-stick tassel (?).

with the loops visible. Eight counterclockwise coils are bound together by three or four cotton cords twined spokewise from the center and, between, by irregularly spaced single stitches that tie two adjoining coils only.

In this particular example the hole at the center is about three-fourths of an inch in diameter while for two others it is $\frac{7}{8}$ and $1\frac{1}{8}$, respectively. Here the fringe strands vary from $1\frac{3}{4}$ to $2\frac{1}{4}$ inches in length; on other specimens they may measure from 2 to 3 inches.

Whether the fringe strings be looped over the belt cord or hung astraddle, their two ends are seldom of equal length. Always the longer is that with the knot; the shorter invariably appears frayed. Rarely is the knot tightly drawn. It lies at, or very near, the end of the strand, and its sole purpose, apparently, was to hold the fibers together for twisting. A few threads are double-knotted; many have no knot at all.

The thought that these fringed coils might possibly have been attached to standing altar sticks was suggested by the central hole. This varies from three-fourths inch in diameter to $1\frac{1}{8}$ inches on the three specimens measurable. Among our type-I "ceremonial stick" fragments are two with lower-knob grooves three-fourths and seven-eighths of an inch in diameter, respectively. The fringed cords, therefore, could have been coiled about such a groove and stitched in place. On the other hand, the hole in one specimen (*c* on pl. 77) is bisected by a tightly twisted 2-ply yucca thread thrust through the several coils and with both ends left free.

I know of but one specimen even remotely resembling these fringed, coiled cords, and that is the "feather ornament" figured by Guernsey from a Pueblo I cave dwelling on the lower Chinle. In this instance, however, the looped ends of the doubled threads are tightly drawn together in a sort of hub from which the free ends radiate. Some of the knots still hold downy feathers (Guernsey, 1931, p. 94, pl. 49, *e*).

From Old Bonitian storeroom 298 we recovered fragments of other fringed artifacts. The pendent elements on these, however, are enlarged by at least two kinds of wrapped stitches (pl. 83, A). Furthermore, the individual strands were doubled over the belt cord and secured in place by twined threads.

In a related but still different specimen (U.S.N.M. No. 335340) the bundle is composed of four or five dozen threads (apparently very fine yucca fiber), each knotted in the middle and twisted into a 2-ply string as in the case of the so-called tassels described above. Here, however, there is a more complex arrangement.

Twenty-one knotted threads were gathered up and bound with

Apocynum (?) a little over half an inch from the end. Then a couple of dozen more threads were separated into two approximately equal lots and tied to either side of the initial bundle half an inch above the first wrapping. A third and lesser addition was made in the same way and followed by a fourth wrapping of *Apocynum* (?) fiber. The end knots are the simple, overhand kind, sometimes doubled, and without a trace of feather or other substance.

Altar (?) fragments.—The thin, painted pieces of wood shown on plate 78, upper, may be from broken altar screens or tablets. Fragment *m,* one-fourth inch thick and beveled toward its notched edge,

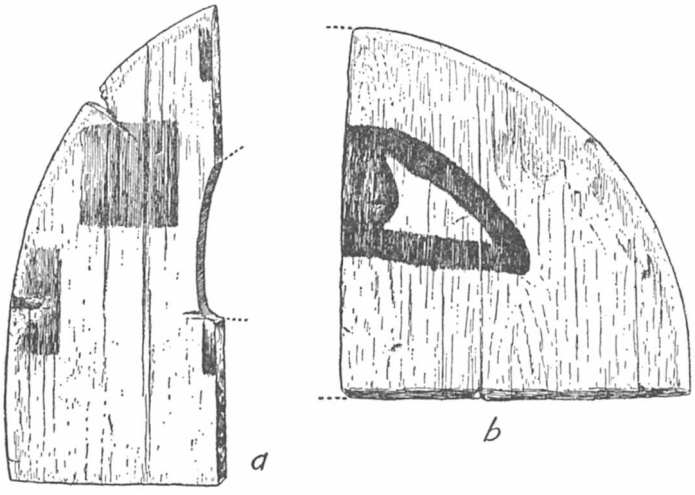


FIG. 75.—Fragments of altar screens (?).

is slightly rounded at both ends as though split from a 4-inch tablet or one shouldered 4 inches from the top. Of the remaining scraps, the thickest measures just a shade over one-eighth inch. All are more or less decayed, shrunken, and warped. All are painted green except *b, k,* and *l,* which are crossed by diagonal blue lines. Paint still adheres to both sides of all except *e, h,* and *i.* This latter, somewhat footlike, probably is wrongly oriented on the plate since the grain of the wood lies horizontally instead of vertically as in the others.

The green paint on both sides of *a* ends at the darker band near the broken lower end. This is also true of *j* where that portion below the middle of the small knothole likewise remains unpainted.

In figure 75 we illustrate two fragments bearing black designs on the front while the rear is blackened all over. Both are three-sixteenths inch thick with the curved edge rounded and the bottom square-cut.

The carved fragment, figure 76, is one-eighth inch thick longitudinally through the body and half that at either edge. Our artist has drawn the head and lower neck lighter to indicate faded orange paint. The opposite side of the head likewise was painted orange. Pinholes for lashings are shown at the shoulders. Between and below these, patches of green paint are represented. It may formerly have covered the entire body.

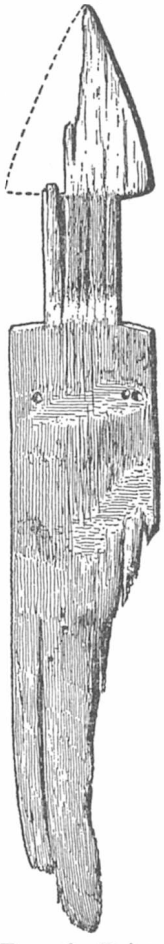


FIG. 76.—Painted wood fragment.

Some of these shaped and painted scraps could be remnants of dance headdresses as readily as of altar screens. All came from Late Bonitian rooms or rubbish in the eastern half of the village.

Wooden cylinders.—When he first saw the round-ended object represented by figure 77, *a*, my old Zuñi camp man pronounced it a "watermelon" such as he plants each spring to insure a good melon crop. Despite variation in length and diameter, the four shown on plate 78, figures *n-q*, indubitably belong in the same class. These five were all recovered from Late Bonitian rubbish while that illustrated by figure 77, *b*, which differs from the others both in its proportions and in the character of its markings, came from Old Bonitian debris.

The other pieces photographed may not be wholly comparable, but they too were recovered from household sweepings. Figure *r*, plate 78, is of juniper and from near the outside of a very large tree. The piece was dressed to cylindrical form with the grain running lengthwise; its ends were cut at an angle of about 30 degrees then smoothed with sandstone. In figure *t* a single lightly incised line spirals up clockwise as though the section had been rolled once under the cutting edge of a flint knife. The lower end of *x* has been cut around and then broken off. None in the lot bears any trace of paint.

Cedar-bark torches (?).—Plate 79, A, illustrates 11 of the 13 cedar-bark bundles found side by side on the middle floor of Room 226. At first sight they looked like a mat or hatchway cover but with no trace of cords binding the units together. On the other hand, our Zuñi workmen immediately identified the bundles as "torches used in the Fire Ceremony to carry fire from one room to another." Except the three longest, all are raveled at one

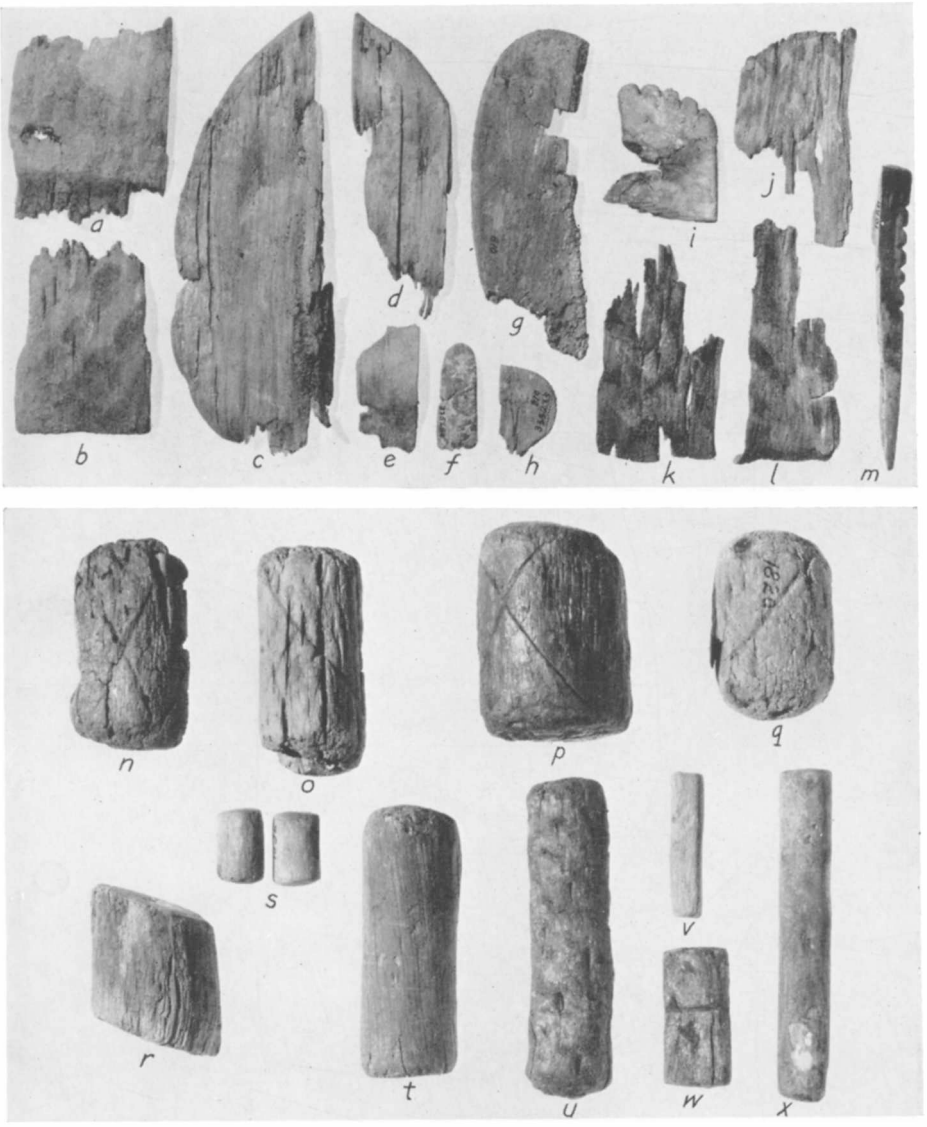
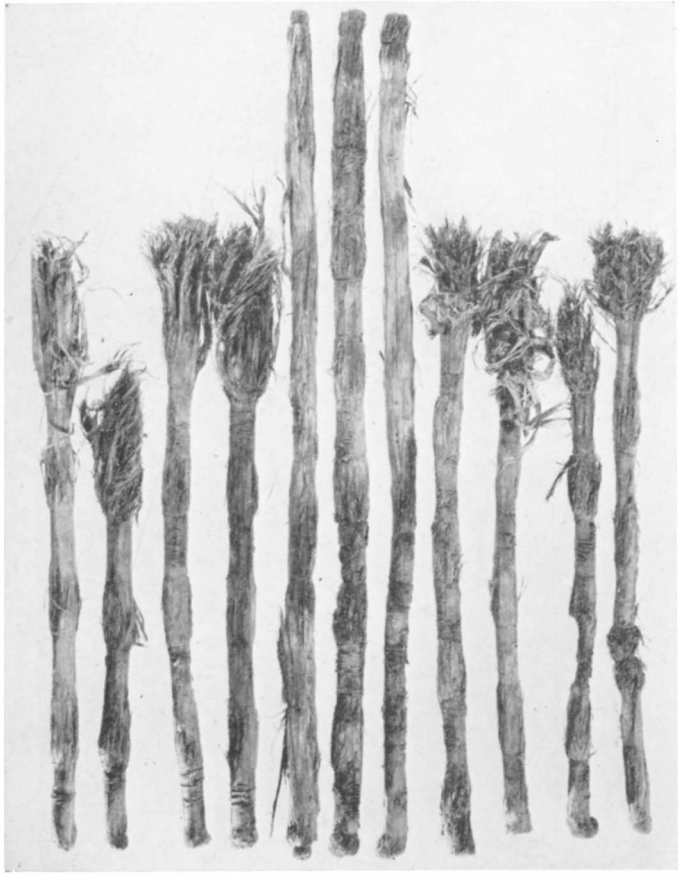
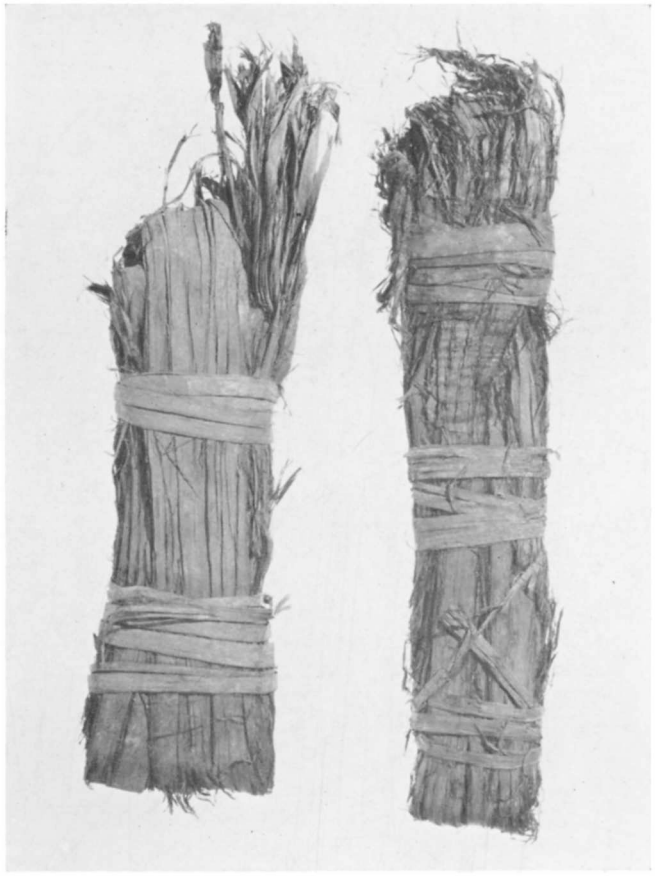


PLATE 78.—*a-m*, Painted fragments of wooden tablets or altar screens; *n-x*, incised cylinders and other objects of wood.

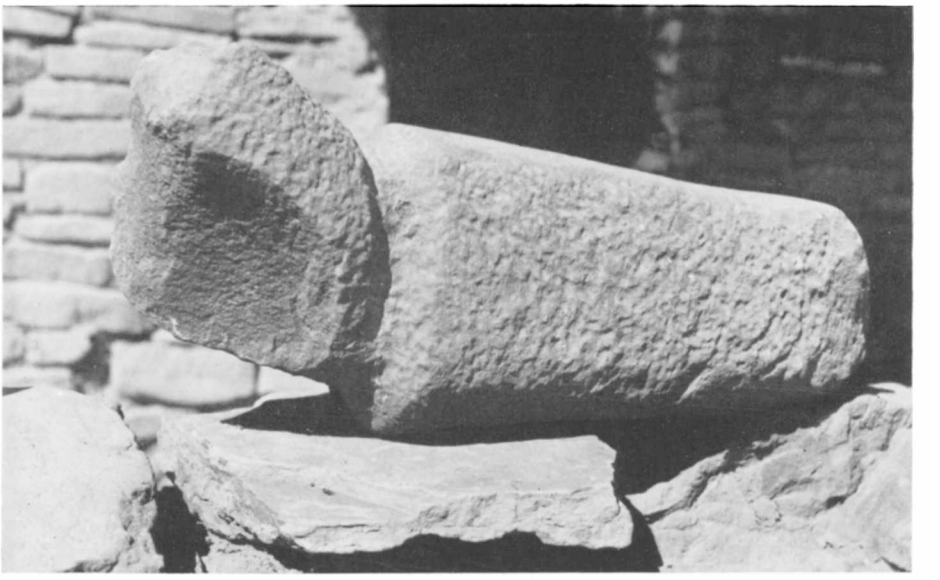


A, Cedar-bark rolls identified by Zuñi men as torches.



B, Cedar-bark bundles, probably used in ceiling construction.

PLATE 79



A, Animal-like carving from Sinklezin, a ruin on the south cliff, opposite Pueblo Bonito. (Photograph by O. C. Havens, 1925.)



B, Stone carving from Ruin No. 8. (Photograph by O. C. Havens, 1923.)

PLATE 80

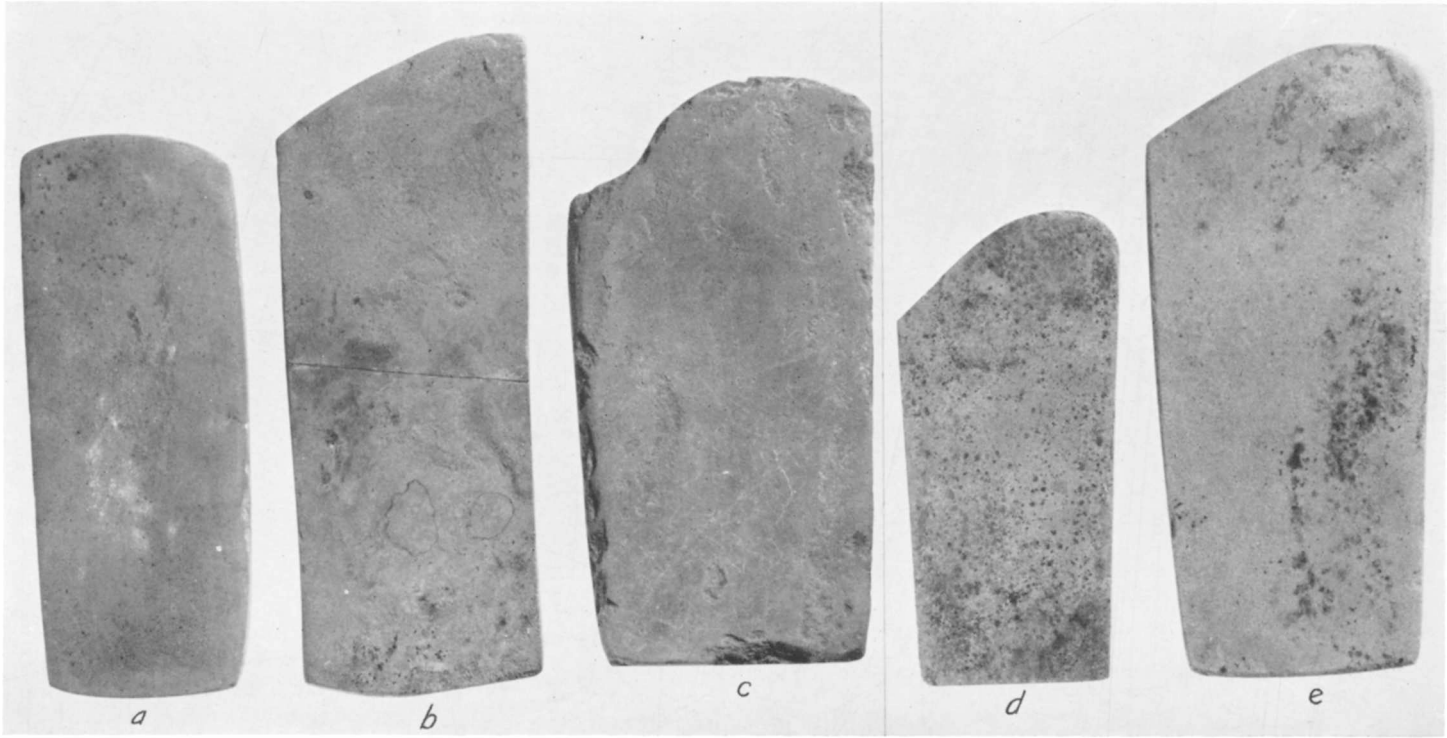


PLATE 81.—Sandal-shaped tablets made of fine-grained sandstone.

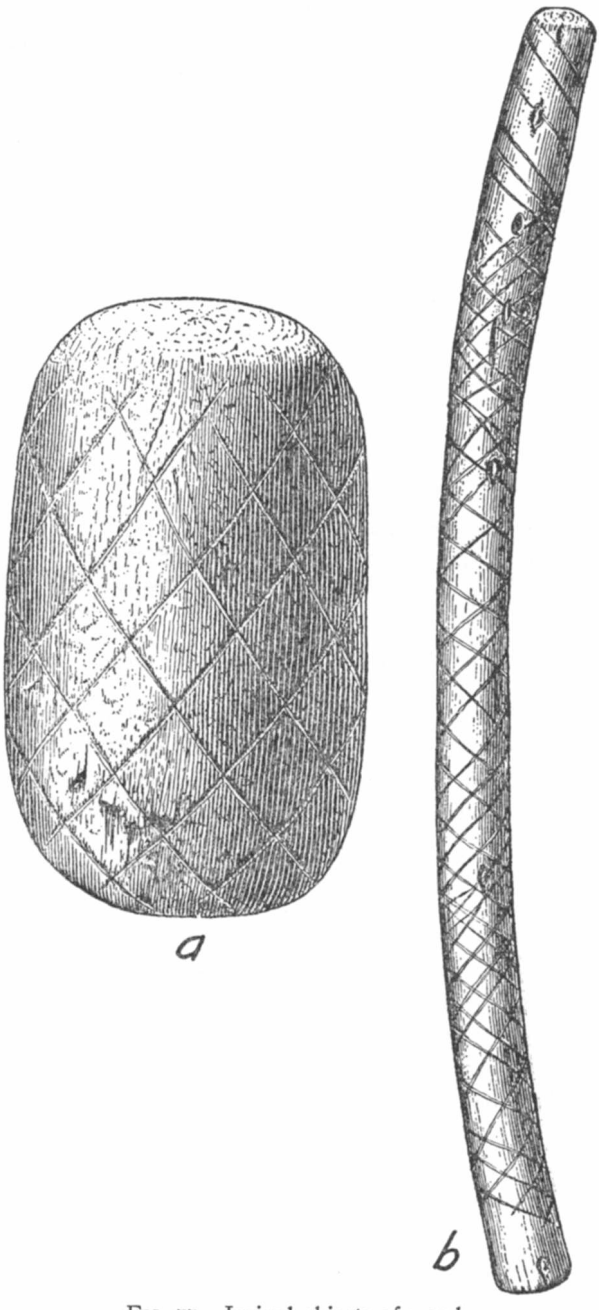


FIG. 77.—Incised objects of wood.

end, but none is charred. Each was wrapped at intervals with fine yucca-fiber string. If prepared as torches they were never used.

Pepper (1920, p. 36) reports a cedar-bark torch, burned at one end, from Room 2.

For certain Pueblo ceremonies fires are lighted with cedar-bark rolls not unlike ours (White, 1932, p. 95; Titiev, 1937, p. 251, ftnt. 11; Parsons, 1939, pp. 749, 766). In other ceremonies comparable rolls are employed for lighting cigarettes or cloud blowers—rather formidable matches, it would seem, for cornhusk cigarettes.

There can be no connection between the foregoing and bundles of loosely wrapped, unshredded cedar bark such as those shown on plate 79, B. These two were recovered in the narrow passageway designated as Room 250; 20 or more had been discarded in the abandoned room next on the south, No. 247. All were somewhat flattened but varied in length, width, and thickness. None was burned or even appreciably



FIG. 78.—Cottonwood rattlesnake effigy.

smoke-stained. Hence, it is our guess these particular bundles served as substitutes for split-cedar shakes in ceiling construction or repairs.

Rattlesnake effigy.—Among dry rubbish overlying blown sand in the east half of Room 226 was a rattlesnake effigy fashioned from a flattened cottonwood root (fig. 78). The root itself, irregularly constricted as it grew, clearly suggested a snake to the finder, for the only modification required was at the extremities: a little whittling to point the tail, a rounded nose, and side notches to delimit the head. Black paint covers the back and, over it, white to suggest markings characteristic of the desert rattler. White paint is present also on the underside of head and tail.

Hough (1914, p. 129) figures part of a snake effigy, likewise made from a crooked root, from a cave near the head of Eagle Creek, Ariz. Carvings or paintings of snakes appear on several Zuñi altars (Stevenson, 1904). In the first quarter of the seventeenth century, Fray Estevan de Perea wrote of wooden pens in which the Zuñi kept rattlesnakes for arrow poisoning—rattlesnakes that hissed and leaped "menacing as the fierce Bull in the arena" (Bloom, 1933, p. 228). And Hodge (1924) has described the snake pens he unearthed at Hawikuh. Thus, among the Zuñi as among the Aztecs, rattlesnakes had a part both in warfare and in religion.

Painted gourd rind.—The fragment illustrated as figure 79 is one of two from the rubbish fill of Room 255. The painted design is light green with a brown border on a red (light vertical hatching) base. These fragments may be from a dance rattle.

OBJECTS OF BONE

Inlaid bone scrapers were regarded as ceremonial by Pepper (1905b, pp. 185-196), and indeed it is difficult to believe such exquisite implements were created for secular tasks. Yet, as has been explained in a previous section, of our 20 humeri end scrapers only 4 were inlaid. One of these was associated with a coiled basket tray, oval in shape, accompanying the body of a woman buried in Room 326. Three other female skeletons in the same room likewise were each accompanied by an oval basket and a scraper made from the humerus of a mule deer. It is, therefore, the association of such a scraper with an oval basket tray rather than the fact one of the four was inlaid, that suggests a possible ceremonial connection.

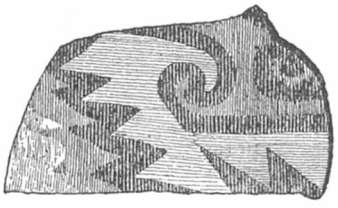


FIG. 79.—Painted gourd rind.

Bone dice.—Games of chance are played by all American Indians. Most of them employ wooden or cane sticks but some tribes, as the Arapaho of Wyoming and Oklahoma, prefer bone counters (Culin, 1907, pp. 53-55). Though such games may fill an otherwise idle hour, they are more frequently played seasonally and with religious sanction. For example, the 4-stick Zuñi game of *sho'liwe* is played ceremonially in May to bring rain (ibid., p. 35). Similarly, ritual stick races in spring and early summer are the means by which Hopi and Zuñi show running water how to hurry on to waiting fields.

Bone dice, so-called, have been reported repeatedly from Pueblo I-III ruins. Of the 16 we recovered at Pueblo Bonito, 12 are elliptical in shape but the degree of pointedness at the ends varies considerably (fig. 80). So, too, in cross section: eight are flattened on both sides, while the others vary from planoconvex to concavoconvex. With one exception (*e*), incised markings, if any, occur on the flatter side.

As to distribution, three were recovered from Old Bonitian debris; five, from Late Bonitian debris and two from mixed rubbish; two came from Late Bonitian rooms of which one had previously been excavated; and four were miscellaneous finds. In their varied form as in their markings these dice are indistinguishable from those unearthed at older Pueblo ruins.

It is believed the small discoidal specimens, figures *j-l,* likewise were gaming counters. The first is a little less than semiglobular; the second, flat on both sides with rounded edge. The third example consists of a cup-shaped section of bone having eight notches around the rim, backed with a semiglobular, brown, resinous pellet molded to shape.

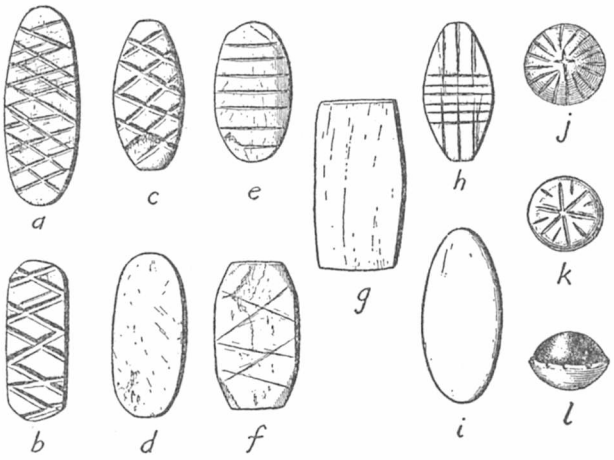


FIG. 80.—Bone dice, or gaming counters.

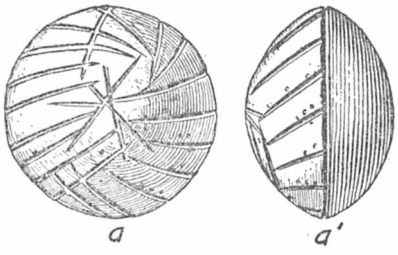


FIG. 81.—Bone die.

Figure 81 illustrates one of three ellipsoidal bone counters from as many Late Bonitian rooms. The three are very nearly equal in size but are marked differently. On one of them (U.S.N.M. No. 335138), traces of a black substance remain in the cuts. The encircling groove appears on all three. Although the bone is too modified for positive identification it has been suggested that each is carved from the head of a bear's femur.

STONE OBJECTS AND MINERALS

In previous chapters reference has been made repeatedly to concretions, mineral paints, and stone artifacts that for various reasons are thought to have been connected with ceremonial rather than secular activities. We come now to more detailed consideration of these several groups.

Sandstone tablets.—Four thin, patiently prepared stone tablets are

illustrated in plate 27, upper. Their over-all appearance and absence of worn areas suggest utilization in esoteric practices and this impression is heightened by the fact that *d* was an accompaniment of Burial 8, Room 326. So, too, with *a;* it comes from Kiva Q and is of a cream-colored marlaceous shale quite foreign to Chaco Canyon.

From Room 23, Pueblo del Arroyo, came five remarkable stone tablets—remarkable for their uniform thinness (average, three-eighths inch) and superior workmanship. All are of very fine-grained calcareous sandstone (or siltstone) ; all are rectangular (average $15\frac{1}{16}$ by $8\frac{9}{16}$ inches) ; all were broken when the ceiling and upper walls crashed to the floor. Two are slightly discolored by smoke and one bears the stain of decayed twilled matting.

These Pueblo del Arroyo tablets evidence skill and boundless patience on the part of whoever made them. (They may very well be the work of a single individual.) They were reduced to their present form solely through abrasion. All are polished to a degree, but exhibit no mark offering a clue to their original use. Since those of sandstone, especially, were too fragile for any utilitarian purpose, it may be inferred that all were in some manner employed in ritualistic observance of the unknown clan whose maternal home stood in the southwestern corner of that ruin.

This conjecture is strengthened by the other unusual stone and earthenware artifacts recovered from these same rooms. Pueblo Indians still store the ceremonial paraphernalia peculiar to each society in dark interior rooms of the house recognized as the ancestral home of that society. Fewkes and others have remarked the use of painted slabs on Hopi altars, and have described the finding of similar slabs in prehistoric ruins. (See, for example, Fewkes, 1904, pp. 104-106; Haury and Hargrave, 1931, p. 56; Kidder, 1932, p. 96. Morris, 1919a, pp. 23-24, describes polished slabs from Aztec Ruin quite like those from Pueblo del Arroyo.) Of our series, however, only one (U.S.N.M. No. 334842) bears a trace of paint and that a wash of yellow ocher on one side.

Sandal-shaped tablets are apparently restricted in distribution to Pueblo III ruins of the San Juan drainage. The more finely woven sandals of that period have a broad notch, or jog, at the little toe, a feature frequently represented on the tablets. Hence the often-quoted theory these latter were lasts on which sandals were woven. The idea is pure fancy, of course, since the Pueblo technique of sandal weaving required no last.[58]

[58] Kidder and Guernsey, 1919, pp. 101-107, clearly describe the ancient methods and briefly consider "sandal stones."

The average length of the seven sandal-shaped tablets in our Pueblo Bonito collection is $11\frac{1}{4}$ inches. All are of relatively fine-grained sandstone, but they vary in both texture and outline. Of those represented on plate 81, *c* appears unfinished since the scars of spalling were only partly erased. The first, *a,* might be classed as readily with the narrower type of rectangular tablet as with the present series. On one of its smooth faces red paint is still discernible. Examples *b* and *d* only remotely resemble each other in outline and workmanship yet both came from Room 326.

The two specimens not illustrated deserve an additional word. One (U.S.N.M. No. 335882), $9\frac{7}{16}$ by $5\frac{5}{8}$ inches, was flaked from a thin leaf of standstone with no effort toward elimination of surface irregularities. The second (No. 335895) measures 13 by $6\frac{1}{8}$ by $1\frac{1}{2}$ inches and weighs nearly 10 pounds; marks of the hammerstone still show on its edges but both sides have been smoothed as though from long use. We may only wonder whether these two meant just as much to local ritualists as did those on which infinitely more labor had been expended.

Utilization of sandal-shaped stones in Pueblo III ceremonies unknown to us, as tcamahias and painted slabs are still employed on Hopi altars, seems quite within reason. Convincing evidence of such use is presented by Morris (1939, pl. 145) in his description of a painted wood sandal form from Aztec Ruin. Transversely across the middle back is the mark of a flat stave to which the form had been sewn and which, presumably, supported it in a horizontal position above the altar.

Tcamahia, according to Fewkes (1900b, p. 589; 1900c, p. 982), is a Keresan word signifying "the Ancients" and is used by the Hopi of Walpi not only in the invocation immediately preceding the public portion of the Snake Ceremony but also to designate a certain type of celt, 18 of which are among the furnishings on the Antelope Society altar. Dorsey and Voth (1902, p. 210) state that a 10-inch jasper celt is concealed within the bundle of eagle tail feathers known as the *tiponi,* perhaps the most sacred article on the altar of the Antelope fraternity at Mishongnovi.

Tcamahias are of interest for several reasons: (1) Those used in Hopi rituals are not made locally but are found about prehistoric ruins; (2) as a culture trait they are apparently restricted to ruins of the upper San Juan drainage and to small ruins rather than the great, compound villages of the Pueblo III period; (3) they appear to have been designed as agricultural tools; the esoteric properties with which they are today endowed by Hopi priests have not yet been fathomed. It means nothing, of course, that tcamahias are usually referred to throughout the Southwest as "skinning knives."

A few examples recovered during our explorations are described on pages 243-246 as agricultural tools. Just when they lost their original function and became appurtenances of religion remains unanswered, but the change probably occurred early in Pueblo III.

At the bottom of a pot-shaped storage cist dug in the compact sand below the floor of Room 266, we found the hematite object shown in figure 82. Its sides are smoothly polished and the corners rounded. Although in outline it resembles one type of tcamahia, its broader end is only slightly beveled rather than ground to a knifelike edge. It was not a paint stone.

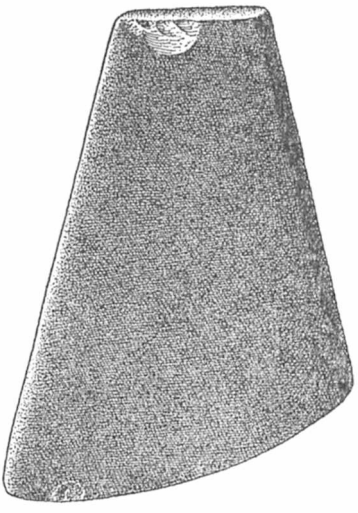


FIG. 82.—Celtlike object of hematite.

Except this last doubtful example, our tcamahias are broken or battered through reshaping rather than by work in rocky soil. None was found under circumstances to connect it indelibly with ritual. And yet, as the symbol of an ancient warrior, the tcamahia is deeply rooted in present-day Pueblo ceremonialism.

Sandstone cylinders.—Three cylinders of friable gray sandstone, $4\frac{1}{2}$ inches in diameter by $4\frac{3}{4}$ inches long, grooved about the middle and slightly convex at the ends, were found on the bench in Kiva J (pl. 82, figs. *h-j*). Two comparable but less carefully finished specimens, *f, g,* lay close together on the floor and just west of the fireplace in Kiva G. Neither has been burned; one (*g*), rather squarish, in addition to the encircling groove is marked by crossed lines incised on each side.

Concretionary cups.—An almost spherical sandstone concretion, unmodified except for incipient cupping, is shown on plate 82 as figure *d.* Half of a similar nodule, a surface find, was hollowed out to form a shallow mortar, figure *c,* and a like fragment from Room 256 had been cupped on its convex surface as though for a pot rest (fig. *e*).

Small sandstone concretions, naturally hollow, are occasionally recovered from ruins of the San Juan drainage. When the cavity has been smoothed or enlarged and external irregularities removed, such specimens are often described as "paint cups." None of the five in our collection bears any trace of pigment (fig. 83).

Paints of prescribed colors in traditional patterns are required for masks and altar paraphernalia, and for the participants, in every

important Pueblo ceremony. At other times paint gives that essential finishing touch to the toilet; frequently it forms a protection against insects or the blistering midsummer sun.

Red was a favorite color of the ancient Pueblos as it is of their descendants. Red oxide, reddle, limonite, hematite—any mineral that produced a reddish mark—was paint to the Bonitians, and they probably knew every odd corner in their arid domain where it was to be found. They were undoubtedly acquainted, for example, with the small deposit under the sandstone cliff about a mile and a half south of their deserted village—a deposit that was claimed in 1923 by a Navaho living nearby. This mercenary individual sought to profit

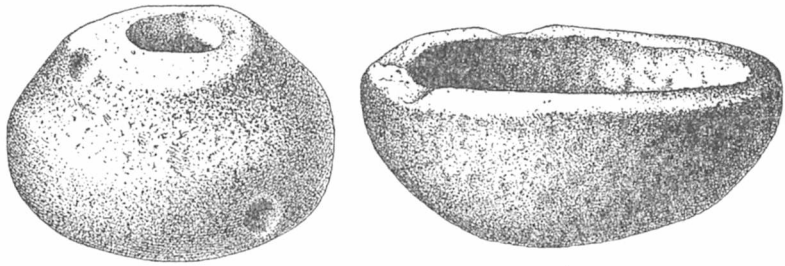


FIG. 83.—Concretionary cups.

from the cupidity of my Zuñi workmen, but I suspect the latter proved the better bargainers, for I saw them return beaming to camp one Sunday afternoon with a fat kid for their frying pan in addition to a bag of choice ocher.

Both in Chaco Canyon and out upon the northern Arizona deserts I have often seen Navaho women, less frequently men, with faces painted a brilliant crimson against the reflected heat of pale yellow sand. Mention of this custom in the National Geographic Magazine (Judd, 1925, p. 238) brought complaint from a Pacific-coast reader as to the inadequacy of commercial rouges and an accompanying plea for a sample of the natural cosmetics used by my Indian neighbors. Now I am not the one to deny a lady's prayer and so I gave her what information I could, but I never had the courage to inquire what damage the iron-stained clays of New Mexico did to that tender California skin.

Our Zuñi workmen coveted almost every bit of red oxide unearthed during the excavations. Time and again I watched unseen as one of them spat on a handy potsherd, moistened a newly found fragment of the mineral, and with a finger daubed forehead, cheeks, or nose. The older men usually carried somewhere about their persons a little buck-

skin bag containing a thimbleful of the red powder, for use both as a dry rouge and as coloring matter for impromptu offerings to the Unseen Forces.

In preparing pigments for their periodic ceremonies, Zuñi priests employ an assortment of stone mortars and pottery cups, while a large sherd or a slab of sandstone appears to satisfy the Hopi. Like the latter, our Bonitian ritualists were generally content to crush and mix their paints on any handy flat-surfaced object—a rough doorslab, a polished sandstone tablet, a jar cover, even a metate or mano. Rarely did they go to the trouble of making special mortars. Indeed, we found only four during the course of our explorations and two of these came from Pueblo del Arroyo. One of the latter, with two squared basins half an inch deep in which red and black pigments had been mixed, was found in Room 27 along with a number of ceremonial objects. From the adjoining chamber, Room 23, came half a doorslab on which yellow and red ochers had, in turn, been liquidized.

Of our two Bonito paint mortars, squarish and both from kivas, one (U.S.N.M. No. 335921) has a secondary circular depression in the middle of its rectangular grinding surface that indicates use of a pestle. But our excavations brought to light only five pebbles worn at one end like pestles and neither bears the slightest trace of paint. It appears, therefore, that the accepted practice in Chaco Canyon was to crush or rub bits of iron-stained minerals and other ores directly upon the stone palette where they were mixed with water, grease, or vegetable extracts.

Any flat-surfaced stone might be utilized as a palette. We found paint on polished and unpolished sandstone jar covers; on half a sandal-shaped stone, and on undressed slabs chipped about the edge to fit doorways or ventilators. Among paint stones from Pueblo del Arroyo are two manos and part of a third stained, respectively, with red, green, and blue. A rectangular muller of exceedingly fine-grained sandstone (U.S.N.M. No. 334824) is coated, except the side last used in grinding, with what appears to be organic matter.[59]

Malachite and azurite pellets, gleaned from distant copper-bearing formations, furnished the green and blue colors we see on baskets, fragments of gourd vessels, and bits of wood. Two-thirds of the pieces of hematite and limonite recovered are faceted by rubbing; one fragment of reddle (U.S.N.M. No. 335402) is drilled through as if for a cord. Yellow occurs along with the red oxides in deposits easily accessible from Pueblo Bonito. The old priests searched widely for

[59] As tested by E. P. Henderson, of the National Museum staff, "the material is driven off by heating to red heat, leaving a brownish residue."

the paints required in their ceremonials, and we may guess that the one who brought home the chunk of sulfur (No. 335645) found in Room 320 was mystified at his inability to make a mark with it.

Kaolin, a chalklike clay, supplied white paint for symbolic designs and a slip for pottery. Besides a number of used pieces, we recovered at Pueblo del Arroyo three cakes of slaked kaolin molded in a bowl—a find reminiscent of a practice among Zuñi potters noted by Mrs. Stevenson (see page 184).

If any difference is to be noted between the mineral paints and paint-making methods of the Bonitians and the Zuñi of 50 years ago, it is in the latter's greater dependence upon tools and utensils. For the most part, any flat-surfaced rock sufficed the Bonitian and he mixed his pigment where he ground it. In contrast, the Zuñi priest preferred a stone mortar, generally flat and quadrangular, and perhaps a small vessel to hold the ground paint. Col. James Stevenson (1883) includes a number of these "paint cups" in his 1879 Zuñi collection, but very few of them retain any trace of powdered mineral today.

Two fragments of fine-grained sandstone tablets (U.S.N.M. No. 335624) were first classified as saws, and quite understandably, since both are knifelike on one edge, thickest (one-eighth inch) at the middle. One (field No. 1047), from Late Bonitian debris in Room 290, bears longitudinal striations on one side and a trace of hematite; the second (field No. 93) boasts a brown border on each side, but within this border one face is coated with yellow oxide and the other with red.

From Rooms 2 and 32 Pepper recovered balls of red and yellow ocher impressed with folds of buckskin bag containers; from Room 60, a large corrugated pot in which was stored a thick layer of red oxide and, over it, a quantity of seeds (Pepper, 1920, pp. 37, 137, 221). In Rooms 64 and 80, respectively, he unearthed a sandstone pestle and a mortar on which geometric designs were painted. These latter two he considered ceremonial (ibid., pp. 237, 264).

"Medicine stones" are presumably relics of ancient shamanistic practices. They may be highly specialized and yet definitely nonutilitarian either because of shape or material. Fossils, unusual pebbles, concretions having some real or fancied resemblance to animal gods or to parts of the human body, also come within this category. Every Pueblo theurgist includes one or more such objects in his "medicine" kit. As fetishes, concretions are still highly prized at Zuñi for their obvious connection with the forces of creation and hence for their power to assist the possessor in attaining a given objective.

I was working in a deep room at Pueblo Bonito with one of my Zuñi assistants one day when he found a cylinder of hematite that in

size and appearance was not unlike the ubiquitous lipstick of the past few years. After holding the specimen in his palm for several minutes my companion volunteered the belief that such objects were employed by the Bonitians, as by his forebears until a generation or two previously, in hunting deer. And he went on to explain that when a Zuñi hunter discovered a fresh track he laid upon it a hematite cylinder and at the same time offered a silent prayer to the gods of the chase. Then, if he were of good heart, the weight of the cylinder on the deer's track eventually so tired the animal that it could be overtaken and killed.

This account illustrates the subtle power of medicine stones, but it does not explain the presence of four hematite cylinders (fig. 84) side by side at the head of a middle-aged female (Burial 8) in Room

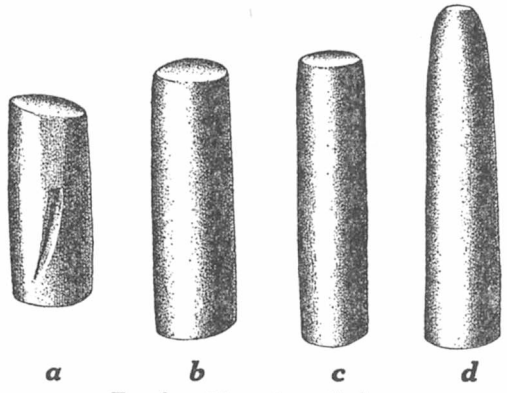


FIG. 84.—Hematite cylinders.

326 (pl. 95, A). No trace of pouch or other container was noted. One of the four is worn at one end as though for paint. Two comparable hematite cylinders were retrieved from Late Bonitian rubbish in Rooms 246 and 251B (U.S.N.M. Nos. 335574, 335576).

Our collection includes a number of more or less specialized objects which, if not medicine stones, may have been utilized in some of the recurrent rituals at Pueblo Bonito. Among these is a small series of pointed implements the aboriginal use of which is problematical. The first three of those illustrated in figure 85 (*a-c*) are of travertine, a calcite often called "Mexican onyx"; the fourth (*d*), of dark limestone. The fact that this latter, more perfectly shaped and polished than the others, was found in Kiva G means little since the chamber had been abandoned and utilized as a dumping place for household rubbish by those living nearby. The tapering, butt end of a similar object (U.S.N.M. No. 335613) was recovered from an adjacent room, 266.

In November 1929, while the three travertine specimens were lying upon my laboratory table, Mrs. John Wetherill, of Kayenta, Ariz., well versed in the lore of the Navaho Indians, remarked that Navaho medicine men obtain identical material through trade from near Albuquerque, N. Mex., and scrape from it a dust which they carry in pouches

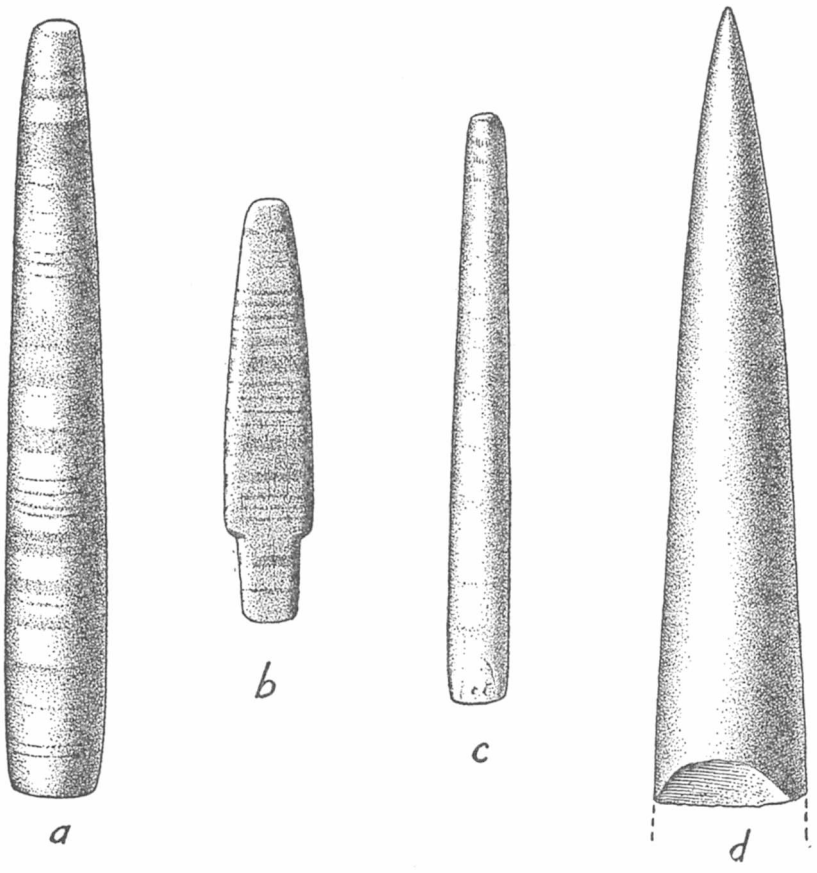


FIG. 85.—"Medicine stones."

for use in certain ceremonies. Our three pieces, however, are finished artifacts; they show no evidence of mutilation. Calcite of this character occurs in limestone formations at numerous places throughout the Southwest. But there is no limestone in the Chaco Canyon region.

In her monograph on the Zuñi Indians, Mrs. Stevenson (1904, pp. 333-334) records that "a piece of banded gypsum, 2½ or 3 inches in length, slender, round, and tapering" is employed by the leader of the hidden-ball game, played to the rain-making Gods of War, in

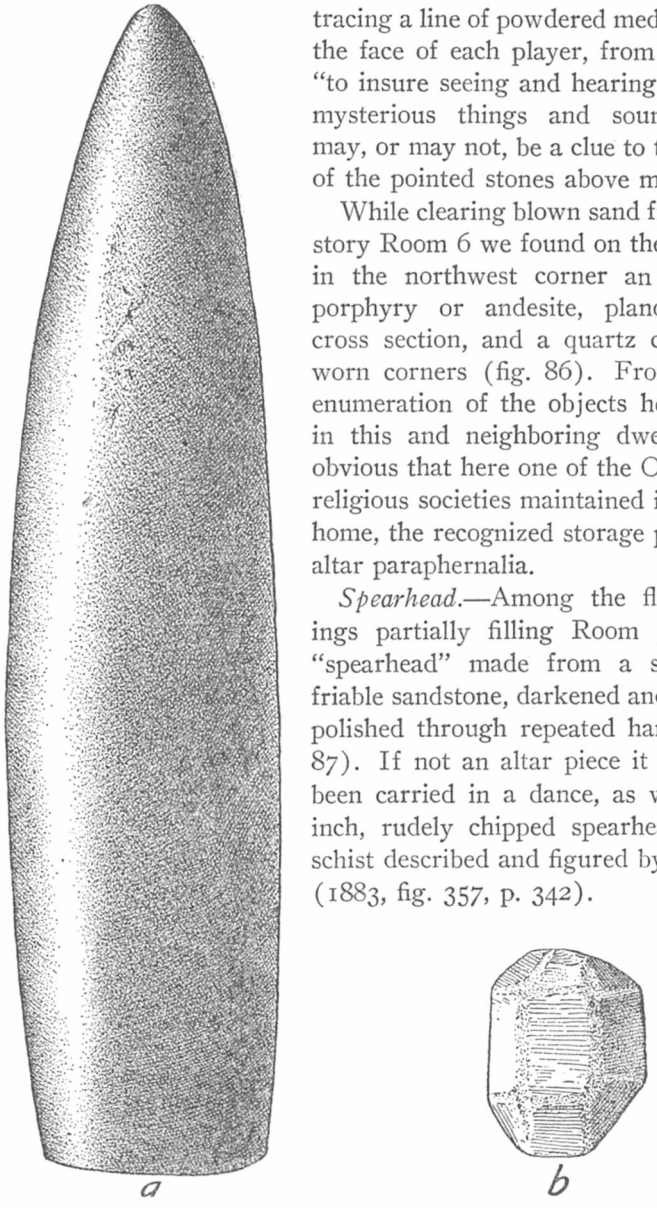


FIG. 86.—Stone "knife" and worn quartz crystal.

tracing a line of powdered medicine across the face of each player, from ear to ear, "to insure seeing and hearing unusual or mysterious things and sounds." This may, or may not, be a clue to the function of the pointed stones above mentioned.

While clearing blown sand from second-story Room 6 we found on the floor close in the northwest corner an artifact of porphyry or andesite, planoconvex in cross section, and a quartz crystal with worn corners (fig. 86). From Pepper's enumeration of the objects he recovered in this and neighboring dwellings it is obvious that here one of the Old Bonitian religious societies maintained its ancestral home, the recognized storage place for its altar paraphernalia.

Spearhead.—Among the floor sweepings partially filling Room 325 was a "spearhead" made from a slab of red friable sandstone, darkened and somewhat polished through repeated handling (fig. 87). If not an altar piece it might have been carried in a dance, as was the 15-inch, rudely chipped spearhead of mica schist described and figured by Stevenson (1883, fig. 357, p. 342).

Similar to this latter in size and crudity, but probably without ceremonial significance, is a large spearhead-shaped sandstone slab that lay among fallen masonry in Room 202. The piece measured 21 inches long by 8 wide and $1\frac{3}{4}$ thick. It had been shaped by coarse flaking

along the edges but, since the tip remained unmodified, the form of the slab as received from the quarry probably gave some indifferent mason the idea and at least momentary respite from the monotony of wall building.

Miscellaneous stone artifacts.—Unusual pieces are the sore thumbs of an archeological collection. There is no taxonomic pocket into

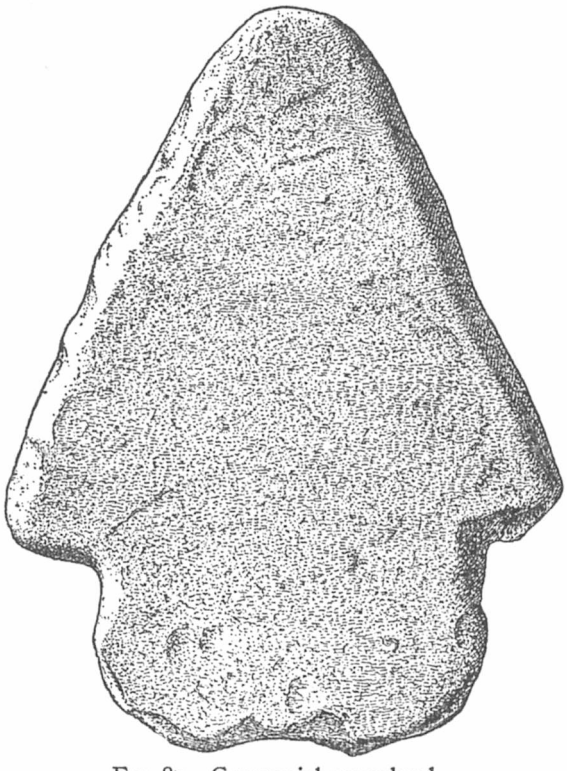


FIG. 87.—Ceremonial arrowhead.

which they can be dropped conveniently. Their very uniqueness makes them conspicuous and tempts the finder to speculation.

Like other excavated ruins, Pueblo Bonito provided a number of strange artifacts—nameless objects whose original purpose, if any, remains obscure. A few have already been described as "medicine stones" because they are plainly nonutilitarian and yet evidence use. Among those remaining is one of fine-grained sandstone, 35 inches long, $1\frac{15}{16}$ by $2\frac{5}{16}$ inches at one end and $1\frac{1}{4}$ by $2\frac{1}{16}$ inches at the other (U.S.N.M. No. 335932). Its sides were first dressed with stone hammers then smoothed by abrasion. We found it, broken in two, among a number of household utensils fallen from the upper stories

of Room 296. What possible purpose could be served by a piece of carefully worked sandstone a yard long and two inches square?

Fossils, concretions, and oddly shaped stones have a place on certain altars and in certain shrines of the present-day Pueblos. Except that they are visible ties to that distant past when the world was young and all mankind spoke a common language with the birds and beasts, we may not fathom the significance which still attaches to such objects. The number Pepper exhumed in the northwestern quarter of Pueblo Bonito is abundant evidence that the Unseen Forces governing Chaco Canyon were much in the thoughts of the Old Bonitians.

Our own explorations, on the other hand, disclosed very few fossils and these are all shells from the Pennsylvanian and Cretaceous for-

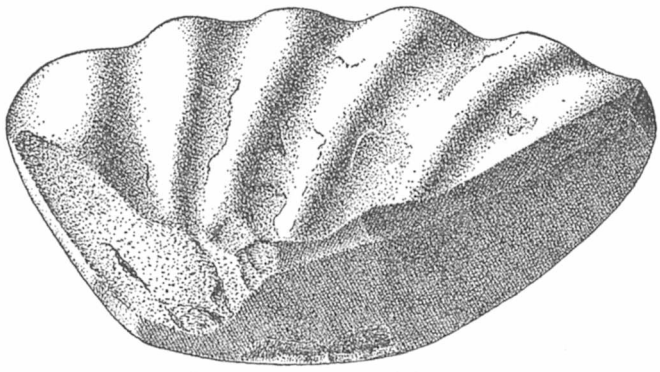


FIG. 88.—Fossil-shell medicine stone.

mations (identified by Drs. G. A. Cooper, curator of stratigraphic paleontology, U. S. National Museum, and John B. Reeside, U. S. Geological Survey, as *Composita subtilita* (Hall); *C. trilobata* Dunbar and Conrad; *Linoproductus prattenianus* (N. & P.); *Linoproductus* sp.; *Juresania* sp.; *Lucina* sp.; *Gyrodes compressa* Meek; *Ostraea* cf. *O. plumosa* Morton; *Metoicoceras whitei* Hyatt; and, possibly, *Pteria nebraskana* Evans and Shumard). A majority comes from reexcavated Room 6. Two have been considerably worked: the single valve of *L. prattenianus* (U.S.N.M. No. 335641) is worn flat on one side by abrasion; the fragment of *Metoicoceras* (fig. 88) is faceted from rubbing and scraping. Obviously the priest who owned this ammonite (it was found in Kiva R) regarded its medicinal properties highly and we may readily believe that he concocted many a potent brew from its scrapings. Similar mystic powers were attributed to a fragment of micaceous schist, if we correctly interpret the cutting and scraping evident on one face (fig. 89). Sections of crinoid stems, on

the other hand, show no modification at all and neither do various calcareous nodules, pieces of stalactitic chalcedony, etc.

Among household rubbish in Room 325 was a dark, plummet-shaped object 1 inch in diameter by 1⅞ inches long, the sandstone image of a dried Mission fig. It is ungrooved, undrilled; appears to be a concretion but little altered if at all.

Pellets of azurite and malachite, according to our Navaho workmen, are to be had west of the Jemez Mountains and north of Cuba. Other minerals—selenite, calcite, galena, iron pyrites, thin flakes of mica, etc.—probably were gathered beyond the Jemez, somewhere east of the Continental Divide. We recovered such fragments throughout the ruin and invariably in piles of debris. Few have been modified and then only in an experimental sort of way. In no instance were these minerals grouped as though part of a medicine man's bundle. A num-

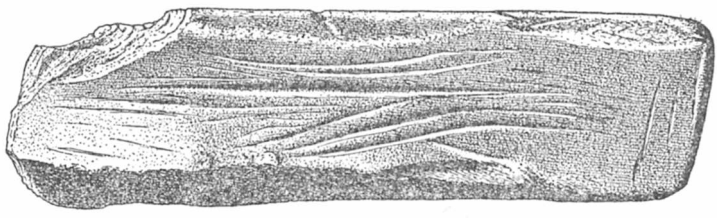


FIG. 89.—Medicine stone of micaceous schist.

ber of drilled or grooved malachite pellets and several bits of selenite have been described herein as objects of personal adornment. Calcite flakes, when worked at all, commonly exhibit but one worn edge.

Water-worn quartz pebbles half an inch wide and perhaps twice as long undoubtedly belong in this same category. They were too small for pottery polishers. More or less translucent flakes of calcium carbonate could be the filler from thin veins in sandstone formations; small botryoidal masses of jasper and chalcedony could have originated in geodes of the La Plata Mountains and so, too, faceted pencils of crystal quartz.

Silicified wood is usually included among the concretions, fossil shells, and miscellaneous rocks in a modern Pueblo shrine. Our excavations disclosed both worked and unworked pieces, the former invariably as hammerstones. A likely source of this fossil wood is the Bad Lands of the Ojo Alamo section, north of the Escavada. Here, too, might be one source of our quartz and jasper pebbles.

For no particular reason we include here two fragments on which even mineralogists fail to agree. Both were found in burned kivas. That from Kiva D, Pueblo Bonito (pl. 70, fig. *a*), looks like solidified

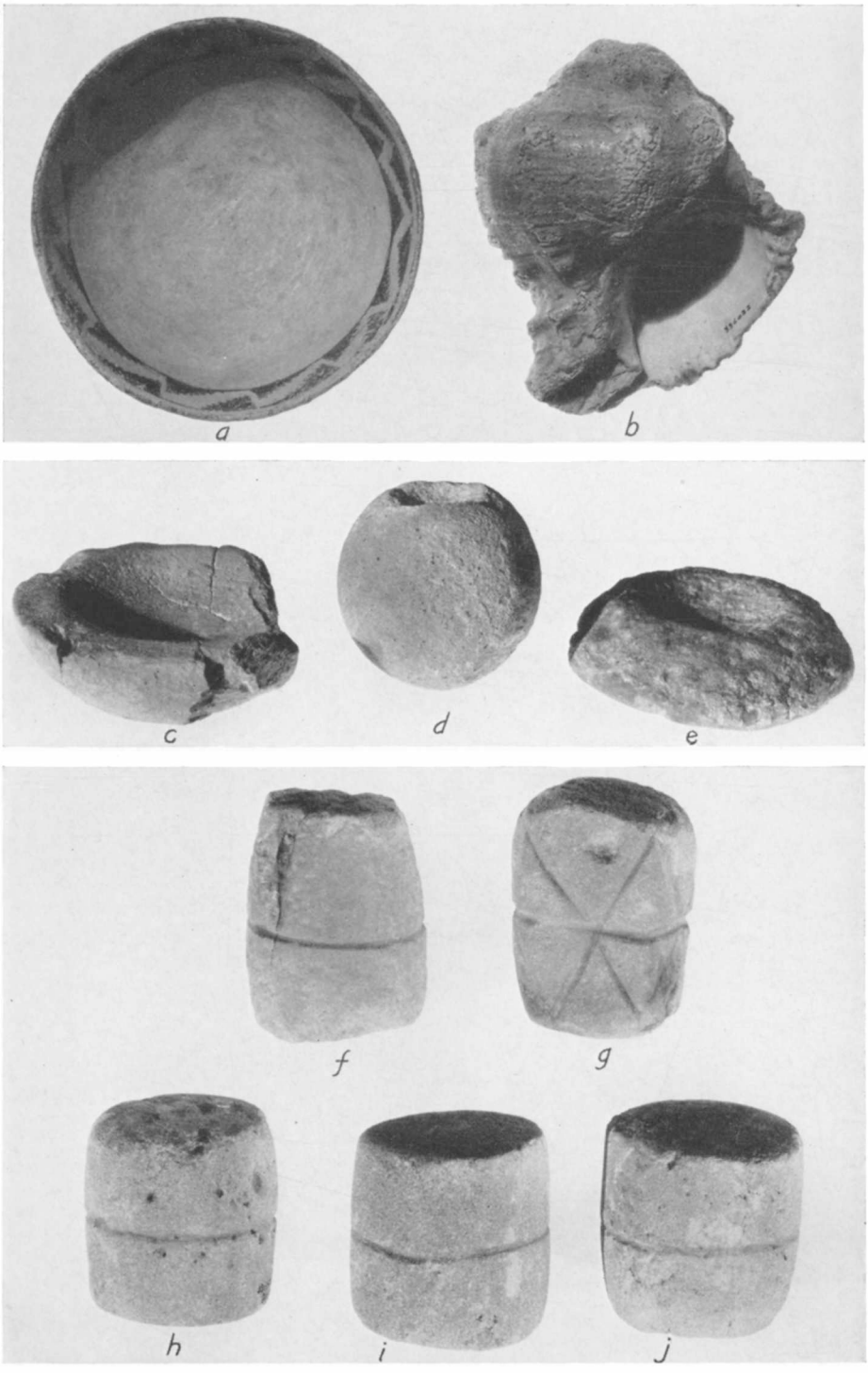
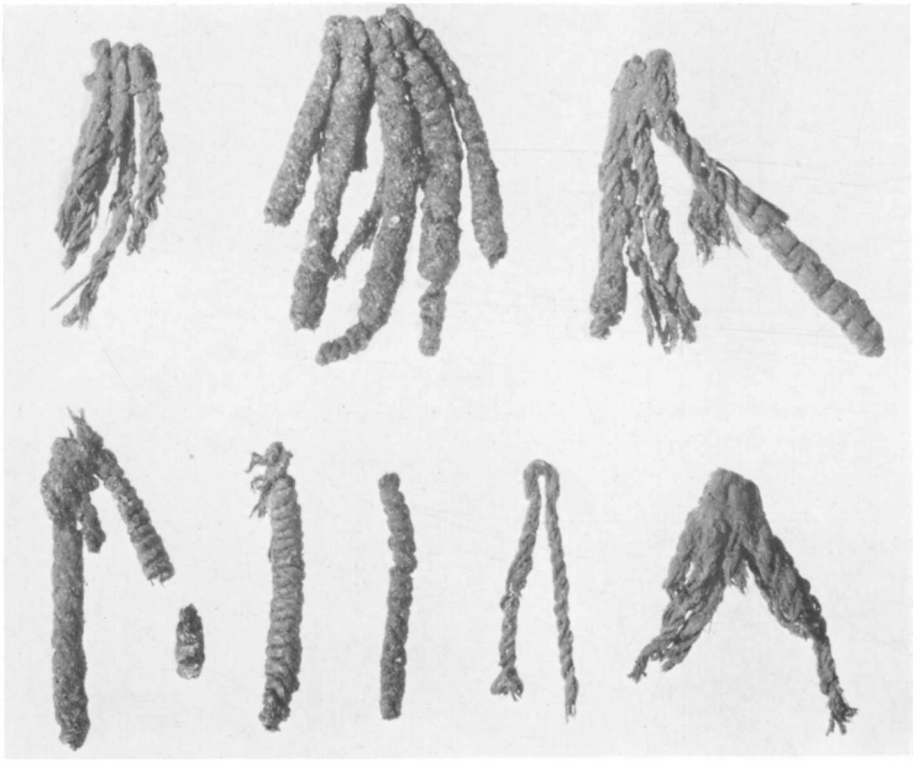
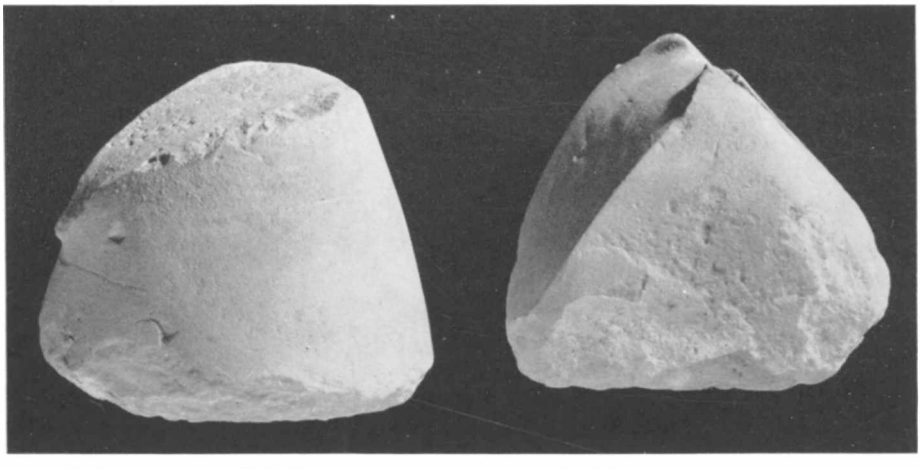


PLATE 82.—*a*, *b*, Earthenware bowl and shell trumpet from a wall niche, Kiva R; *c-e*, mortars made from sandstone concretions; and *f-j*, cylinders of soft sandstone.



A, Wrapped pendent elements thought to have adorned some religious object.



B, Sandstone heads believed to represent Mountain Lion, hunter of the north.

PLATE 83

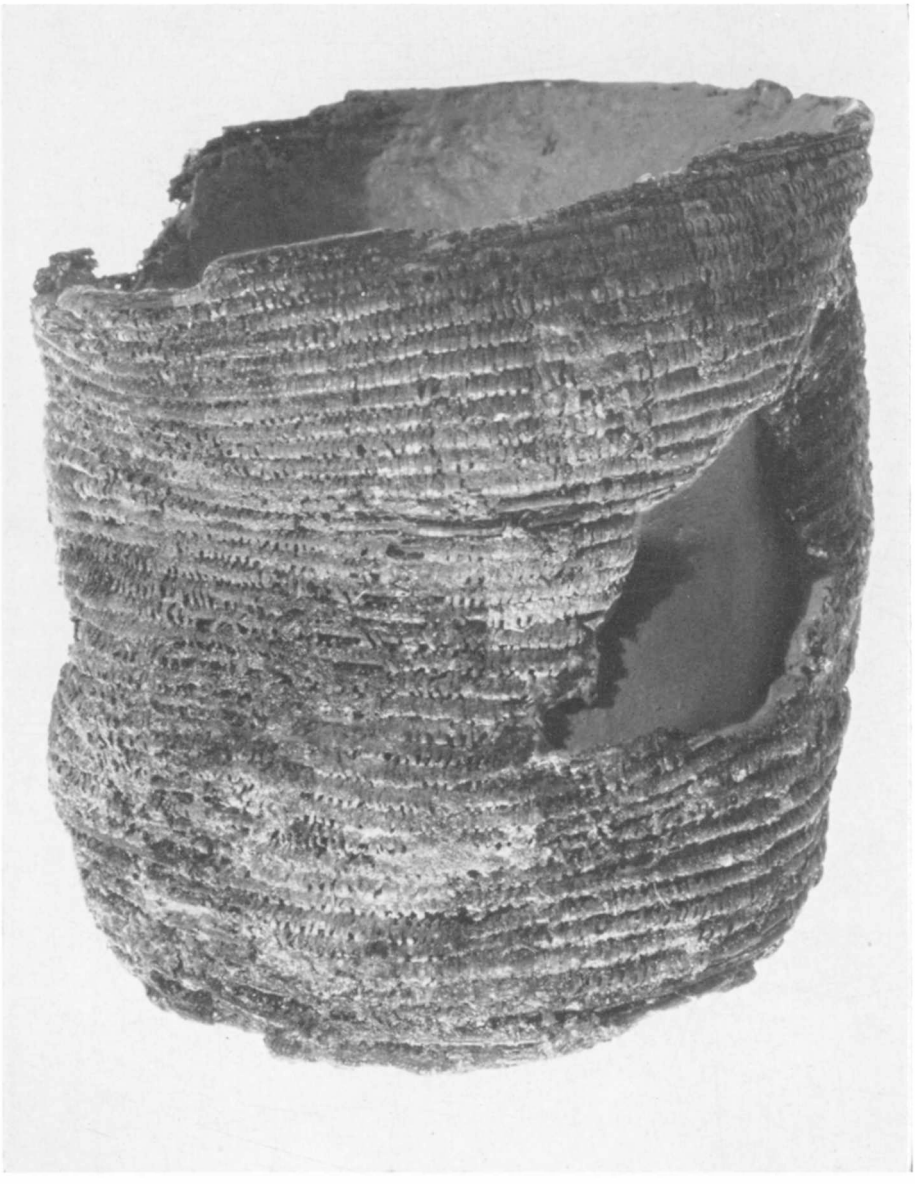


PLATE 84.—Cylindrical basket decorated with a painted design in black, orange, green, and brown.

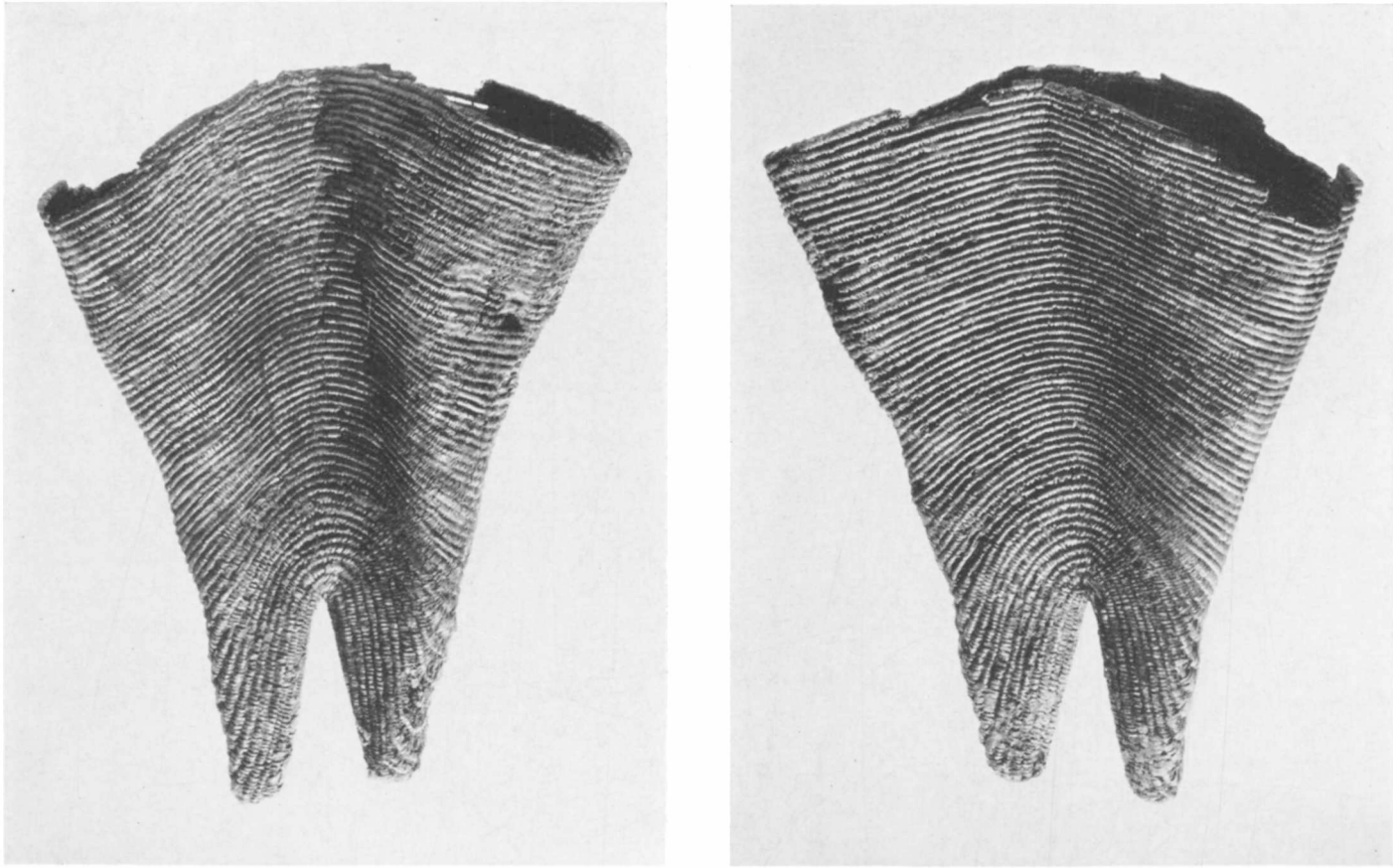


PLATE 85.—Painted bifurcated basket from Room 320, obverse (left) and reverse.

sea foam and weighs but little more. The second (*b*), in two pieces, more glassy in appearance and more vesicular, was found near the floor on the eastern side of Kiva C, at Pueblo del Arroyo.

Both these circular subterranean chambers had been destroyed by fire and my initial thought was that the two slaglike pieces were products of those conflagrations. Dr. W. F. Foshag, of the U. S. National Museum, shared this impression but Drs. C. N. Fenner and Fred E. Wright, of the Carnegie Institution of Washington, were positive the fragments originated in some distant volcano.[60]

Pepper found pieces of like substance in Rooms 10 and 38, neither

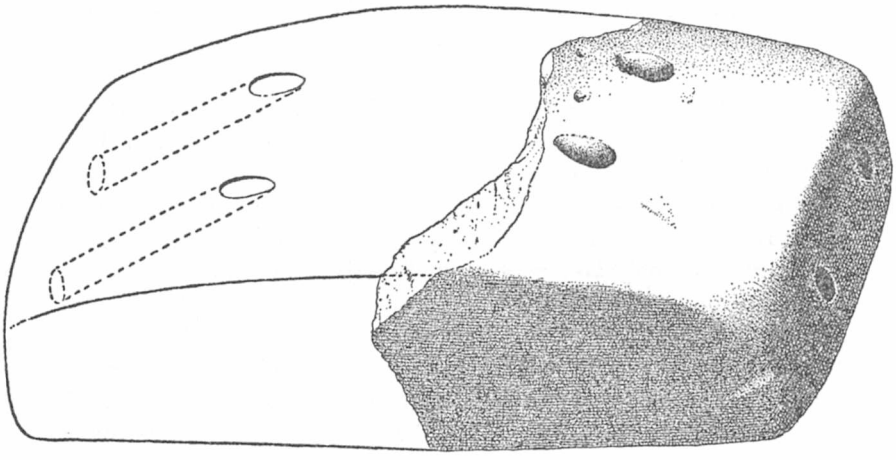


FIG. 90.—Fragment of clay plume holder (?).

of which had been burned. Four of those from Room 10 were shaped like arrowpoints, or parts thereof; two were white and two dark. Pepper's conclusion, derived from blowpipe analysis, was that the material was of volcanic origin (Pepper, 1920, pp. 59, 191).

Plume holder (?).—Among household debris dumped through the hatchway of Kiva L was part of an unusual object, tentatively identified as a plume holder (fig. 90). It is of fine-grained paste, apparently rock-tempered, meticulously stone-polished, and fired to a blue-gray

[60] On the basis of homogeneity, surface glaze, and softening temperatures, Fenner and Wright identify the specimens as "excellent examples of volcanic pumice; of rhyolite pumice, to be more exact," high in silica. Foshag, on the other hand and after independent analysis, expresses the belief that they are "pieces of either pitchstone or perlite that were present in the kiva and were altered to their present unusual appearance during the burning of the kiva roof." They could not have resulted from burning of the grass crowded behind the cribbed ceiling poles.

in the middle. Its base, unscarred by attrition, is both longitudinally and transversely concave; its upper surface is correspondingly convex. While the clay was still plastic, two holes were punched through from the end and out the top.

At its whole end the fragment is $2\frac{3}{4}$ inches wide by $1\frac{1}{8}$ thick. The broken end has a width of $3\frac{1}{16}$ inches and a thickness of $1\frac{3}{8}$. Since its length is only $2\frac{1}{4}$ inches, the fragment clearly represents less than half the original.

From Room 80 Pepper (1920, p. 268, fig. 111) recovered a like object with pairs of slanting holes at both ends and one side. No description is given.

Jeancon (1922, p. 27, pl. 19), from Pueblo I or even earlier ruins in the Pagosa-Piedra region of southwestern Colorado, reports another example likewise with paired holes slanting up from the two ends and one side. But his dimensions, $5\frac{1}{4}$ inches long by $1\frac{3}{4}$ wide and $\frac{9}{16}$ inch thick, indicate a specimen with less than half the width and thickness of ours. His is the earliest example of the type known to us.

Our fragment has been designated a possible plume holder because of its remote resemblance to the clay pedestals on Hopi altars. These latter support crooks and other symbolic objects. Voth (1903, pl. 3, 1) illustrates the Flute Society emblem upheld by a semiglobular base from which at least four feathered sticks project at angles (see also Stephen, 1936, fig. 427, p. 791). If the paired holes in our concavo-convex specimen likewise were designed to receive small sticks the latter would project outward only if the specimen rested on its convex face.

Clay ball on stick.—Among the objects unearthed in Room 326, a burial chamber, was an unfired clay ball pierced by a rounded stick, slightly pointed at the bottom (fig. 91, *a*). The ball is seven-eighths inch high with diameters of thirteen-sixteenths and seven-eighths inch. Its upper surface is wrinkled as though the clay, while moist, had been wrapped in cornhusk, closely gathered and tied at the neck. A light-brown substance that may once have covered the entire ball folds into the upper half as a shaft lining; traces of kaolin remain in the corrugations.

In the second specimen (*b*), exposed as we leveled the refill in Room 48, the pin is complete and notched at the end. It extends $1\frac{1}{16}$ inches above but does not pierce the ball. The latter is fifteen-sixteenths inch high with diameters of fifteen-sixteenths and $1\frac{1}{4}$ inches; its paste is noticeably granular and includes at least three conspicuous galena crystals. As illustrated, the ball weighs $1\frac{1}{4}$ ounces. Here, again, surface irregularities suggest molding in a rush or cornhusk bag.

EFFIGIES AND FIGURINES

Effigies doubtless were as indispensable in the religious practices of the ancient Bonitians as they are in those of present-day Pueblos. And if they were guarded as carefully from the uninitiated then as now it explains why so few have been recovered through archeological exploration.

Mountain-lion (?) heads.—One may only guess at the animal or animals represented by the two sandstone carvings illustrated in plate 83, B. Facial features are not indicated but both have ears above a slightly concave "face." They may be Mountain Lion, hunter of the north. The first still bears a faint trace of red ocher, but its ears have

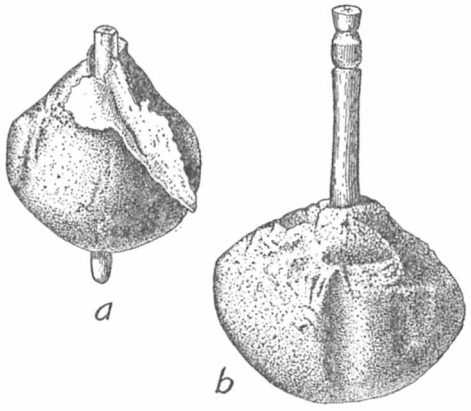


FIG. 91.—Clay balls on sticks.

been battered away. Both carvings were found in Room 272 which was partly filled with Late Bonitian sweepings. It will be noted also that the base of each was left roughly spalled, with tool marks still visible; that neither shows the wear and grime that follow repeated handling and pushing about on adobe floors.

In Room 64, Pueblo del Arroyo, we found a slightly more realistic "lion" head (U.S.N.M. No. 334876). It is smaller than the two above mentioned but, like them, is carved from friable yellow sandstone. A straight incised line forms the mouth; eyes are not indicated; ears are rounded knobs. Since marks of the pecking hammer show at the base of the neck, this head also is obviously complete in itself. Contrasted with these, two apparent effigies from other Chaco ruins are provided with tenonlike bodies that suggest horizontal placement in a wall. One of them, found at Sinklezin ruin by the Griffin children in 1925, and still in their custody at Pueblo Bonito 4 years later, is

shown in plate 80, A. The second (pl. 80, B), from Kinkletso, has not been seen by the present writer.

Stone effigies of diverse animals are essentials on certain modern Pueblo altars, but none known to me even remotely resembles the sandstone heads from Chaco Canyon. These modern examples are more nearly comparable to those exhumed on the Zuñi reservation by Roberts (1932, pp. 147-149).

Hopi, Zuñi, and Navaho, perhaps all Southwestern tribesmen, deposit in their corrals and grazing lands unfired clay figures of domestic animals as prayer offerings for the increase of herds and flocks. An entirely different concept governs the small figures of prey animals worn as amulets by many living Indians. As protection against witchcraft and evil spirits, every one of our Zuñi workmen during seven summers at Pueblo Bonito wore a prehistoric arrowhead on a neck cord or attached to his hatband.

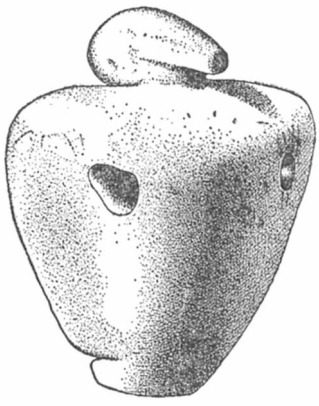


FIG. 92.—Bird carved from turquoise.

Without description, Parsons (1939, p. 304) refers to "the animal figurines which guard each house" in Hopiland. These are fed regularly, generally a pinch of cornmeal or a crumb of bread. "Places where the fetishes are kept . . . are disturbed as little as possible . . . there is always the greatest reluctance to remove a fetish, which is sometimes left behind, but looked after, in an otherwise abandoned house" (ibid., p. 480).

Birds.—The turquoise bird represented by figure 92 undoubtedly had been interred with one of the bodies in Room 329. But, as was explained on page 99, its weight (49.37 grams), its shape, and the position of the two holes, drilled to meet half an inch above the keel, render the figure ill-suited for use as a pendant. Furthermore, the edge of the drilling is sharp, unworn by a suspension cord. There are no wear facets on breast or back; the turquoise is of poor quality, pale green and chalky. For these reasons it seems likely that the effigy served, not as a personal ornament, but ceremonially, and in some such manner as the four wooden birds suspended above the altar of the Hunter Fraternity at Zuñi (Stevenson, 1904, pl. 59) or those on the Blue Flute and Drab Flute altars at Mishongnovi (Fewkes, 1900c, pp. 989-992).

The Hopi bird effigies just cited stand on straight sticks thrust into altar sand, but the holes in our Pueblo Bonito specimen, as may be seen from the angle of drilling, were never intended for leg sockets. Rather they were the means by which the effigy was secured to something else. Hough (1914, pp. 103-104) figures from Bear Creek Cave, Arizona, wooden staffs with birds carved on one end and, from both Hopi and Zuñi villages, compound wooden birds drilled through the body for attachment at the keel.

Pepper (1905b; 1909) found a number of bird effigies made of "decomposed turquoise" in Rooms 33 and 38. From his illustration and description, they are smaller than our lone example and their beaks thrust forward instead of hanging drowsily upon the breast.

"Frogs."—Pepper's jet frog from Room 38 (Pepper, 1905b, p. 190) and ours, from Room 336, likewise may have been objects of religious import. However, and solely as regards our own find (fig. 20, *o*), placement of the suspension holes seems rather to identify the piece as an ornament. Paired on the underside of the shoulders, these drillings allow the figure to hang almost perpendicularly, the hind legs a little inside of plumb. On the other hand, the four drilled holes are not cord-worn; the back of the effigy is more highly polished than the belly; jet is exceedingly brittle and outjutting legs such as ours possesses were bound to be broken if the piece hung free from a neck cord.

Human figures.—When earthenware utensils were under consideration we included those modeled in the form of men and beasts. We had no reason to place them in any other category. However, human effigies in clay or stone are different. They occur sporadically in Pueblo shrines and on Pueblo altars today although less frequently, perhaps, than concretions with some fancied resemblance to mythological beings or parts thereof.

At Pueblo Bonito we found only one human effigy, rudely modeled in clay (fig. 93). Its mouth and eyes are casually gouged; nose and breasts pinched-up. At midlength the body is $1\frac{7}{8}$ inches wide by $1\frac{1}{16}$ inches thick. The clay, sun-dried and readily scratched by a thumbnail, is rather sandy and contains particles of charcoal but no visible temper.

Clay figurines, usually female, were made by primitive peoples the world around as a religious expression. In general they were offered to some potent god with a prayer for bountiful crops, for increase of family and flocks. In the Aztec-Toltec domain of Mexico, figurines represent a fertility cult of long standing.

Throughout the old Pueblo area, modeled figurines likewise evi-

dence the former presence of such a cult. It had become firmly established at least as early as the Basket Maker III period and it persisted until Pueblo IV or later. Figurines have been reported from sites widely separated by time and distance; their local characteristics have been noted, in part, but the only comparative study of which the present writer is aware is that essayed by Haury (*in* Gladwin et al., 1937, vol. 1, pp. 233-242) and published just as Steward made known his observations in northern and western Utah (Steward, 1936).

Our lone Pueblo Bonito example lacks the sophistication of Haury's Snaketown figurines; it lacks the basal cleft and the punctate embellishment of Basket Maker specimens figured by Morris (1927, p. 153) and Guernsey (1931, pl. 51); it lacks the applique dress and anatomical features to be seen on many of the central Utah examples described by Morss (1931, pp. 46-50) and Steward (1936, pp. 22-28) and it is quite unlike the Pecos figurines illustrated by Kidder (1932, pp. 112-125). In its limblessness, its pinched-up nose and breasts, our Pueblo Bonito specimen resembles some of those from Utah but it is more rectangular, thicker and heavier.

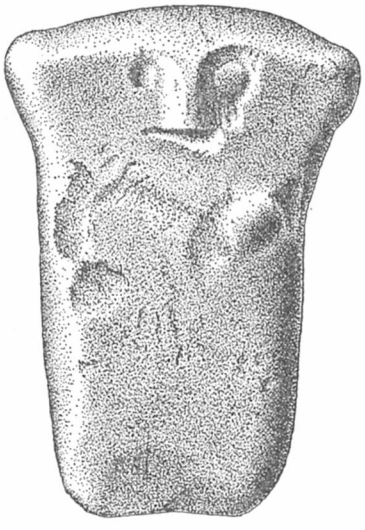


FIG. 93.—Clay figurine.

The basal fragment of another possible figurine (U.S.N.M. No. 336084), oval in cross section and rather smooth-surfaced, came from Room 288.

"A number of small crude objects of unbaked clay" found by Pepper in the rubbish fill of Room 25, and which Cushing called "seed offerings," included at least two figurines comparable to ours from Room 308. Both had mouth and eyes indicated by fingernail indentations; both had modeled breasts, and the larger, a modeled nose. The upper face of this latter was painted red, while chin, neck, and chest were black (Pepper, 1920, pp. 101-103).

From Pueblo del Arroyo we recovered two additional clay figurines (Nos. 334683-4). One, a discoidal face on a necklike body, is surprisingly like that figured by Kidder and Guernsey (1919, p. 143, fig. 62, *b*) from Marsh Pass. The second is a somewhat cylindrical lump of clay with squared bits of charcoal inset to represent eyes and

mouth. These two and a third from a nearby structure, added to those from Pueblo Bonito, prove the existence of a figurine cult in Chaco Canyon at the height of Pueblo III. Our available specimens are too few, however, to permit at this time selection of the dominant type.

PIPES AND CLOUD BLOWERS

Among the Pueblo Indians smoking is a formality, beginning and ending every important ceremony. The chief priest accepts a pipe filled with native tobacco and, after a few solemn puffs, hands it to his associate next on the left. Each in turn puffs smoke toward the altar and passes on the pipe. Smoke reconsecrates altar and altar paraphernalia. Formal smoking is a recognized rite without which no ceremony would be regarded as complete and efficacious. As bearers of individual prayers, smoke clouds rise to mingle with clouds in the sky and thus bring rain.

The Bonitians used both stone and earthenware pipes. In shape, these vary from the tubular or "cigar-holder" form to the "elbow" type, whereon the bowl stands more or less at right angles to the stem. Six of our pipes and pipe fragments are of stone; 10, of earthenware.

Three earthenware pipes belong to that class commonly called "cloud blowers." One, the fragmentary example in figure 94, *a*, has a bowl that comes to within seven-eighths inch of the mouthpiece. This suggests a relatively short pipe, since the fragment itself is only 1⅝ inches long. While plastic, and in the process of manufacture, the pipe was ornamented three-fourths of the way around with spaced punctations produced by the hollow end of a wire-grass stem or something akin. A similar reed could have formed the smoke passage in any of the pipes before us.

Figures 94, *e*, and 95, both from Kiva R, are cloud blowers of Pueblo III vintage. The first remains unstained by tobacco while the second carries within its bowl unmistakable evidence of having been smoked, if only half a dozen times.

Considering the shallowness and position of its bowl, a cloud blower could not be used as we are accustomed to seeing pipes smoked. From earliest times, no doubt, the type was employed to produce symbolic clouds. Smoke was blown through the stem and out the bit end rather than drawn into the mouth of the smoker and then expelled. The procedure is clearly portrayed by Voth (1903, p. 15) in his description of the Oáqöl ceremony at Oraibi.

During the sixth song on the first day the chief priest goes to the fireplace and lights his cloud producer, "a large, cone-shaped pipe which he has previously filled, takes a little honey into his mouth,

kneels before the medicine bowl, and taking the wide end of the pipe between his lips, blows large clouds of smoke towards the altar, over the objects in front of it, and into the medicine bowl."

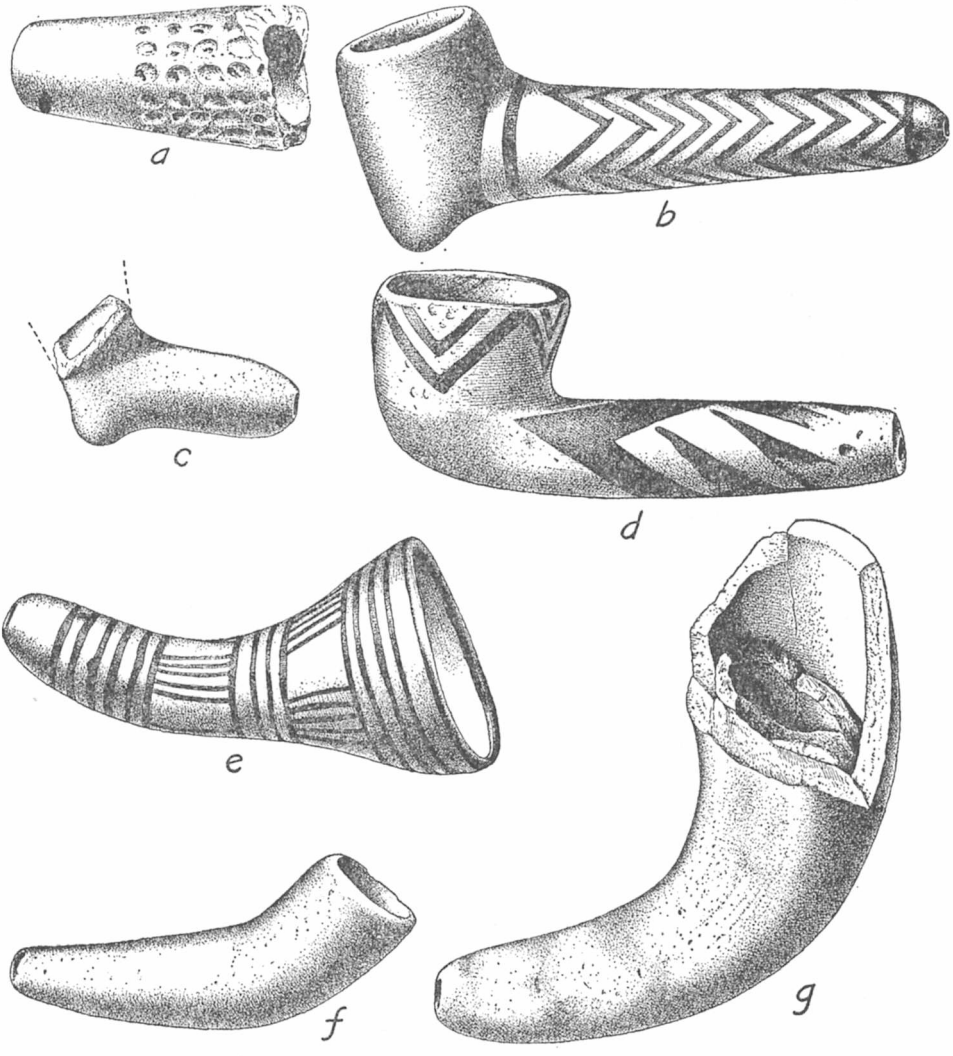


FIG. 94—Earthenware pipes and cloud blowers.

We lack the dimensions of that particular Hopi pipe but our specimen (fig. 95), $1\frac{5}{8}$ inches across the bowl, when filled with burning tobacco would test the elasticity of any priestly mouth. Or perhaps Pueblo cloud-making practices have changed since introduction of this bell-ended form early in Pueblo III times.

Seven of the nine pipes Fewkes (1923, p. 95) found in Pipe Shrine House, Mesa Verde, are cloud blowers and five possess the expanding bowl of our figures 94, *e,* and 95. Two of the five have an over-all width of $3\frac{1}{8}$ inches. One wonders, then, whether bell-ended cloud blowers were not originally held a short distance from the lips as the priest blew into the lighted bowl and caused smoke clouds to issue from the opposite end. Related examples from the Pagosa-Piedra region, as described by Jeancon and Roberts (1923-24, pp. 35, 304), are cruder and presumably older than those from Pipe Shrine House.

Figures 94, *d,* and 96 illustrate earthenware elbow pipes. Both are from Kiva G; both were thinly slipped with white before the black

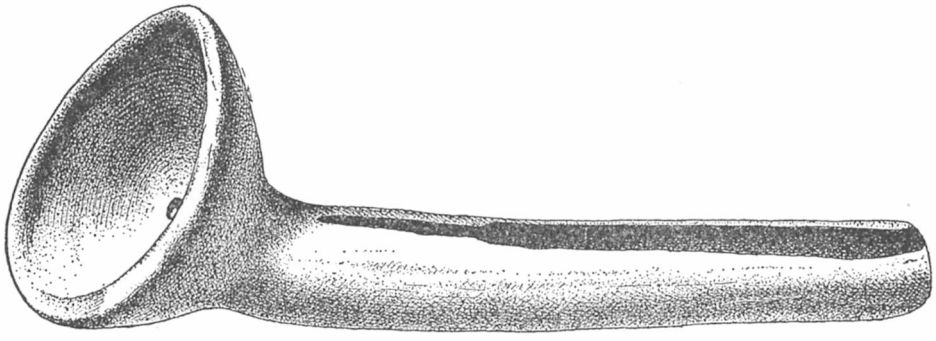


FIG. 95.—Cloud blower from Kiva R.

mineral paint was applied. Within the broken bowl of the second a painted rim band may be seen and part of a circle below. The paste is a uniform blue-gray, apparently sherd-tempered, and almost over-fired. A serpent stretches its undulating length down the back of the stem. On the first example, the stem has been ground off to provide a new mouthpiece.

The diminutive pipe represented by figure 94, *c,* is sand-tempered, unslipped, and unpainted.[61] Its size and finish are in marked contrast to figure 96, for instance, or 94, *b.* This latter, from Old Bonitian Room 320, is stone-polished over a thin black paint, presumably organic. Its basal protuberance is more pointed than that on the miniature.

Specimens shown in figure 94, *f* and *g,* might reflect intermediate stages in pipe development. They seem about midway between the

[61] Mera, 1938, pl. 9, 1, figures a comparable but slightly thicker pipe and with two feet instead of one, from Largo Phase dwellings northeast of Pueblo Bonito. Probable Largo Phase vessels are cited in our chapter V.

tubular pipes of Basket Maker times and the elbow variety of Pueblo I-III. The first came from apparently Old Bonitian rubbish in Kiva V; the second, from an exploratory trench on the east side of the West Court. Both are smoothed externally but unslipped; the paste of the second (*g*) is light gray and rock-tempered. A $\frac{1}{8}$-inch deposit of ash clings to the inside of its broken bowl.

With a single exception, that from Room 320 (fig. 94, *b*), our earthenware pipes and fragments came from Late Bonitian rooms and kivas. One of these, Room 327, was half full of dominantly Late rubbish and two, Room 307 and Kiva V, contained mixed debris. The fragment from Room 327 is an inch-long section (U.S.N.M. No. 336046) from a pipe of cigar-holder type. Its surface is polished black and its fine-grained paste discloses no visible temper.

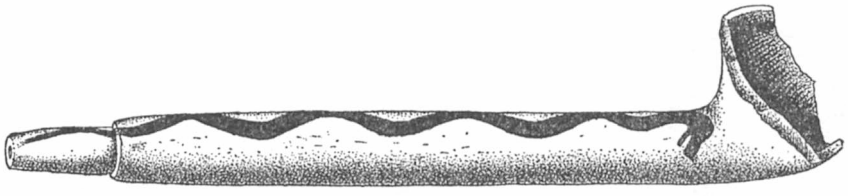


FIG. 96.—Earthenware pipe from Kiva G.

Our stone pipes are of materials foreign to Chaco Canyon. The first, figure 97, *a*, is of pale yellow claystone, a rock sometimes employed for tcamahias. In its present condition the specimen measures $1\frac{11}{16}$ inches long by three-fourths inch in greatest diameter. But the bowl as it now exists is only seven-sixteenths inch deep; a newly ground edge evidences repair with a view to retention after the original rim was broken. Part of a hollow bone mouthpiece crowds the $\frac{7}{32}$-inch drilling at the small end—the only one of our pipes, stone or earthenware, so fitted. This interesting example comes from 201, a storeroom built by Late Bonitians against the outer north wall of Old Bonitian Room 6. Since it lay among fallen masonry and blown sand, the specimen presumably had been placed for safekeeping either in a second-story wall niche or between ceiling poles.

Figure 97, *c*, illustrates an elbow pipe of steatite, found by one of our Navaho while loading wagons outside the northeast quarter of the ruin, between Rooms 186 and 189. I did not learn whether it was found among earth and rock thrown out of those four rooms or beneath the lower, older accumulation of blown sand and fallen stonework.

An even more interesting specimen is that pictured in figure 97, *b*. It is of translucent travertine that might have been obtained in south-

western Colorado or in the Zuñi Mountains of New Mexico. The bowl base is flat but merges with the rounded stem, the bit end of which is missing. Above, the bowl is rimmed by a disklike collar that protrudes slightly all around. The bore is one-half inch in rim diameter by thirteen-sixteenths inch in depth. About one-eighth inch from its rounded bottom the hole has a diameter of five-sixteenths inch, thus showing use of a stone drill rather than a hollow reed. Ringing of the orifice is the result of incipient boring on the part of a tubular drill

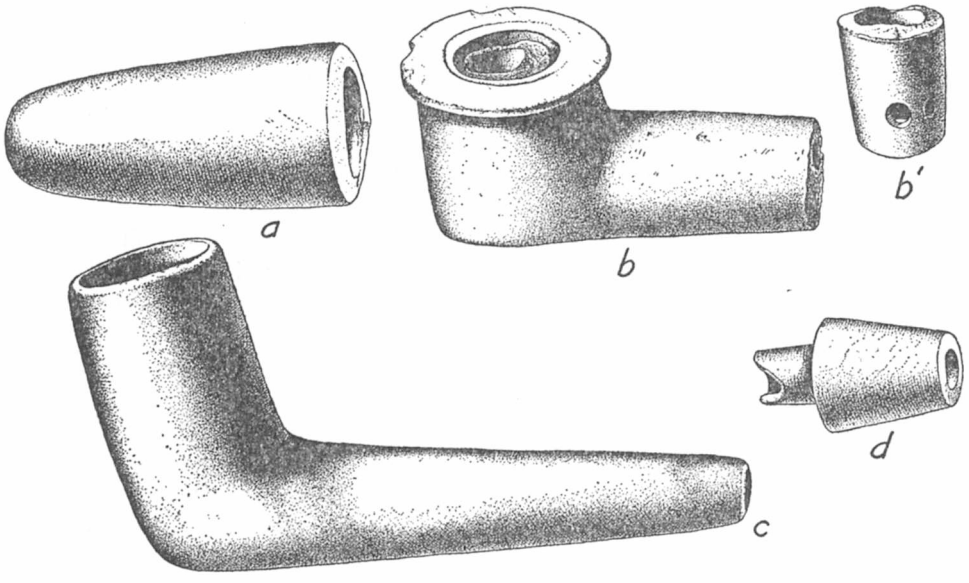


FIG. 97.—Stone pipes and accessories.

five-eighths inch in diameter. As noted in the drawing, the stem perforation was drilled a little above center.

At time of finding, the pipe was equipped with a bowl plug (fig. *b'*). This plug is of a mineral similar to, but more opaque than, travertine; it fits closely but not snugly; the drilled hole through one side conforms with that in the pipestem. The lesser, incomplete hole to the right suggests that the plug slipped after drilling began. Neither pipe nor plug is fire-stained.

The pipe (fig. 97, *b*) lay among a small quantity of sweepings on the floor of Room 332, one of two Late Bonitian closets east of Kiva U. In those same sweepings were two other pipe fragments of translucent travertine (U.S.N.M. No. 336049).

Still another Room 332 specimen is illustrated by figure 97, *d*. It,

too, is of travertine. Length is three-fourths inch; greatest diameter, three-eighths inch. The larger portion is polished; the smaller end, also conical, is not polished. The longitudinal boring is five-thirty-seconds of an inch in diameter at the larger end, and less than one-eighth at the smaller. This unusual object has been tentatively identified as an ornamental mouthpiece for a pipe.

Among Late Bonitian rubbish in Old Bonitian Room 307 we found a fragment of "satin spar" (U.S.N.M. No. 336044) that looks like a vertical section from a pipe bowl. The fragment had been squared off top and bottom and longitudinal grooves at either edge evidence an attempt to salvage the middle quarter-inch, perhaps for a pendant.

Among the pipes described by Pepper were one of coarse green steatite, elbow type, from Room 9, and an earthenware bell-ended cloud blower from Room 12 (Pepper, 1920, p. 52, fig. 12, *b;* p. 64, fig. 20, *c*). Both are Old Bonitian rooms in the north-central portion of the pueblo.

We have no certain knowledge of the tobacco smoked by Bonitian ritualists. In response to my request, Navaho and Zuñi members of the excavation crew brought in plants of native tobacco which were said to occur both in Chaco Canyon and on the mesas above. These plants were later identified at the National Herbarium as *Nicotiana attenuata* Torrey, a species widely distributed throughout the Upper Sonoran Life Zone of the Southwest and the one most commonly used by the Indians.

Both Zuñi and Navaho say they gather the plants when in flower; dry them out of doors and crush the leaves in the palm for rolling in cornhusk cigarettes. As described by Fewkes (1896, p. 19), *N. attenuata* is smoked in Hopi pipes on ceremonial occasions, and is used at other times as an ingredient in prayer offerings. Hopi practices have not changed appreciably although Whiting (1939, pp. 40, 90) observes that the tobacco is now often mixed with other plants. For instance, rain is more likely to follow if the dried leaves and flowers of *Onosmodium thurberi* are added. Young leaves of spruce, pine, and aspen are gathered every four years to be dried, carefully stored, and mixed with native tobacco so that larger smoke clouds on ceremonial occasions will bring rain sooner.

MUSICAL INSTRUMENTS

Bone whistles.—Five fragments of tubular bone whistles (U.S.N.M. Nos. 335114-335117) are our only wind instruments. They belong to a class generally described as "birdcalls," and vary in length from $2\frac{5}{16}$ to $3\frac{1}{8}$ inches. Each is broken at its vent, cut through one wall at

approximately one-half the original length. Immediately beneath the vent on two specimens lesser holes were drilled laterally through both walls as though to support the diaphragm. Three of the five were made from ulnae of the golden eagle; one, from the femur of a bobcat. The fifth fragment is an unidentified mammal bone. All came from Late Bonitian dwellings of third- or fourth-type construction.

An eagle wing-bone whistle is used in the Oraibi Powamu ceremony. During the ninth song, one of the priests blows tiny bird feathers in turn to each of the cardinal points and follows the blowing with a few sharp notes on his whistle. During the fifth song on the fifth day, a priest drops a pinch of corn pollen into a medicine bowl and then blows upon it with a bone whistle (Voth, 1901, pp. 79, 80, 88).

On the afternoon of the first day of the Oraibi Oáqöl ceremony, the chief priestess deposits prayer feathers and cornmeal near a certain spring then blows four times on a bone whistle before depositing the remainder of her offerings in the spring itself (Voth, 1903, p. 12).

While excavation of Hawikuh was in progress, specimens such as our five fragments must have been were identified by elderly Zuñi as birdcalls (Hodge, 1920, p. 128). Shorter ones may occasionally have found a way onto necklaces or wrist guards but their prime purpose was ceremonial.

Wooden flutes.—Six remarkable wooden flutes or fragments thereof from Room 33 are described by Pepper (1909, pp. 199-204). Their associated artifacts formed the paraphernalia of some society or religious order. Wooden flutes have played a part in Pueblo life, both secular and esoteric, from early times to the present day.

During his visit to a Tigua village in 1540, Castañeda observed that music was piped for the pleasure of girls at their mealing bins. "A man sits at the door playing on a fife while they grind, moving the stones to the music and singing together" (Winship, 1896, p. 522). Over 300 years later a like custom at Zuñi, but on a more elaborate scale, was described by Cushing (1920, pp. 383-387). Few except tribesmen would recognize music in the squealing of a Zuñi flute.

Shell trumpet.—The shell trumpet illustrated on plate 82, *b,* lay in front of the accompanying black-on-white bowl in the north bench recess, Kiva R. It has been identified as *Phyllonotus nitidus* Broderip, with a range from Magdalena Bay, Lower California, to Acapulco. Its spire has been ground off, opening into the body; its outer lip is drilled, presumably for a suspension cord; the tip of the columella and most nodules are somewhat battered; a slight polish on the varices evidences repeated handling.

Among several fragments of like shells are two, from Room 201

and Kiva A, respectively, whose apexes likewise have been cut away (U.S.N.M. No. 335721). The second of these two still retains traces of its coniferous-pitch mouthpiece.

Pepper (1920, pp. 69, 85, 190) found several shell trumpets, some with mouthpieces of clay and "gum," during the course of his excavations at Pueblo Bonito. Shell trumpets are still employed in Hopi and Zuñi rituals.

CEREMONIAL BASKETRY

Bonitian baskets reserved for consideration under this heading are of three kinds: Cylindrical, bifurcated, and shallow elliptical trays.

Cylindrical baskets and *oval trays* have been described hereinbefore as household utensils. In the same paragraphs, however, attention was directed to their associations at time of discovery and the possibility of a ritual connection. In four instances cylindrical baskets and shallow elliptical trays accompanied the bodies of women. Six cylindrical baskets and one bifurcated basket were among the diverse objects in a one-time storeroom, the improvised tomb for 10 women and girls. Hence the question: Could these unusual containers have belonged among the paraphernalia of some women's society?

Like their earthenware counterparts, cylindrical baskets seem lacking in many respects as utensils for everyday household use. This is especially true of that illustrated on plate 84. Its flat bottom averages $3\frac{3}{4}$ inches in diameter; its original height is estimated at 5 inches. Fine workmanship is indicated by a count of 7 coils and 20 stitches per inch. The stitches are uninterlocked on a two-rod-and-bundle, bunched foundation. Coiling is counterclockwise; the rim is wrapped normally but the terminal tie is missing.

The basket was so fragile we added a lining of plaster for support. Its painted ornamentation, four rows of diamonds ascending to the right and repeated three times, is represented by the drawing in figure 98. The first three rows are, respectively, black, orange, and blue-green; the fourth row remains the natural splint color.

An even more exquisite example in this same category is the one Pepper found with Skeleton 14, beneath the floor of Room 33. Not only its turquoise overlay but its store of beads and pendants mark it as one entirely removed from the mundane life of the village. In the same room were the remains of a second cylindrical basket, covered with a mosaic of shell and turquoise and wrapped about with a necklace of turquoise and shell beads (Pepper, 1909, pp. 227-228; 1920, pp. 164-173).

Our elliptical basketry trays are of much finer construction and are

complete in themselves, nevertheless one sees in each the parallel of that forming the base of a bifurcated basket.

Bifurcated baskets, both in shape and in size, were entirely unsuited for any conceivable domestic task. Their capacity was too limited for practical use in gathering foodstuffs and other materials. Therefore



FIG. 98.—Painted design on cylindrical basket.

we must conclude that they were developed expressly for religious purposes, for the support or transportation of unidentified objects required in unknown rituals. Those from Pueblo Bonito will be better understood if we first review the distribution of this curious form and its development.

The earliest published notice of a bifurcated basket known to the present writer is that by Cummings (1910, p. 4), reporting one from the Segihatsosi, in the Kayenta district, northeastern Arizona. He also notes a second example, found in nearby Segi Canyon that same sum-

mer (1909) by a Government surveying party under W. B. Douglass. A few years later Cummings himself unearthed a third specimen in Bat-woman House, a Pueblo III cliff dwelling dated A.D. 1275 and occupying a shallow cave in one of the rincons on the west side of Dogoszhi Biko, the upper east branch of Laguna Creek (Cummings, 1915, p. 281; McGregor, 1936, p. 37; Hargrave, 1935, p. 32).

The Segi Canyon basket, now in the U. S. National Museum, was featured by Fewkes (1911a, p. 29) as "a Cliff-dweller's cradle" and attributed to "Cradle House" on the west side of "East Canyon," the Dogoszhi Biko of the preceding paragraph.

Weltfish (1932, p. 7) echoes Fewkes's identification and traces another specimen mentioned by him from Chicago to Philadelphia and the University of Pennsylvania Museum. From the latter institution we have Farabee's altogether satisfactory description of this, the fourth, bifurcated basket—a truly remarkable product that still looks brand new. It was found prior to 1904 in a cliff house in Moki Canyon, southeastern Utah; its balanced red-and-black design, on a background of undyed splints, is of almost pristine freshness (Farabee, 1920, pp. 202-211).

Farabee also cites two unfinished specimens in the Deseret Museum, Salt Lake City. My own notes on these two, written July 19, 1916, state that each consists of the uncompleted legs only; that both came from San Juan County, Utah. No. 526, presented by Platt D. Lyman, measures about 7 inches high by $7\frac{1}{2}$ inches wide. No. 790 was purchased from a Mr. Lang and is labeled "from Cave 1." [62]

Specimen 790 admirably illustrates the beginning of a bifurcated basket for it is no more than a long, narrow, oval tray the ends of which have been bent down to form a capital A whose bar is a yucca cord piercing the inner side of the legs halfway between toe and crotch. The cord clearly was intended to hold the tray in this unnatural position until the legs and lower body could be completed. That the

[62] In his article "Prehistoric Man in Utah," published in the Archaeologist, vol. 2, No. 8, pp. 227-234, August 1894 (reprinted at Toronto in January 1906), Prof. Henry Montgomery, then of the University of Utah, partially describes mixed Basket Maker and Pueblo material newly received in Salt Lake City and "said to have been collected by Messrs. C. B. Lang and Neilsen" during the previous three months. Cave No. 1 is located "about fifty miles south of Moab and forty miles north of Bluff City." A more fanciful account in the Washington (D. C.) Post of July 15, 1894, identifies C. B. Lang as "a young student of Pittsburg, Pa.," J. B. Neilsen and Robert Allen as his Utah guides, and the scene of their collecting as Allen Canyon. This latter can only be the upper, right-hand fork of Cottonwood Creek, which heads under the Abajo Mountains and empties into the San Juan at Bluff City.

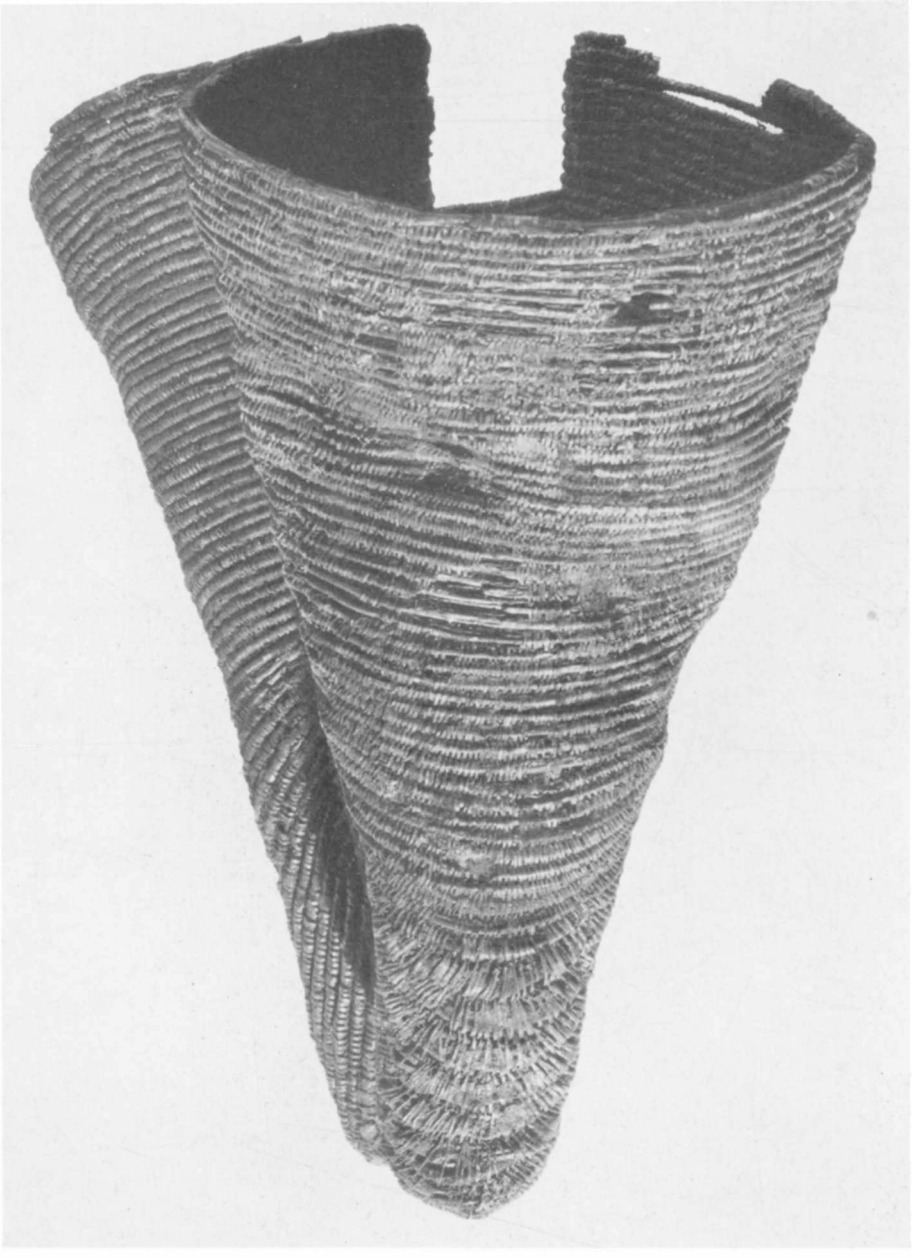


PLATE 86.—The peculiar construction of the bifurcated basket from Room 320 is clearly seen in this view.



A, Part of a bifurcated basket from Room 326, mounted on wire screen for preservation.



B, The miniature bifurcated basket buried with Skeleton 8, Room 326, was partially preserved.

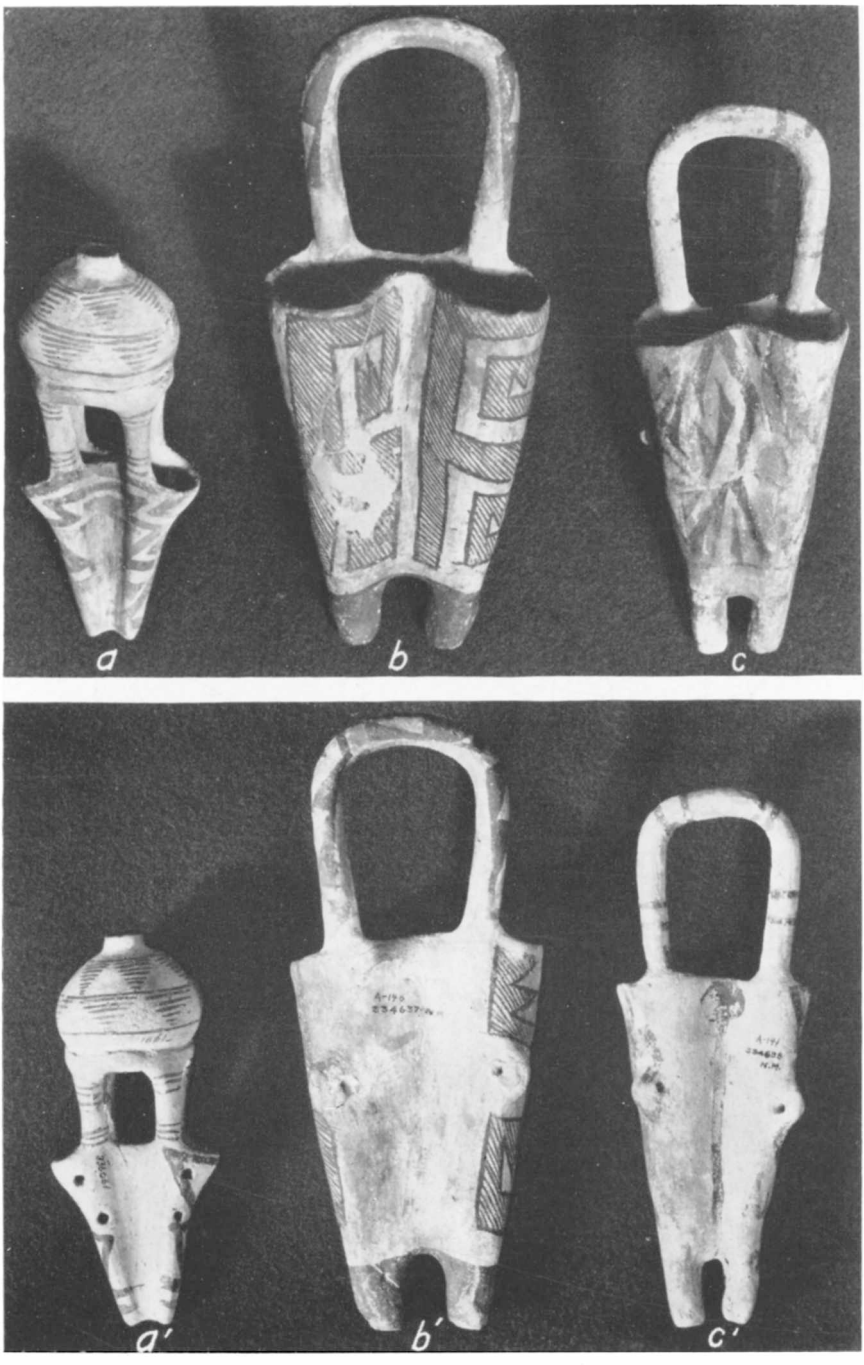


PLATE 88.—Earthenware effigies of bifurcated baskets, obverse (upper) and reverse.

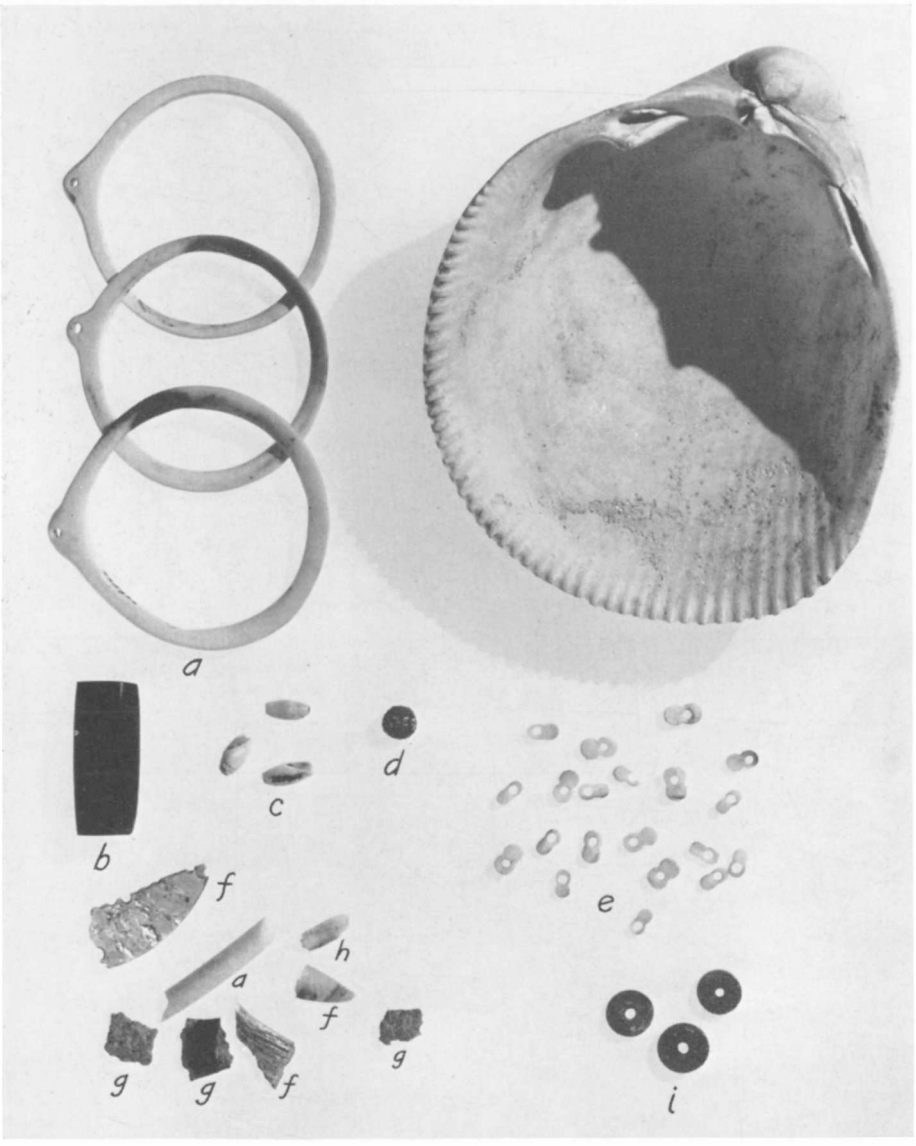


PLATE 89.—A cockleshell and its contents, found in a masonry box beneath the floor of Kiva D.

position was forced is further evidenced by the outward spread of the fabric, front and back, at the fold.

Now these two, and the four completed baskets above mentioned, are the only ones of their kind known to the present writer prior to our Pueblo Bonito explorations. That from Segihatsosi was found by old Hoskininni about 1884. Afraid of the Anasazis, he promptly reburied the piece but disinterred it in June 1909 for presentation to Mrs. John Wetherill. A few weeks later Mrs. Wetherill gave the basket to Prof. Byron Cummings, leader of a University of Utah exploring party. In 1915 it was borrowed for exhibition at the Panama–California Exposition, San Diego, and there it remained until 1938 when Professor Cummings finally regained possession and donated it to the Arizona State Museum, Tucson. At the time she examined this specimen in San Diego, Miss Weltfish apparently was not informed of its ownership.

Farabee observed the close resemblance between his Moki Canyon basket and those from the Segi and Segihatsosi. As Weltfish (1932, p. 7) remarks, they are so nearly alike they "might have been made by the same woman." That from Bat-woman House, now in the University of Utah Museum, presumably has never been published.

Two of those from northeastern Arizona came from the eastern branch of upper Laguna Canyon; the third, from nearby Segihatsosi. In this picturesque district all the more conspicuous cliff dwellings were still inhabited in the third quarter of the thirteenth century. Moki Canyon empties into the Rio Colorado approximately 50 air miles to the north. The Deseret Museum's unfinished baskets No. 526 and No. 790 may be ascribed to the wild country between Grand Gulch and upper Cottonwood Creek. Thus the six specimens under consideration were all found within a 40-mile radius of the point where the San Juan River crosses the 110th meridian.[63]

From this same circumscribed area come also the oval, relatively shallow, Basket Maker II hamper illustrated by Guernsey and Kidder (1921, pl. 23, *k, l*) and a larger, deeper carrying basket of Pueblo I age. This latter, the lone representative of its period, has outward sloping sides that flare sharply above the middle and an over-all zoned decoration in red and black (Guernsey, 1931, p. 95, pl. 13, *b*). Of even greater interest to our present discussion is the fact that the middle rim, front and back, rises a couple of inches above the sides

[63] Since this was written, the Deseret Museum's collections have been divided. The two specimens herein examined could not be located in 1943, but record of them is preserved in the Temple Square Mission and Bureau of Information, Sale Lake City. (Courtesy of John H. Taylor, Mission president.)

in consequence of a dip to right and left as coiling followed the line initially fixed by a slight basal arch.

This basal arch is lacking on what looks like the lower third of an unfinished basket of the same type, photographed among Grand Gulch specimens by Pepper (1902, p. 8, middle; p. 23, second row, middle). It is lacking, too, on an oval-bodied, wide-shouldered carrying basket figured by Cummings (1910, p. 34, bottom), although the upper coils are undulating. This latter specimen, purchased by Professor Cummings in Moab, Utah, in 1907 for the University Museum, was found on Salt Creek, at the eastern margin of Beef Basin, in 1894 or 1895. With it was a bowl-and-hollow-handle ladle of P. III design and decoration.

In the *Teocentli* of December 1939 (No. 28, p. 4), Haury describes from northeastern Arizona "an excellent bifurcated burden basket with a painted decoration in red, green, and yellow . . . found in a vault grave of unusual type dating from about the middle of the 13th century."

From information and photographs kindly furnished by W. S. Fulton, director of the Amerind Foundation, Dragoon, Ariz., we learn that the shoulders of this fine specimen are less pronounced than in the Moab basket; that the lower portion is about 20 percent longer; that tumpline attachments are present; that its painted decoration overlies an unusual design in dyed splints; that the arching of the basal coils is less marked than in Guernsey's Pueblo I example. This arching does not force the body coils out of a horizontal position; certainly it is not of a degree to justify placing the specimen in the "bifurcated" classification.[64]

Natural History in 1927 (vol. 27, No. 6, p. 637) announced Earl Morris's recovery of four Basket Maker III miniature carrying baskets from the Mummy Cave talus. They are exquisite little pieces, clean and fresh as though newly made. Accompaniments of a child burial, they are decorated with dyed-splint designs in red and black; the lower half of each, like Guernsey's Pueblo I prize, is more or less wedge-shaped, front to back, but not forked. In the same lot is a fifth, unornamented specimen (A.M.N.H. 29.1-8640).

Assuming that these miniatures faithfully portray an adult form, that Guernsey's Pueblo I specimen is typical of its period, and that Cumming's Moab purchase and Fulton's northeastern Arizona acquisition belong to Pueblo II or later, two parallel lines of Anasazi carrying baskets seem indicated.

[64] Haury (1945, p. 44) has since described the basket more fully.

First is the strictly utilitarian variety in which increased capacity remained ever the prime desideratum. Next, and contemporaneously, there was evolved a form deliberately sacrificing cubic content to an eccentricity, the arched base.

Guernsey's Pueblo I basket is the earliest example with basal arching known to me. Latest, are the deeply forked specimens enumerated above, including three from thirteenth-century cliff villages in the Segi and Segihatsosi. Between these three and their progenitor is a time interval of at least 300 years. During that interval the type changed from a capacious, wide-mouthed, purposeful hamper to one of less than half its capacity, with straight walls and a basal fork approximately one-third the total height.

Pueblo Bonito is two centuries older than the Segi cliff dwellings and, as one might have anticipated, its basketry differs in several respects.

Bifurcated baskets from Pueblo Bonito include one well-preserved example and portions of at least five others.

First and foremost is that from Room 320. When found, it lay on the floor, leaning against the east wall (pl. 92, lower). Near its rim was the cylindrical basket shown as figure *e*, plate 45, and beyond its feet two more (figs. *d* and *f*).

From front or side the basket is noticeably V-shaped—wide at top, narrow and pointed at bottom (pls. 85 and 86). Maximum width and thickness at rim, 12 inches and 8 inches; height, $15\frac{5}{8}$ inches. The left leg is a trifle shorter than the right; their average length, $4\frac{1}{4}$ inches. Front and back, walls above the crotch have been pressed in until they are only $1\frac{1}{4}$ to $1\frac{3}{8}$ inches apart. The resultant folds, sharpest in the upper half and especially on the front side, divide the basket cavity into two triangular compartments roughly $5\frac{1}{2}$ inches on a side and 15 inches deep. Missing stitches let it be seen that many of the foundation rods are cracked or broken at the folds. Were it not for this distortion, thickness at rim would be increased to 15 inches; rim circumference would measure 41 inches.

The basket had its beginning in a single willow rod, a full quarter inch in diameter and more or less encompassed by barklike fibers. For 8 inches rod and fibers were closely wrapped with sewing splints then doubled back, around the other end, and again down the opposite side. As the doubling progressed, rod and bundle were firmly stitched to the first 8-inch section.

The second coil was built on a slightly smaller rod; the third introduced a foundation of two still smaller rods with fiber bundle above and between them. It is probably pure accident that inception of the

first coil lies under the left foot; that the two subsequent reductions in foundation rods occur halfway down the right leg and in front. The stitches of these first three coils are larger and less compact than those that follow. A majority are split on the outside, suggesting a concave work surface. Viewed from that angle, coiling is counterclockwise.

With the third complete encirclement of its initial 8-inch section, the narrow mat was bent into an A form and presumably anchored in that position. I detect no trace of the holding cord itself but note that at the apex rods are cracked and stitches crowded by the sharp bending. Thereafter the sewing followed up one leg and down the other. To shorten the coils and bring them the sooner to regularity, a filler was inserted on the outside of the legs where each coil dropped lowest. Filler for the fourth and part of the fifth coils was only a little additional fiber, but for the next few an extra foundation rod was broken into pieces or doubled three or four times to bridge the downcurve. Stitches three-eighths to three-fourths of an inch long were required to bind foundation rods, bundle, and filler together; not until the twenty-fifth coil did these end stitches assume normal length.

There are 59 coils in the basket; the last was self-wrapped but its terminal tie is missing. In the upper 4 inches 22 coils appear in front and 23 at the back. Body stitches average 16 per inch.

With black-dyed splints the maker provided a sparse, all-over design of thin lines and half terraces. Horizontal lines are one coil wide; vertical lines, two stitches in width. Subsequently, that portion of the decoration visible on the front and sides was painted black, and with greenish-blue paint balancing lines and terraces were introduced (fig. 99). No effort was made to illuminate continuation of the same dyed-splint elements across the rear wall.

A few additional notes.—A slight sheen on the lower half of the back, above the crotch, may be the result of friction. No provision was made for tumpline attachments, an omission almost unique. With the possible exception of their upper rear, both legs are coated with a membranous substance as far as the lower framing line of the decoration. Some cracking of foundation rods vertically down the right front shoulder and down the rear left shoulder is due to pressure from the overburden of blown sand, rubbish, and fallen masonry during the years prior to exhumation. Two small stones on the floor left imprints on the left front shoulder.

Our next example is a body fragment from Room 326 (pl. 87, A). Although damp when exposed, most of it was saved by prompt and liberal application of melted paraffin. In the laboratory, when we sought to remove this wax, the fragment collapsed and we lost its

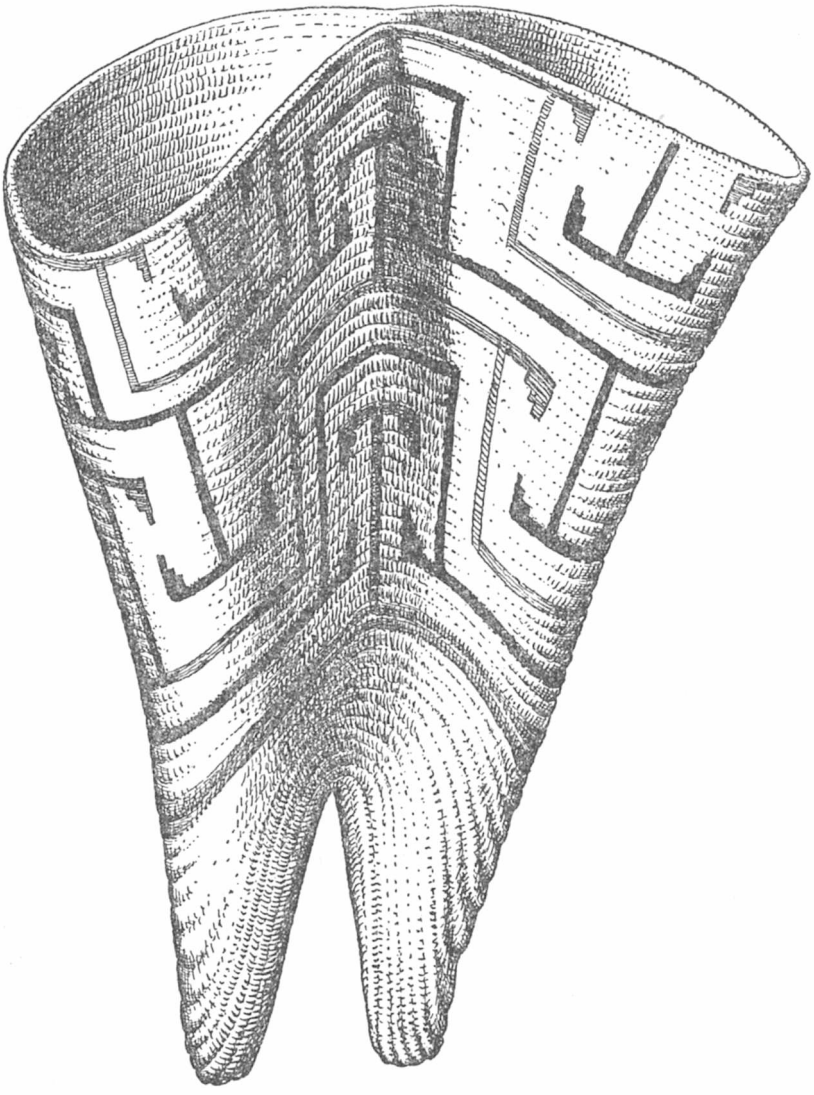


FIG. 99.—Design painted on bifurcated basket from Room 320.

vertical median constrictions. The technique is again two-rod-and-bundle, bunched foundation with uninterlocking stitches. There are 5 coils and 15 stitches to the inch. Portions of the self rim remain but its termination is missing.

Two, possibly three, like baskets are represented in miscellaneous fragments from the same room. One lot, gathered from among scattered human bones, sweepings, and debris of reconstruction on a few square feet in the middle floor, includes three large pieces from a basket about the size of that first described. These three exhibit 8 coils and 22 stitches per inch. Other fragments, presumably from bifurcated baskets, show from $4\frac{1}{2}$ to 6 coils per inch and from 16 to 20 stitches; three scraps bear traces of green and blue paint.

Another fragment, poorly preserved at best, has been cleaned and freed from surplus paraffin but unsuccessfully mounted. In its present condition it suggests a basket 12 or 14 inches high with rim width and depth of about 8 and 5 inches, respectively. Coils run $5\frac{1}{2}$ to the inch; stitches, 16. Between coils in several places are what appear to be flakes of orange paint. This is the fragment elsewhere cited as having been found, together with part of a cylindrical basket, above an infant burial (No. 10) in the southeast corner of Room 326.

Smallest of our series is that illustrated on plate 87, B. It was one of the burial offerings with Skeletons 8 and 9. In the photograph, plate 94, left, it may be seen resting against a sandstone slab (fig. *d*, pl. 27) with a cylindrical basket, an ellipitical basket tray, and several earthenware bowls and pitchers close by.

Here again we were unable to preserve the rim and median constrictions of the partially decayed specimen. Although the body is now somewhat distorted, it is obvious the legs were originally disproportionately short. In its present imperfect condition the specimen measures 8 inches high; its legs average only $1\frac{1}{4}$ inches. With 8 coils and 22 stitches to the inch, this smallest of the series equals in fineness of stitching one of the largest, the one represented by three of the fragments described above.

Our Pueblo Bonito bifurcated baskets and fragments all illustrate the same coiling technique: uninterlocking stitches on a two-rod-and-bundle, bunched foundation. All were provided with relatively short, pointed legs; all were constricted vertically through the middle, a distinctive feature; all exhibit undulating coils and a fullness of fabric at the brim. In execution, therefore, and apparently in concept, we have here what seems to be a distinct variety, an eastern type.

In contrast, comparable baskets from western cliff dwellings are from 5 to 6 inches taller than our best eastern example; they have

straighter-walled, more-columnar bodies and sturdier legs that measure about one-third the total height. Their workmanship is coarser; coils and stitching, larger. In either case, eastern and western varieties, as we now know them, only remotely resemble the Pueblo I carrying basket that, presumably, furnished the idea of a basal notch.

The use to which these bifurcated baskets were put is purely conjectural. They were ill-suited and entirely inadequate for transporting fuel or foodstuffs. They certainly were not cradles, as Farabee (1920, p. 211) pointed out so clearly. The only alternative then is to believe them a specialized carrying basket, an accessory in the ritual of some long-dead cult.

Describing the Moki Canyon specimen, Farabee (1920, p. 206) observes: "The back of the basket where the [tumpline] thongs are attached shows some polish from use and the bottoms of the legs show considerable wear. On the inside there is some polish for four inches down from the top but lower down the surface is very rough and shows no wear except on the crotch where apparently the burden, whatever it was, rested."

Repairs made with coarser splints and triple-length stitches are conspicuous on the backs of the Segihatsosi basket (Cummings, 1910, p. 34) and that figured by Fewkes (1911a, pl. 20). On each, vertically paired holes for attachment of a carrying band are to be seen at either side and just above the mended area. The extent of these repairs and, indeed, the very necessity for them evidences repeated use of the baskets for transporting fairly heavy burdens. A light weight, no matter how often carried, would not have induced equal wear.

And this again raises the question: What kind of objects were moved in bifurcated baskets and for what distances? The only suggestion that has come to my attention is that offered by the old Navaho shaman who explained that the bifurcated basket was a container for the arrows and sacred medicines of the Slayer God and that its two legs represented the ears of the Bat-woman (Cummings, 1915, p. 281).

There are no holes for tumpline attachments at the back of our painted Pueblo Bonito basket, no handles, and no mark such as might have been caused by a netted cord or other suspension device. If this basket was moved from place to place, it was carried in the arms of its bearer. There is no certain indication of wear on its back; no friction-rubbed area inside. The vertical grooves press in from front and back until they practically divide the basket. This structural feature further limited the character and bulk of objects placed within. Nevertheless, the constrictions were considered essential, for they are clearly indi-

cated both on our bifurcated baskets and on the earthenware models next to be considered.[65]

Earthenware effigies of bifurcated baskets.—We have for consideration under this heading six specimens from Pueblo Bonito and two from Pueblo del Arroyo. The latter (pl. 88, figs. *b, b', c, c'*), with several other unusual objects, had fallen with collapse of the second-story floor of Room 27. Their respective designs differ but both have black-painted rims, flattened lugs at the back punched through horizontally, and surmounting loops attached to the rear rim. After the modeling was completed, both front and back were pressed in vertically along the median line but not enough to bring the inner walls together. On the larger of the two specimens, this pressure caused the inner front wall to crack throughout its upper half. The legs of this specimen are hollow; those of the smaller one, solid.

The third specimen (*a, a'*) lay among disarticulated skeletons in the middle north half of Room 329, Pueblo Bonito (pl. 97, lower). It has much in common with the other two and yet differs from them in several respects. After the lower part had been completed its walls were pressed in until they actually met vertically through the middle. This left on either side the junction cavities no more than an inch in depth. Thereafter the four uprights and the ring they support were casually attached inside the brim. The right rear and left front legs presumably were positioned last because less effort was made to obliterate their union with the inner wall.

The superimposed jar likewise was made separately and positioned while the clay was still moist. Subsequent modeling fixed it so firmly in place on the ring that a bit of tooling was necessary to emphasize the point of separation. Finally, two pairs of holes to symbolize tumpline attachments were provided. But while the upper holes were punched all the way through—in one case the punch tip actually dented the opposite wall—the lower two were merely quarter-inch deep indentations. It is the miniature jar in this instance rather than the basket effigy that bears the black rim line characteristic of Chaco pottery. Like the two from Pueblo del Arroyo, this composite is externally slipped, hand-smoothed while plastic, and partially stone-polished.

Four other effigies of bifurcated baskets, each with a superincumbent jar, have come to my attention. One is in the Southwest Museum at Los Angeles (P. G. Gates collection, G-268.105), provenience unknown. Another, in the San Diego Museum (No. 5177), belongs to

[65] Morris and Burgh (1941, pp. 54-56) recognize the ceremonial carrying basket as a cult object associated both with miniature models of carrying baskets and clay effigies of human females.

the Rio Puerco collection purchased in 1912 and believed to have been gathered within a radius of 40 miles of Houck, Ariz. In both cases the jar stands upon four legs attached to the basket rim, as in our Pueblo Bonito specimen, but without the latter's supporting ring. My notes do not indicate the nature of the symbolic tumpline attachments, if any.

A third example, also from the Houck area, is illustrated by a sketch received at the National Museum some years ago from a Dr. Regnier, of Regnier, Okla. Its painted design consists of solid triangles, ticked along their opposed hypotenuses; two vertical lugs, transversely perforated, lie on the back. Instead of four vertical posts, rolls of clay rise from the rim to loop across the median grooves, front and back, as supports for the miniature jar.[66]

The fourth specimen of the kind known to me is in the Museum of the American Indian, Heye Foundation (No. 5-2632), and is recorded as from Chaco Canyon. The lower part portrays an oval carrying basket with wide-flaring rim and vertical loop handles at the sides rather than on the back. Both front and back are slightly indented along the median line but there is no basal cleft. Within the rim and rising well above it is a hollow, globular mass representing an Early Pueblo neckless olla. Over a heavy white slip, three squiggled black lines encircle the shoulder of the miniature olla; three more lie just below the rim of the basket effigy, and three shorter lines hang vertically at either side of the median groove. As in the case of the other three cited, the decoration on this example is more suggestive of Pueblo II than Pueblo III.

Of our five remaining earthenware effigies of bifurcated baskets from Pueblo Bonito, four evidence some sort of superstructure. That illustrated by figure 100, *b*, is sherd-tempered, heavily slipped, stone-polished, and ornamented with a black pigment that fired reddish brown. It was found with late hachured sherds in Room 350, one of two adjoining subterranean chambers at the south end of the West Court. The rim is rounded and unpainted; front and back are slightly indented; the back is undecorated and lacking in tumpline attachments of any sort; the maximum curvature, front and back, is flattened by attrition, indicating long use and repeated placement in a recumbent position.

Within the vessel cavity, paired quarter-inch ropes of clay were dropped to the very bottom and pressed firmly against the rear wall.

[66] In response to an inquiry of April 12, 1940, I learned that Dr. Regnier had been dead several years; his home burned, and nothing is now known of the specimen herein described.

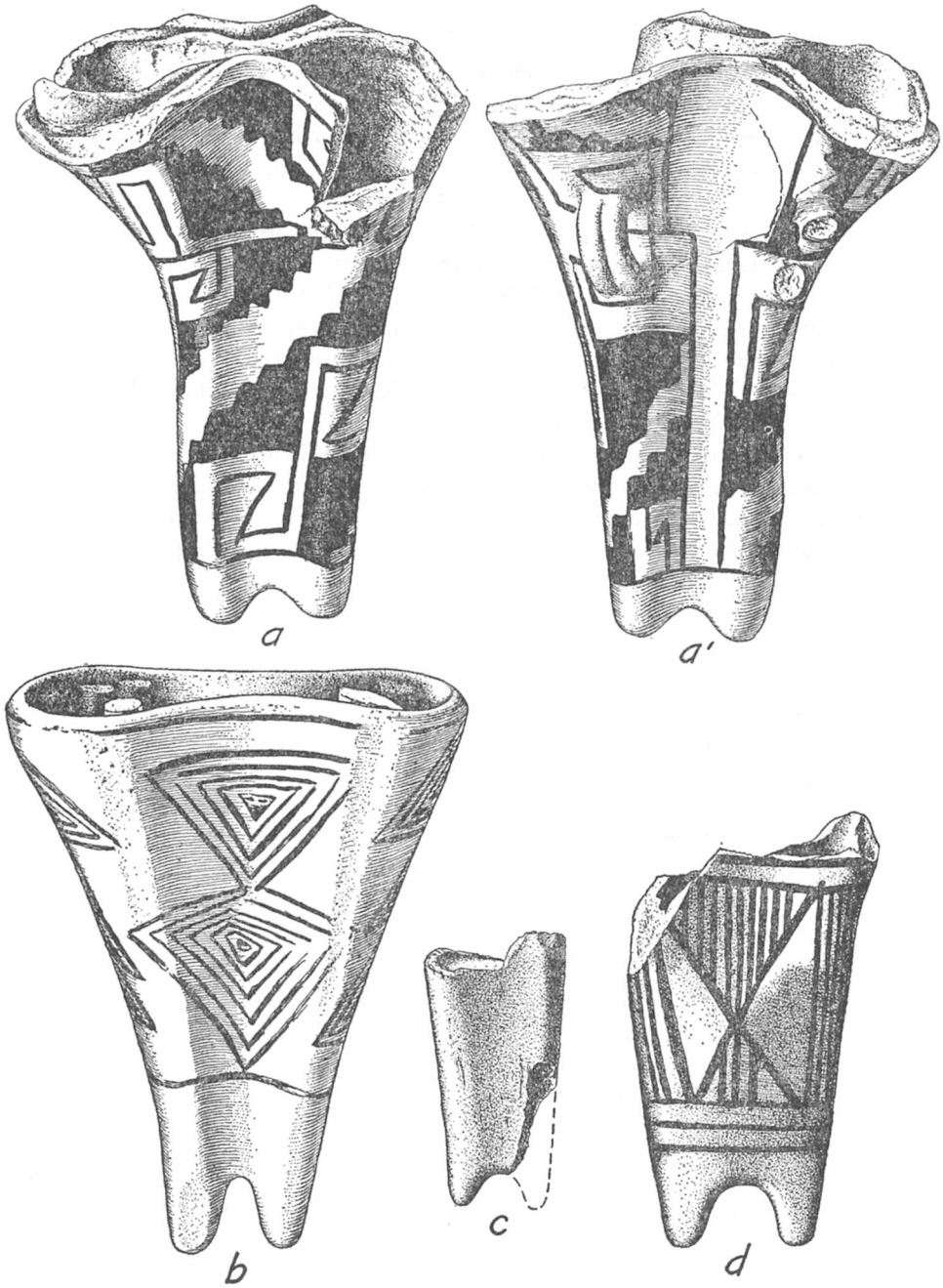


FIG. 100.—Earthenware effigies of bifurcated baskets.

The inner roll of each pair rises halfway up the middle and then, flattened by a finger, turns outward at approximately right angles to join its companion. At the front, single clay ropes were brought up in the same manner, meeting in the middle and continuing thence gradually outward respectively to reach the rim opposite the two inner rolls of the rear pairs. Those in front were positioned last; all were more or less flattened as far down as the potter could reach with her finger.

In temper, surface treatment, paint color, and absence of tumpline attachments, our next specimen (fig. 100, *d*), agrees with that last described. But the body is not as well balanced, being thicker at its left shoulder. The highest point here preserves a bit of the rim. Fire clouds remain on the upper right and lower left front. Within, a single clay rod $\frac{3}{16}$ of an inch in diameter rises vertically through the middle (front and back were compressed just enough to hold this rod in place) to where it was broken off two-thirds of the distance above the crotch. A discard, the fragment was retrieved from the east refuse mound.

Our third example indicates a different sort of superstructure but, again, there is not enough left for reconstruction (fig. 100, *a, a'*). Restored from fragments recovered in Room 330, the effigy is sherd-tempered with a stone-polished slip. Double-roll, vertical-loop line attachments were fastened on the back by the riveting process. The slip does not extend beneath these loops but lines of the decoration do. With its stubby legs the lower inch and a half of the body appears to have been made solid; above the crotch, pressure front and back brought the vessel walls almost in contact. The resulting external grooves broaden at the top in keeping with the outflare of the basket. It will be noted, also, that the brim rises in the middle; sweeps low on either side.

Enough of the brim is present to show that it was somewhat thinned at the edge, rounded, and unpainted. Within is all that remains of the secondary feature—modeled walls $\frac{1}{8}$ inch thick that curved up and inward. Marks of an edged, spatulalike tool and fingernail imprints appear where the added clay was pressed and shaped to the wall of the effigy.

Finally, we have the miniature illustrated by figure 100, *c*, our smallest example. It is unslipped and undecorated; the only one of the series that is sand-tempered. The body, from feet to cavity, is solid. We found the fragment among debris of occupation underlying the terrace designated Room 347, fronting Room 324.

Thus, of our eight complete or fragmentary earthenware models of

bifurcated baskets, five came from household rubbish; one was recovered in Room 330, a burial chamber; two only, those from Pueblo del Arroyo, apparently had been stored away. In no instance did the position of the object as found, or its associations, provide a clue to its purpose. Since they cannot have been utilitarian, we may conclude that these effigies, like the baskets they represent, were entirely ceremonial.

Less sophisticated models have been found farther west, in the same culture horizons that produced the early varieties of carrying baskets. As "funnel-shaped objects," Guernsey (1931, fig. 26, *a-b*, p. 86) figures two unfired clay effigies of Basket Maker III panniers. There can be no doubt as to the concept portrayed. The elongate body with reduced base, the outflaring rim, the punched holes simulating tumpline attachments, all unite in identifying the model with contemporary burden baskets.

From Mummy Cave, Canyon del Muerto, Morris recovered the clay model of a wider, deeper basket with zoned decoration indicated by punctations (Morris, 1927, p. 154, fig. 6, *f*). If his figure 6, *e*, be reversed, Morris has another such model but this time with punched holes at the back and a more pronounced basal cleft. Likewise, if the drawings of them be turned about, a group described as "nipple-shaped objects" unquestionably picture the Early Basket Maker hamper, as Morris himself observed (ibid., figs. 10-12, pp. 156-158).

In the Fremont district, west of the Rio Colorado in Utah, Morss (1931, p. 50) found fragments of six undecorated "nipple-shaped objects, similar to those described by Morris." Roberts (1929, p. 125) unearthed several fragments bearing punctate decoration at a Basket Maker III site 9 miles east of Pueblo Bonito. And Morris (1939, p. 166) recovered parts of two at Site 33, a Pueblo I ruin in the La Plata district. The smaller of these has just the suggestion of a basal notch and thus accords with its utilitarian contemporaries but, from the description, one seems justified in placing the larger somewhat later. Although undecorated, its upsweep of rim, front and back, its exaggerated rim flare at either side, its narrow body with short, pointed legs and vertical, median grooves are features more in harmony with the basket effigies of Pueblo Bonito than with those from older ruins.

Our Chaco Canyon observations, combined with those of coworkers in other areas, thus warrant the conclusion that miniature earthenware models of carrying baskets, fired and unfired, were among the paraphernalia of some cult that came into being in Basket Maker times and persisted at least until Pueblo III.

Clay-coated basketry.—Another specimen thought to have been made for ceremonial use is that represented by the fragment shown in figure 101. Coiled on a one-rod foundation with uninterlocking stitches, the fabric is covered inside and out with red clay to a minimum thickness of one-sixteenth inch. The clay is very fine-grained and doubtless gets its color from a high iron oxide content; it is hard and brittle as though fired, but this may be accidental since the two shortest rods are charred at the end.

Both surfaces were carefully smoothed and one was then embellished with a design that included stepped triangles or rectangles. Thick black paint was employed on the fragment before us. Our fragment, recovered from Room 300, lacks perceptible curvature but it probably belonged to the same vessel as the rim sherd Pepper (1920, p. 69) found in Old Bonitian Room 13, next on the south.

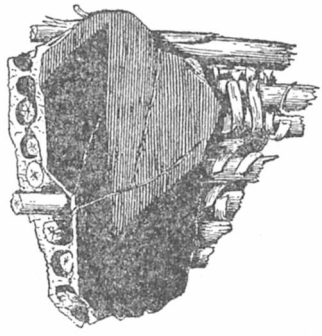


FIG. 101.—Basket fragment, clay-coated and painted.

Morris describes three fragments of red-paste-covered baskets from Chaco rubbish in Aztec Ruin (Morris and Burgh, 1941, p. 26).

"Ring-bottomed vase."—This term is adopted from Morris (1919b, p. 198), and with equal hesitation, to describe the queer little vessel illustrated on plate 9, C. What special purpose, if any, it was designed to serve, remains unknown. It is included with objects supposedly ceremonial only because it had fallen, with collapse of the upper floors, into the lowermost chamber of Room 249, where macaws were imprisoned, and because we assume the attendant priests stored their paraphernalia in those upper rooms.

Morris's example came from a Basket Maker III or Pueblo I ruin in southwestern Colorado. It is undecorated and has a tubular handle. Jeancon (1923, pp. 46-47) describes two others, of biscuit ware and without handles, from the ruin of Po-shu-ouinge in Chama Valley, N. Mex.

The basal ring of our Pueblo Bonito specimen is hollow and connects on either side with the cylindrical neck. The strap handle is solid and was attached by riveting. Opposite the handle a miniature jar rests on the body of the vessel and opens into it. A black rim line on this jar has been partially worn off; a similar line circled the principal orifice, with a "spirit path" above the handle. The vessel,

smoothed but not polished, originally bore a chalky-white slip; firing clouds largely obscure the painted ornamentation on the neck. The solid design, which dates the specimen about midway in the history of Pueblo Bonito, covers all but the bottom and inner face of the ring.

Sacrificial deposits.—Earlier in this chapter we remarked the finding of "ceremonial sticks" embedded in house walls, and elongated repositories designed, presumably, for like offerings. The deposits now to be considered are of somewhat different character. One was sealed in a kiva wall; another lay in a masonry box beneath a kiva floor; still others had been hidden among roofing timbers.

Between decayed ceiling poles about 3 feet above the bench in both the southeast and southwest quarters of Kiva R, we found sacrificial offerings of bone, shell, and turquoise beads, shell-bracelet fragments, broken pendants, etc., and part of the upper bill of a redhead duck (*Nyroca americana*). Although these materials (U.S.N.M. Nos. 336004-336010) were removed in seven lots, it is believed that they originally formed but two deposits, each of which had been broken up through settling of the domed ceiling. In one lot the number of olivellas would have sufficed for a necklace.

The character and diversity of these two offerings are reminiscent of those concealed in pilaster logs. The latter, however, in even larger measure were made up of scraps from the lapidary's workbench although whole beads and pendants were included and, occasionally, brightly colored feathers, or twigs from unidentified plants. Sacrificial deposits in kiva pilasters will be discussed at greater length in a subsequent report.

Whenever they occur in an offering, unbroken turquoise pendants are likely to be off-color—too pale or too green for the fastidious Bonitian. They are of a quality that reminds one of Zuñi sacrifices at springs and shrines in the days of the Conquest. For instance, the anonymous author of the Relacion del Suceso observed that, in addition to prayer sticks, the Zuñi offered "such turquoises as they have, although poor ones" (Winship, 1896, p. 573). So, too, in pre-Spanish times—when the devout Pueblo sacrificed turquoise to his gods he oftentimes used that of least value.

Three inlaid scrapers from Room 244 are illustrated in plate 36, figures *a-c*. Each was made from the left humerus of a deer. The fact that they lay side by side on the middle floor of an otherwise empty room suggests another offering.

Half a handful of turquoise bits, both worked and unworked (U.S.N.M. No. 340007), was enclosed in a small block of masonry

built against a partially razed older wall underlying the southwest foundation in Room 186. The Zuñi workman who made the find said it had been put there "to hold up the wall."

Under the floor of Kiva D we chanced upon a crude masonry box built against the concave wall of an older, abandoned kiva. In that box was one of the most colorful offerings recovered by the expedition (pl. 89).

First of all was a creamy-white cockleshell (*Laevicardium elatum*), from somewhere along the Pacific coast between San Pedro and Panama. It served as a receptacle for the following:

a. 3 bracelet pendants and 1 fragment (*Glycymeris giganteus*).
b. 1 dark brown hematite cylinder.
c. 3 olivellas (*Olivella* sp.).
d. 1 blue azurite pellet and 15 tiny bits not shown.
e. 20 figure-8 shell beads.
f. 3 fragments of nacreous *Haliotis* sp.
g. 3 worked pieces of turquoise matrix.
h. 1 shell fragment, unidentified.
i. 3 purple disks of *Spondylus princeps*.

A larger, more diversified offering was concealed in the north wall of Kiva Q and accidentally exposed during our work of repair. It included the following, partly shown in plate 90:

a. Shreds, apparently, of juniper and rush; 3 scraps of abalone shell; 1 bit of twined fabric, perhaps a sandal.
b. 1 flint and 2 obsidian arrowheads; 1 red claystone and 4 turquoise tesserae.
c. 9 pendants of abalone shell.
d. 1 quartz crystal; 3 azurite pellets.
e. 3 bone awls.
f. 2 brown chert blades and 1 of quartzite.
g. 1 flint knife blade.
h. 2 flint, 2 fine quartzite spalls.
i. 2 quartz, 2 quartzite pebbles, unworked.
j. 2 sandstone jar covers.
k. Base of indented corrugated cooking pot.
l. Bowl of cloud blower.
m. Fragments of 2 B/W jars with middle and late hatching.
n. 1 B/W bowl sherd, squiggled decoration.
o. Sandstone concretionary cup with slight pecking inside.
p. 3 quartzite hammers.
q. Part of sandstone muller.
r. Sandstone pallet, slightly concave on middle face.
s. Not shown: Claws and phalanges, of the black bear, dog, and mountain lion. Also not shown, the following turquoise: 1 small, undrilled pendant, 2 small discoidal beads; 6 blanks for beads; 7 fragments more or less worked, and 6 bits of matrix.

In addition:

2 bone and 1 slate discoidal beads; 2 olivellas, spires removed; 1 squash seed; 4 wild-grape seeds (*Vitis arizonica*); 1 unidentified seed fragment; and 1 spine of western locust (*Robinia neomexicana*).

Of more than passing interest in this assemblage are the digital bones of the bear, dog, and mountain lion. As identified by H. Harold Shamel, of the division of mammals, U. S. National Museum, the lot includes:

Black bear (*Euarctos americanus*):
- 33 proximal phalanges.
- 76 middle phalanges.
- 4 claws.
- 1 metacarpal.
- 4 metatarsals.
- 26 disunited digital extremities.
- 7 carpal bones.
- 27 sesamoids (a few possibly dog).

Dog (*Canis familiaris*):
- 3 proximal phalanges.
- 4 middle phalanges.
- 21 claws.

Puma (*Felis concolor*):
- 2 claws.

No distal phalanges are present and only four bear claws. Furthermore, 7 proximal and 26 middle phalanges are scored by flint knives. In every case these marks lie on the body, somewhere between its articular surfaces; in nearly every instance the cuts are approximately at right angles to the long axis of the bone. Like scoring occurs on one middle phalanx of the dog. No knife mark at all appears on five bear middle phalanges with pronounced arthritic (?) accretions.

Among historic Pueblos, east and west, bears are prey animals and thus associated with war. They are also associated with the west, where dwell the dead. Bears are considered humans in animal form; hence the universal Pueblo taboo against killing them for food. In most villages bears are closely connected with curing societies (Parsons, 1939). Stevenson (1904, pls. 108, 127) shows bear paws on altars of the Sword Swallower and Little Fire fraternities at Zuñi. But these observations do not explain the presence of digital bones of the bear in a sealed sacrificial offering.

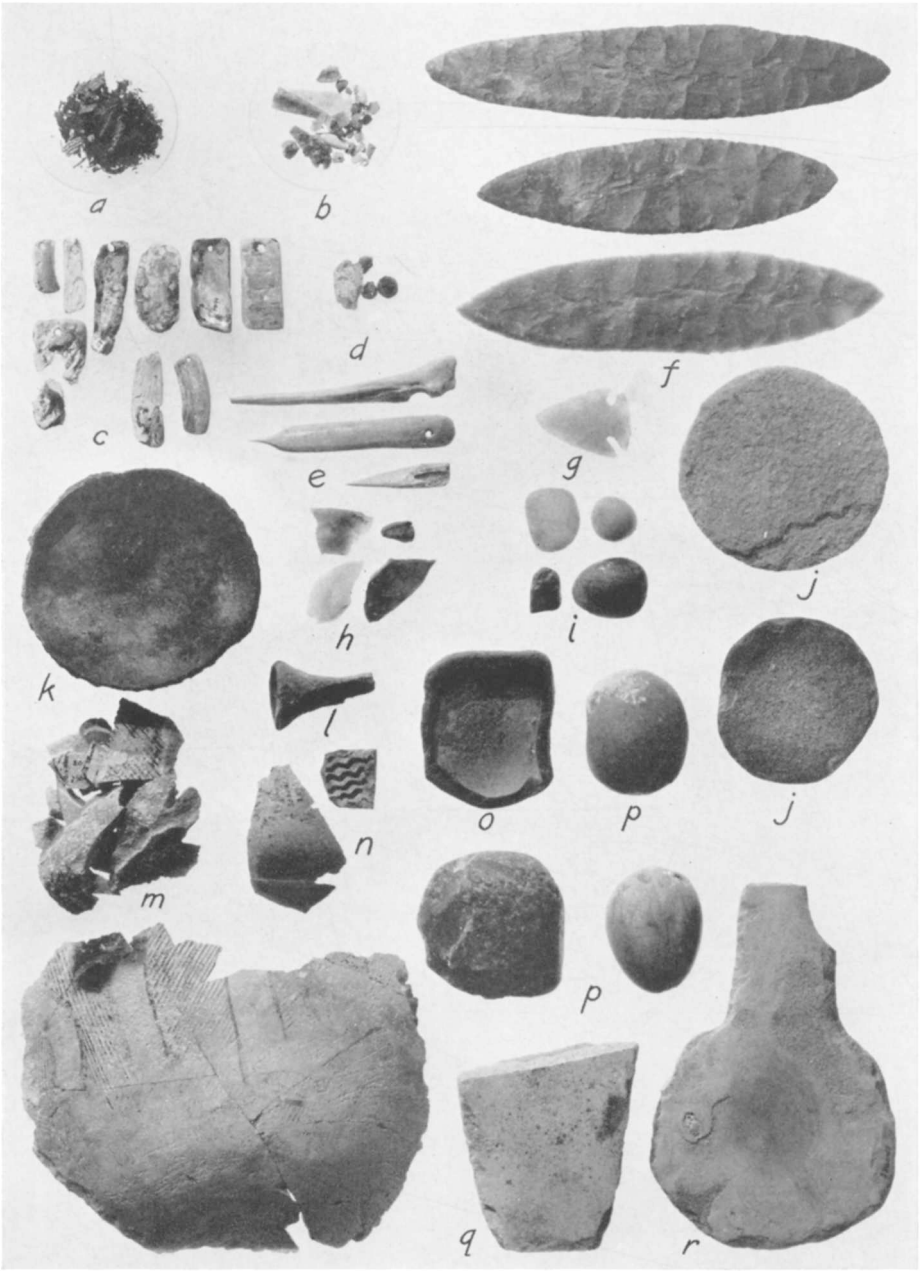


PLATE 90.—Part of the material from a concealed repository in the north wall of Kiva Q.



PLATE 91

Upper: Disarticulated skeletons, northwest quarter of Room 320.

Lower: Disturbed skeletons and their grave furnishings, northeast corner of Room 320.

(Photographs by O. C. Havens, 1924.)



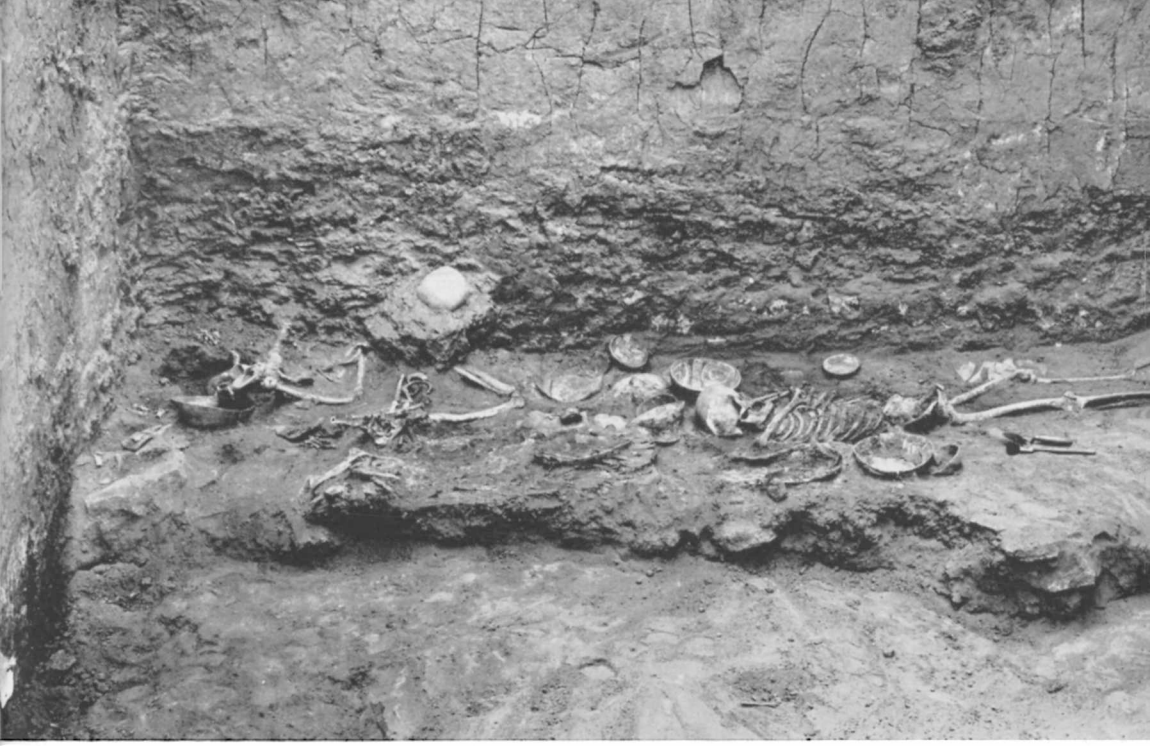


PLATE 92

Upper: Skeleton 12 (right), and partial skeletons 11 and 13, Room 326.

Lower: Cylindrical and bifurcated baskets, southeast quarter of Room 320.

(Photographs by O. C. Havens, 1924.)





PLATE 93

Upper: Skeleton 14, Room 326, lay on a mat of rushes between the clay base of a roof support and the south wall.

Lower: Skeleton 23 occupied a shallow pit beneath the floor of Room 330.

(Photographs by O. C. Havens, 1924.)



VIII. INTRAMURAL BURIALS

The cemetery at Pueblo Bonito has never been found. This fact not only adds to the mystery of the ruin but limits our knowledge of its one-time occupants. With an estimated peak population of over 1,000, and with one section inhabited perhaps 250 years, Pueblo Bonito should have experienced between 4,700 and 5,400 deaths.[67] How the bodies were disposed of, and where, continue to be tantalizing puzzles.

The only human remains thus far discovered at Pueblo Bonito had been buried within the house cluster. The Hyde Expeditions exhumed perhaps 20 (Pepper, 1920); Moorehead (1906, p. 34; Pepper, 1920, pp. 210, 216) unearthed 2 or more. Sometime during the late 1890's, while Richard Wetherill was operating his trading post nearby, Col. D. K. B. Sellers of Albuquerque, N. Mex., and another man broke into "a large room on the west side of Bonito" and there found part of the "mummified" body of a woman and a quantity of turquoise, including two turquoise birds.[68] The National Geographic Society's expeditions disclosed 73 skeletons, complete and incomplete. Thus of all the people who formerly dwelt there, young and old, we account for less than 100. Except three infants, all were interred in that part of the pueblo occupied by the Old Bonitians.

Room 320, the first of four burial chambers we encountered, was designed for storage. It was floored with flagstones, in itself an unusual feature. Its lone doorway, in the middle east wall, was equipped with secondary jambs and lintel to support an inclined doorslab placed from Room 326. Paired ventilators in both east and west walls had been blocked, presumably when the Late Bonitians built close against the outer west side.

Despite its original purpose, Room 320 came finally to be used as a tomb, the sepulcher of eight women and two girls. Two of the adults lay side by side on a single rush mat spread upon the floor at the south end. They lay extended, on their backs, and with heads toward the east. Traces of a feather-cloth robe, cotton fabrics, and yucca cordage were noted in the covering of earth. Their pallet overlapped the near edge of a fine willow screen carelessly folded upon itself in the southeast corner. No offering was directly associated with this double inter-

[67] Based on Hooton's estimate (1930, p. 349) of an annual death rate at Pecos of between 20 and 25 per thousand.

[68] Verbal communication from Colonel Sellers, May 5, 1921.

ment, but a couple of feet away, south of the east doorstep, were several baskets and earthenware vessels (pl. 92, lower).

Of the other eight bodies, none remained intact. All had been shamefully pulled and booted about. No. 1, comprising only the articulated lumbar vertebrae, the pelvis and femurs, had been tossed to a sitting position in the northwest corner with the left ilium against the west wall and the knees touching the north. Within the pelvic arch were the fragile bones of a fetus (field No. 1417).

The headless skeleton of a second female, No. 2, sprawled belly down across miscellaneous bones from at least two others (pl. 91, upper). Under her left knee and at her left side, respectively, were remnants of two plaited ring baskets; under her right foot, the edge of a superb mat of peeled willows (pl. 10, A). Her left hand rested on the floor 5 inches below the head of the humerus; the detached right hand was at the same level but out in front of the left shoulder.

In the northeast corner, jumbled with earthenware and baskets, were six crania and a lone mandible, several vertebrae and a mutilated torso (pl. 91, lower). Some of these lay directly upon the flagstones; some were 2 to 5 inches above. Pack rats had nested in baskets and pitchers and under the arched ribs of the torso, but by no stretch of the imagination can they be charged with the disorder so apparent here.

At time of interment, the 10 bodies had been lightly covered with earthy debris including potsherds and pieces of adobe mortar and flooring. But windblown sand had soon leveled all surface irregularities and gathered into deeper, stratified accumulations in corners. These deposits averaged little more than a foot deep through the middle of the room when the north half of the ceiling collapsed, apparently under the weight of masonry fallen from above. More sand drifted in, and with it came sweepings from nearby dwellings.

In what I believe to have been a relatively short period this neighborhood dump reached above the surviving portion of the second-story floor. Basis for this belief is the debris of reconstruction in the pile and the uniformity of types among the 1,250 potsherds recovered. Of these latter, 628 came from below first-story ceiling level and include fragments of late Chaco hatching and Houck polychrome. Sherds of Early Pueblo ware and what we have called Chaco–San Juan were conspicuous throughout; also, fragments of both plain and corrugated-coil cooking pots.

An extra right humerus in Room 320 presumably derives from Room 329 wherein three right humeri were missing.

Room 326 was originally the family living quarters, and 320 was

one of two connecting storerooms. There had once been two doors in the east wall but one was wholly, the other partially, closed, perhaps when Rooms 328 and 329 were built. As Room 320 eventually was appropriated for burials, so also was 326. It became the common sepulcher of a man, nine women, and an infant.

Of these 11 individuals the first to die was a woman of 30 or 40, identified in my field notes merely as Skeleton 14. (Three lots of miscellaneous bones subsequently were recognized as parts of numbered skeletons.) Her bed was a mat of selected, uniformly small bulrushes. She had doubled it upon the earthen floor in the southeast corner, in the narrow 18-inch space between the south wall and the basal ring of ceiling prop No. 6 (pl. 93, upper). That she died in sleep is evident from her position, comfortably on the right side with knees drawn up and hands before the face. We observed no trace of blankets and no burial furnishings. The body had been covered with the material nearest at hand, dried mud mortar from razed walls, after which the room naturally was abandoned as a vital unit of the family residence.

Another female, No. 12 of my field notes, was next to be interred here. The reconstruction waste carried in for burial of No. 14 was hurriedly leveled until only 6 to 8 inches thick. Upon the uneven surface a bulrush mat was then spread and the deceased gently laid upon it full length with head east, left arm straight at side and right across the chest (pl. 92, upper). More debris of reconstruction was brought in and piled over the corpse.

In contrast to her predecessor, No. 12 was generously outfitted for her journey to the Underworld. A turquoise pendant lay on the left breast; a string of turquoise beads formed a 3-coil bracelet for the left wrist (pls. 22 and 98, upper). At the right shoulder, remnants of an oval basket tray contained one of the peculiar bone fleshers invariably associated with such baskets locally. Assembled about the head and shoulders were 14 earthenware vessels; at the left knee, a shattered olla.

Of these diverse objects, the following are illustrated herein:

	Plate		Plate
Turquoise pendant	22, *g*	Bowl	54, *h*
" bead bracelet	22, *e*	"	55, s_2
Deer humerus flesher	37, *d*	"	54, h_2
Bowl	54, d_2	"	54, j_2
"	54, *r*	"	55, u_2
"	54, *j*	Pitcher	57, *j*
"	54, *o*	"	57, *n*
"	54, *e*	Olla	64, *d*

That No. 12, in turn, was only shallowly covered with earth is obvious from the fact that three of the vessels at her head were immediately overlain by an empty burial mat. Between this mat and the southeastern corner of the room were parts of a disarticulated skeleton we recorded as lots 11 and 13. The legs were separated from the torso and from each other. The mandible and several ribs somehow had come to rest at the head of the right femur. What we believed to be the associated cranium lay 6 inches above the right foot and abutting the south wall.

Skeleton 10, an infant, was on its back 10 inches above the floor, head to the east and knees pressed down to the left. The skull, 5 inches from the east wall and 4 feet 3 inches from the southeast corner, is strongly marked by *Osteoporosis symmetrica,* a disease of childhood attributed to dietary deficiency. Parts of a cylindrical basket (U.S.N.M. No. 335305) and a bifurcated basket (No. 335313, field No. 1680) were found just above the infant.

Skeletons 8 and 9 evidence a dual burial. They lay extended on the back, head east, 10 to 12 inches above the floor (pls. 94, left, and 95, upper). The former had her hands at the sides; the latter, left hand on chest and right on belly. A joint offering of pottery, baskets, etc., was grouped between the two skulls and Post 5. Waste from building operations underlay the two bodies, as in the case of 10, 11, and 12.

The knees of No. 8 were separated, perhaps thus to shorten the legs and allow space for two digging sticks between feet and west wall. A small sandstone slab lay upon the sticks and the right foot pressed against the slab.

Each skeleton had a turquoise pendant at the throat and, in addition, No. 8 boasted one of jet. Of greater interest, however, is the fact that the grave furniture included a small bifurcated basket, two cylindrical baskets, and two oval trays with companion scrapers fashioned from deer humeri. These and other objects in the assemblage are illustrated herein as follows:

	Plate	Figure		Plate
Turquoise pendant (S.8)	22, *f*		Bowl	54, *g*
" " (S.9)	22, *h*		"	55, a_3
Jet " (S.8)		20, *f*	"	54, g_2
Bifurcated basket	87, B		" (S.9)	54, *l*
Deer humerus scraper (9)	37, *b*		"	54, *k*
Elliptical tray	44, *a*		" (S.8)	54, *q*
Digging stick	71, *k*		" (S.8)	54, *p*
" "	71, *i*		Pitcher	57, *m*
4 hematite cylinders		84	" (S.9)	57, *l*
Sandstone tablet	27, *d*		" (S.8)	57, *e*

While these dead were gathering at the south end of Room 326, half a foot of blown sand gradually accumulated throughout the northern two-thirds. Then neighbors dumped in some 4 inches of household rubbish that included many potsherds; next came another 4 or 5 inches of floor sweepings mixed with debris of reconstruction. Neither layer was uniform throughout; each was noticeably thicker at the margins and the latest merged with a deposit of occupational debris over the six burials mentioned.

At this point Room 326 experienced a brief period of inactivity; its earthy fill, varying in depth from 14 to 20 inches, settled and crusted over. Then in fairly rapid succession, or perhaps at the same time, 5 more interments were made. We found two in the middle of the room, their scattered bones under and between decayed ceiling poles and fragments of adobe flooring; the other three undisturbed although only a few feet to the southeast.

Skeletons 5, 6, and 7 apparently were interred together. They more or less paralleled each other, on the same level and about 25 inches above the floor. No. 5 lay with skull close on the north side of Post 4; Nos. 6 and 7, on the south side. Each lay extended on the back with head east and arms at side; each had an offering of pottery vessels and other utensils grouped just beyond the head (pls. 94, right, and 95, lower).

The skull of No. 5 rested upon a stuffed-basketry "pillow" but since this was underneath the burial mat its position may have been purely accidental. Accompanying artifacts illustrated herein are:

	Plate	Figure		Plate
Basketry pillow	41, B		Bowl	54, *z*
"Napkin ring"		63	"	54, e_2
Bowl	54, *t*		Pitcher	57, *b*

Artifacts with skeleton 6 are as follows:

	Plate		Plate
Deer humerus scraper	37, *a*	Bowl	54, *s*
Oval basket tray	44, *b*, *c*	"	54, *d*
Bowl	54, *a*	Pitcher	57, *f*
"	55, x_2	"	57, *i*

The fact that one of the earthenware bowls rested in the basket tray opposite the flesher is doubtless just another chance happening.

No. 7 lay upon a mat of small bulrushes, neatly bound at intervals with twined threads. Traces of a twilled rush mat were noted over the body.

Mystery envelops the two disarticulated skeletons. They lay in the middle of the room, only a few feet from No. 5 and on the same packed surface. Neither occupied the orthodox position in death, facing west. One vertebral column headed north; the other, northwest. Clearly both bodies had been dragged from their burial mats while flesh and ligaments still held joints together. Whatever its source, the disturbance occurred shortly before the ceiling collapsed, since ceiling poles were actually in contact with the bones. Any thought of accidental death is countered by the fact one of the two craniums still rested upon part of its burial mat. If either body was covered with earth at time of interment the covering must have been very meager indeed.

Above these five skeletons and generally throughout the room was some 18 inches of floor sweepings and trash; above that, about 2 feet of like material in which windblown sand seemed dominant, and then another layer of rotted ceiling poles. Between these latter and the broken top of the walls the fill consisted of fallen masonry plus the ever-present Chaco sand. That second series of poles, about 5 feet above the floor, undoubtedly represents the second-story roof.

Thus, of the 11 individuals buried in Room 326, only one (No. 14) appears to have died where the body was found. An infant, No. 10, and adults 8, 9, 11, and 12 presumably were interred within a relatively brief period since their remains in no instance were more than 12 inches above the floor. That the head and limbs of No. 11 had been pulled from the trunk may, as a guess, be attributed to the jittery haste with which preparations were made for a later burial. Vandalism is ruled out in this case since three nearby skeletons on the same general level and two others, 4 or 5 inches above them, were quite in order.

Sepulture is a fearful task the Pueblo assumes unwillingly and concludes as speedily as possible. It is dread of what might happen rather than callousness that motivates grave diggers at modern Zuñi, for example, where each new grave in the crowded churchyard disturbs half a dozen deceased relatives and one-time neighbors. Get the disagreeable job done and get away! So uprooted bones are anxiously scraped in on top of the latest corpse and covered with a bare foot or two of earth.

The dead in Room 326 had each been placed on one or more sleeping mats. A majority of these were made of carrizo or carefully selected bulrushes, uniform in diameter, laid parallel, and bound in place by twined threads at 4- or 5-inch intervals. That under No. 12 measured 2 feet 11 inches wide. A few comparable mats were fashioned from dressed willows, pierced and the threads run through; still others,

from split rushes twilled over-two-under-two. Under the body of No. 7 there had been a mat of small parallel rushes and one of twilled rushes above it. Remnants of matting and cotton cloth over other skeletons suggest that they were bundled or sheeted at the time of burial.

Although there is some doubt in the case of 2, 4, and 11, it seems likely that every interment except the first, No. 14, had been accompanied at least by offerings of pottery. These, together with vessels not identifiable with a given body and still others restored from fragments in the household rubbish overlying the 11 skeletons, are shown on plates 53, 54, 55, 57, 64, and 67.

Besides the two planting sticks with No. 8, we noted decayed remnants of others and staves with crooked ends in association with other skeletons. A planting stick in Hopi graves is an aid to resurrection, since it represents the ladder into the house of Masauwii, god of death; at Acoma the prospective traveler is offered a crooked stick as a cane and prayer sticks are given the dead "because they are going away" (Parsons, 1939, pp. 71, 271).

Room 329 is a one-story structure abutting the outer east wall of 326. It may have been provided with a ceiling hatchway, but the only visible means of access is a door in the southwest corner. Equipped with secondary jambs for support of a doorslab positioned from 329, this opening was half closed with rude masonry when we found it. Because the blocking was incomplete the door presumably continued in use until interment of the first corpse in 326. In addition to constructional separation from its neighbors, a central fireplace and a ventilator low on the east side combine to identify this room as the probable one-time council chamber for some secret society. Nevertheless it, too, finally was pressed into use as a burial vault.

Seventeen women, six children, and a man were buried here at various times. Two of the children died first, for their bodies lay on the bare earthen floor. Over them, and throughout the room generally, household sweepings and blown sand had been spread to an average depth of 14 inches. In and upon this fill, with quite meaningless variations in elevation, were the other 22 skeletons. We found them in utmost confusion. Bones were scattered everywhere (pl. 97). Not a single adult skeleton remained intact. All the skulls were present, but three right humeri were missing, and, despite intervening walls and a half-blocked door, the extra humerus we found in Room 320 may be one of these.

In contrast, only one of the six child burials had been disturbed. This exception, a youngster of about 12, was buried on its back facing

east, but the head had been twisted off and left face down. Under the shoulders was part of a willow screen, and just beyond the skull were a bowl and two pitchers that we assume were offerings with this particular burial (pl. 96, left).

Against the middle north wall we found the body of an 8-year-old (field No. 1880) on a bulrush mat with two pitchers and a bowl at its head. Close by, head east and arms at side, was a third little skeleton (field No. 1921), that of a child less than 6. It had no mat but was accompanied by a duck-shaped pitcher, two ordinary pitchers, and a bowl. Another child of like age (field No. 1922) had been buried in the southwest corner, a couple of inches above the floor. It lay on its right side with head northeast; before its partially flexed knees were two bowls each containing a cupful of what probably had been cornmeal, protected by an inverted bowl (pl. 53, figs. *c, c', d, d'*). Another 6-year-old (field No. 1923), head south and with no grave furnishings at all, was buried close against the northeast alcove, a structural feature to be described elsewhere. The fragile bones of a child less than 2 (field No. 1924) lay alone on the floor in the north-central portion of the room.

From the graves of these children, and from among the broken, scattered remains of their elders, we recovered 47 earthenware vessels including 25 bowls, 10 pitchers, and 6 cylindrical vases. In addition to the two mentioned above, there is a third porringer containing vegetable matter covered by a smaller bowl. Except two specimens, restored from fragments that might have been carried in with the debris of occupation spread over the interments, I believe all the pottery was introduced as burial offerings.

Pieces of rush and willow mats were noted here and there, but in only two instances, the child skeletons cited above, were those mats actually occupied at the time of exhumation. Remnants of a fairly large cotton fabric (U.S.N.M. No. 335349) were traceable beneath portions of two adjacent skeletons in the north half of the room.

A pair of shell pendants (No. 335706) was recovered beside one child's body (field No. 1922). With another we found the only turquoise pendant (U.S.N.M. No. 335748) seen in Room 329—one of good color but with an angular face and no matrix backing. From the general burial level we gleaned four fragments of shell bracelets, a few olivella beads, one of jet, and perhaps a handful of discoidal shell and stone beads. If not chance losses gathered up with household sweepings and tossed out, these are truly scant adornment for 24 Bonitian dead.



Skeletons 8 (right) and 9, Room 326, with grave furnishings that included pottery, basketry, and agricultural tools.



Skeletons 5 (left) and 6, Room 326, were accompanied by earthenware vessels, baskets, and other objects.

(Photographs by O. C. Havens, 1924.)

PLATE 94



PLATE 95

Upper: Skeletons 8 (front) and 9, Room 326, rested on a layer of constructional waste and blown sand.

Lower: Skeletons 5 (front) and 6, Room 326, had been interred on a second burial level, about 25 inches above the floor.

(Photographs by O. C. Havens, 1924.)





The head of Burial 12, Room 329, an adolescent girl, had been twisted off and left face down.



Detached skulls lay among earthenware vessels and baskets in the northeast corner of Room 320.

(Photographs by O. C. Havens, 1924.)

PLATE 96



PLATE 97

Upper: Overturned burials in the southwest corner of Room 329.

Lower: Parts of three disarticulated skeletons, northwest quarter of Room 329.

(Photographs by O. C. Havens, 1924.)



The duck effigy of pale green turquoise illustrated as figure 92 comes from Room 329, but weight and off-center balance preclude the possibility of its having been worn as an ornament.

Room 330 has much in common with 329. It also abuts Room 326 on the east and its only entrance was a ceiling hatchway. A slab-lined, adobe-rimmed fireplace, a ventilator through the middle east wall at floor level, and absence of a lateral door further mark 330 as another chamber designed for esoteric rites. And it, too, in the course of time, came to be set aside for burial purposes.

Twenty-three individuals were inhumed here—13 men, 4 women, and 6 children. (My field notes include a Skeleton 24, but the miscellaneous bones recorded as Lot 1 later were recognized as belonging to various skeletons.) Two of the men, perhaps members of the secret society that met here, were first to be interred. Both were in their late twenties at time of death; both were buried in cramped quarters under the floor (pl. 93, lower).

The skeleton of a child less than 6 (No. 21) lay flexed on the floor in the northwest corner, in a bin formed by two low adobe walls. Since these were only 6 inches high and were directly overlain by a covering of sticks, it seems likely the bin was constructed purposely to enclose the little body.

Skeleton 10, the remains of a warrior in his prime, lay on his back in the middle of the room, head east, heels together and knees outspread (pl. 98, lower). On the floor between his knees 28 finely chipped arrowheads had been arranged to form a triangle; under his right hip lay a bundle of reed-shafted arrows. Both lots are described at greater length on pages 254-255. An accompanying bowl probably contained food for the long, last journey. Here, truly, was an honored defender of the village! Under the right knee of another, but disarticulated, skeleton we found eight arrowheads (pl. 74, A).

We do not know whether the child in the northwest corner, the warrior, or No. 22, an arthritic, was first to be interred above floor level. But we do know that first inhumation was scantily covered with occupational debris. Above this lay some 16 inches of sand containing floor sweepings and a few potsherds. The total accumulation averaged only 18 inches thick but in it, within a room less than 13 feet square, 21 human bodies had been buried. Resting directly upon the burial layer and flattened against the walls were the broken timbers and other components of the collapsed ceiling.

Of the 21 interments above floor level only 4 had escaped mutilation. The others had been callously pulled and kicked about before the roof fell (pl. 99).

Nineteen food bowls, 19 pitchers, 1 "duck" pitcher, 1 cup-size canteen, 6 cylindrical vases, 1 broad-handled ladle (fig. *a*, pl. 62), and fragments of two ordinary ladles were collected from Room 330 and its two subfloor graves. As in 329, several small bowls contained what probably was ground meal, covered by smaller, inverted bowls. Although the total averages practically 2 vessels per burial, 21 were either crushed by trampling feet or broken elsewhere and dumped in with kitchen rubbish. The latter could happen, as witness a restored bowl, one sherd of which came from Room 329, next on the north. Fragments of a 6-inch, half-gourd type dipper were recovered also from Rooms 325 and 327. Here, again, is proof Bonitian housewives dumped their daily sweepings in the place that seemed most convenient at the moment.

The jet rings illustrated on plate 22, figures *a, b,* lay in loose earth near an incomplete male skeleton (No. 6) in the southeast corner of the room; figure *c* lay beside the skull of a youth (Skeleton 13) 15 to 18 years of age. But we have no means of knowing whether the rings actually were buried with these two bodies. An unpolished disk of lignite, 3 inches in diameter by one-fourth inch thick, was found beside Skeleton 5. In addition to these treasures, we recovered a few discoidal turquoise beads in Room 330 and squared tesserae from mosaics, but not a single turquoise pendant.

A shell necklace and paired eardrops (U.S.N.M. Nos. 336033-336034) had been left on the chest of Skeleton 23, a 25- to 28-year-old male interred below floor level. Paired pendants or eardrops were found near Skeleton 1, a child, and a pair of *Haliotis* disks 2½ inches in diameter lay beside Skeleton 22, another male. These and other ornaments from Room 330 are described and figured in chapter III.

Near Skeleton 2, that of a child 8 to 10 years old, was the fragment of what looked like a cedar-bark potrest. Remnants of some sort of fiber mat were noted under a detached skull, No. 3; Skeleton 16, an adolescent male, rested on a bulrush mat spread upon the child's tomb in the northwest corner. Scraps of rush and cedar-bark (?) matting, cotton fabrics, baskets, and at least two willow mats were observed among the disordered remains. Fortunately, the one basket we were successful in saving is the painted example described on page 306.

Seventeen dead ruthlessly overturned! By whom and for what reason?

If we add the Room 330 figures to those from Rooms 320, 326, and 329, we learn that of 68 interments 46, or 67.6 percent, had been violated. One of the 46, No. 11 in Room 326, might have been the

victim of a later burial party but it is the only one to which that possible explanation would apply. Of the other 45 bodies most had been dragged from their burial mats before decomposition was complete. Articulated limbs, a torso here and there, skulls with part of the cervical vertebrae attached, all provide seemingly convincing evidence the general confusion in these four rooms was caused by irreverent hands. Lack of turquoise ornaments and, indeed, the paucity of ornaments of any kind, suggest a motivating reason for the vandalism.

As representatives of Bonito's prehistoric population these 68 skeletons contribute very little to knowledge. One gathers nothing statistically from them. They are too few. Their physical differences are not of racial import. Nineteen are of children, sex undetermined. Thirteen are males, and two others probably male. Thirty-two, possibly 33, are female.

If we had several hundred skeletons for examination and this same preponderance of females held true the figures would have significance. In his study of Pecos skeletons, for example, Hooton (1930) counted 140.8 males per hundred females. Few of either sex survived age 55. Arthritis was prevalent among Pecos adults; *Osteoporosis symmetrica* occurred frequently in children. Hooton estimates nearly 50,000 deaths during the 10 centuries Pecos was inhabited.

These dead were buried everywhere about Pecos—"under the floors, under the walls, in the plaza, and in the terraces"—but most often in the rubbish heaps. Flexed or partially flexed burials predominated in the early periods of occupation; extended burials, in the later periods.

In contrast, the prescribed burial position at Pueblo Bonito appears to have been on the back, full length and head east. Of the 22 undisturbed skeletons in the Society's four burial rooms, at least 15 occupied this position. One other, the 12-year-old child in Room 329, had been interred with head to the west. My notes on three younger children here are unfortunately incomplete but one of them was buried with head south.

Only 3 of the 22 were flexed and then but partially. One of these is the young woman who died on her sleeping mat in the southeast corner of Room 326. The fact that at least 17 of our undisturbed skeletons faced west in death suggests the probability of a local taboo against doing so in life. The Hopi give no thought to bed orientation but at Zuñi, Acoma, and Laguna, among others, sleeping with head to the east would be fatal since it is the recognized position for burial (Parsons, 1939, p. 99).

For a people habitually barefoot, size of foot is no criterion of stature or robustness but, merely as an item of passing interest, we may note that a right footprint in the adobe floor of Room 244 measures $8\frac{1}{2}$ inches long by $3\frac{3}{4}$ inches across the ball. A like print on an earlier pavement, 38 inches below latest floor level in Room 288, is reproduced on plate 100, upper.

Infant burials.—In the debris of occupation filling Room 287, a late nondescript structure on the east side of the East Court, and about 4 feet above the floor, we encountered the skeleton of a small child (field No. 923).

An oval fireplace, 25 inches long by 14 inches wide and 9 inches deep, was situated at the base of the northeast wall in Room 290, a late third-type dwelling partly overhanging Kiva L. In that fireplace, face down with head to the northwest and lower legs doubled back over the thighs, lay the skeleton of a child less than a year old (pl. 100, lower). Wood ashes surrounded the remains and covered them to floor level. The fact that this covering was later burned proves the place continued in use as the family hearth, at least for a time.

The body of a very young infant (field No. 1202) in a 14 by 9 by 5-inch deep excavation against the south wall of Room 306 had been covered with sticks and floored over. Three macaws likewise had been buried in holes dug in the adobe floor of this Old Bonitian house.

Rooms 308 and 309 are of second-type stonework and were built against the outer south wall of 306-307, of first-type construction. Special features suggest that all four, and especially Room 309, were set aside for ceremonial rites of some sort.

A block of plastered masonry, with a cruder, unplastered extension, screens off the southwest corner of Room 309 and thus forms a triangular alcove whose floor is 2 inches above that of the room proper. On this raised portion behind the screen lay the remains of a macaw and a very small child (field No. 1258). The character of its debris-of-occupation fill identifies Room 309, like 307, next on the north, as a Late Bonitian dump.

Pepper (1920, pp. 210, 264) reports a child's skull in Room 53 and the skeleton of a child beneath the floor of Room 79.

Intramural burial of stillborn infants and very small children is an old Anasazi custom and one still practiced in several Pueblo villages (Parsons, 1939, p. 71).

Miscellaneous human remains.—Single teeth were found in Rooms 226 and 227-I, and in Kiva L; part of a femur was found in Kiva V and an adolescent pelvis was unearthed during trenching operations in

the southeast quarter of the West Court. From the dominantly Late Bonitian rubbish in Old Bonitian Room 325, and about 3 feet above the floor, we recovered a lone cranium (field No. 1874).

Pepper (1920, p. 223) noted fragments of a skull, mandible, and other bones, many of them charred, in the debris fill of Room 61, and from Room 80 fragments of burned human bones that appear to have fallen from an upper story (ibid., p. 267).

HYDE EXPEDITION BURIAL ROOMS

Pepper (1909, 1920) has recounted his observations in burial rooms 32 and 33, two ground-floor, Old Bonitian structures in the crowded northwest section of the pueblo. His published field notes are often confusing and sometimes contradictory, but a little winnowing and regrouping of the data presented gives what seems to be a fairly understandable picture of conditions in the two chambers.

Room 32 has three doors connecting, in turn, with Rooms 53 on the north, 33 on the west, and 28 on the south. The three sills are at the same general level, about a foot above the floor; the ceiling beams, 4 feet higher (Pepper, 1920, p. 163). When Pepper forced an entrance through the sealed south door he encountered "a wall of drifted sand" (ibid., p. 129). This had filtered in on the east side until it reached nearly to the ceiling; opposite, the deposit was about 3 feet deep, to judge from the discoloration on the north jamb of the west door (ibid., p. 141, fig. 52).

Troweling through this sand accumulation, Pepper came upon 33 pieces of pottery, a metate, at least one basket, and various lesser objects. For the most part these were distributed without plan and from a few inches to as much as 2 feet above the floor. Some vessels stood upright; others lay on the side or even bottom up. Three rested on the floor between the south door and the southwest corner. An appreciable number, however, are reported from doorsill level, that is, approximately 12 inches above the floor. At this height and near the south wall were two nested bowls and, a few inches away, three more, likewise nested.

Leaning against the wall in the northwest corner were two or three bundles of arrows (including 81 with chipped points attached), an elk-antler club, and about 375 ceremonial staves. Of these latter the longest reported measured 3 feet $8\frac{3}{4}$ inches. Since the sand at this point was not over 3 feet 9 inches deep (lintel height of the west door) and since some of the staves "protruded over a foot above the surface"

(ibid., p. 129), it is patent that from 8 to 12 inches of sand had gathered here before the staves, arrows, and war club were stored.

Six inches above the west doorsill Pepper found portions of a human skeleton "mixed with fragments of wooden implements and other objects" (ibid., p. 134). It is a fact pertinent to our study that 18 inches of sand should have sifted down into this dark interior room before the burial occurred. And it is also of interest to note that, as it accumulated, this sand gradually covered all but one of the 33 pottery vessels left here from time to time, presumably for safekeeping. Remnants of a woven garment trailed from the incomplete skeleton through the west door.

Room 33 adjoins 32 on the west and is connected with it by an open door. On the east side of that door sand had collected to a depth of approximately 3 feet. In Room 33 the accumulation was somewhat less (ibid., p. 163), perhaps 30 inches. Here, in a space but little more than 6 feet square, in approximately 100 cubic feet of sand, 12 dead had been interred.

Not many years after burial, the 12 bodies were dragged from their graves. When Pepper happened upon them none was intact although he describes three as partly articulated (Pepper, 1909, pp. 210-221). Only four skulls were in position; only three mandibles are mentioned as accompanying the skull. Beneath the floor, however, were two additional skeletons, undisturbed and still lavishly bedecked with personal ornaments. They lay full length on the back, apparently, and head to the north.

With Skeleton 13 were 10 turquoise pendants and 5,890 beads. There were 698 pendants and over 9,000 turquoise beads with Skeleton 14 and, in addition, numerous tesserae, shell ornaments, and other objects. These two subfloor burials, more than all others combined, have since come to symbolize the wealth of Pueblo Bonito.

But turquoise treasure was also found above floor level in Room 33. Many beads and pendants were recovered from the narrow space behind beam-supporting posts in three corners. From these same cramped corners Pepper removed eight remarkable wooden flageolets and 22 of the 39 ceremonial staves he reports. A diversity of objects, including 27 earthenware vessels, came from the middle of the room but "it was impossible to determine with which skeletons the various pieces had been buried" (ibid., p. 210).

Pepper (ibid., pp. 209-210) attributes this disorder to rainwater flooding through the open east door and swirling about. The evidence, it seems to me, points rather to another hostile raiding party. This,

despite the 503 turquoise pendants "found with the bodies" (p. 240) above the plank floor. Driven by haste, grave robbers conceivably might have overlooked these jewels, but it requires an even greater stretch of the imagination to believe that rainwater, draining from one or more neighboring rooftops, could have poured into Room 33 with such force as to dislodge, in succession, 12 human bodies buried in a foot or two of sand. Roof drainage there was, of course, but the amount at any one time sufficed merely to stratify the sand grains as water collected momentarily in depressions favorably situated. Such, at least, was our interpretation of the evidence in rooms we cleared. Whatever its total volume, the rainwater percolating through the sand in Room 33 did not cause decay of all the fabrics, wooden flageolets, mosaic-encrusted baskets, and other perishable objects deposited there.

Room 53 is "one of the two rooms explored by the Moorehead party" in the spring of 1897 (Pepper, 1920, p. 210). A few weeks later, when Pepper arrived for his first full season at Pueblo Bonito, he found a headless skeleton at the south end of Room 53 and, near the middle east wall, the skull of a child. These may represent two burials or one only. No data are given as to depth of interment. Because a choice turquoise necklace lay near the child's skull, it is possible that this room had not been disturbed prior to the year mentioned. Because fragments of feather-cord blankets and the endboards of two cradles are listed among the objects recovered, it is assumed the inflow of rainwater had caused little, if any, damage in this instance.

Room 56, adjoining 53 on the west, was also excavated before Pepper's return. Under the floor were two graves, separated by a masonry wall that is identified as part of an older building. One grave was 2 feet deep and the other, 3. Each was long enough to contain an extended adult body. The south grave, floored with sticks, was walled, and possibly covered, with hewn boards (Pepper, 1920, pp. 216-217). It was in one of these two vaults, no doubt, that Moorehead (1906, p. 34) found "a splendidly preserved skeleton of a young woman wrapped in a large feather robe."

In his description of the room, Pepper mentions scattered human bones in the northeastern and northwestern corners and intimates that more than two burials had been exhumed.

From Pepper's own description of conditions in these four rooms it seems clear that the disorder could have been caused by human agency only and not natural forces. His subfloor burials, like ours,

were intact while most of those above had been disturbed. That some rainwater trickled in from time to time is not to be questioned but that it ever attained the volume or force to wrest human heads, arms, and legs from their trunks is simply incredible.

The situation here, as in 320, 326, 329, and 330, is more readily and more logically explained, in my opinion, as the work of plunderers. If the Late Bonitians had already vacated their three-quarters of the pueblo, the defensive power of the remainder would have been proportionately weakened. Under such circumstances, a relatively small band of raiders, striking with speed and ruthlessness, could so paralyze the broken community that its store of maize, its womenfolk, and even the jewels on its shallowly buried dead might be seized at little risk.

Because these eight burial rooms all lie in the oldest section of the village we may assume their final occupants were all Old Bonitians. Because the graves were shallow and crowded it is possible, but by no means certain, all were filled within a relatively short period. That this period came late in the history of Pueblo Bonito is proven by the presence of late-type pottery among the grave furniture. Hence my conviction that these dead represent an Old Bonitian remnant that clung to its ancestral home after the Late Bonitians had migrated. Because that remnant was unable to marshal the necessary defensive strength, it paid the customary price to its enemies.

But even though this interpretation be the correct one, we are still left with the query that opened this chapter: Where did the Bonitians bury their 5,000 dead? The local cemetery is yet to be discovered. If our Late Bonitians adopted the burial practices of their hosts, as seems likely, the puzzle is all the greater. For, as I have elsewhere explained, the Old Bonitians were a Pueblo II people living in a Pueblo III age. One would naturally expect them to follow the recognized customs of their cultural level, including burial in trash piles near the dwellings. But they did not. Our trench through the West Court exposed a previously undisturbed portion of the old village dump. We found no burial there and none in cross sectioning the west refuse mound, composed of both Old and Late Bonitian rubbish.

Hewett (1921, p. 11) supposed the area about Casa Rinconada, on the south side of the canyon, to be the common burial ground for Chettro Kettle, Pueblo Bonito, and Pueblo del Arroyo, although a quarter century earlier Pepper had ascertained that burials occurring there belonged to nearby house groups (Pepper, 1920, p. 376). Our own study of small-house sites throughout the Chaco district, sites varying in age from B.M. III to P. III, show that burials were fre-



PLATE 98

Upper: A necklace of turquoise beads formed a bracelet for the left wrist of Burial 12, Room 326.

Lower: Skeleton No. 10, Room 330, lay upon a bundle of arrows, with a burial offering of arrowheads and a food bowl below his outspread knees.

(Photographs by O. C. Havens, 1924.)





PLATE 99

Upper: A confusion of human bones, earthenware vessels, stone artifacts, and debris of reconstruction appeared in the southeast corner of Room 330.

Lower: The wild disarray in the northwest corner of Room 330 could have been caused only by prehistoric grave robbers.

(Photographs by O. C. Havens, 1924.)





PLATE 100

Upper: A footprint in an adobe pavement 38 inches below the floor of Room 228. (Photograph by O. C. Havens, 1924.)

Lower: The skeleton of an infant buried in the fireplace of Room 290. (Photograph by Neil M. Judd, 1923.)



quently, but not exclusively, made in the associated refuse heaps. When we come to the major villages, however, a new custom presents itself, isolation and concealment of the community burial ground.

What is true in Chaco Canyon is equally true elsewhere throughout the Anasazi area. From Mesa Verde to Segi Canyon and back again no cemetery has yet been disclosed in connection with a major Pueblo III ruin. A few burials, yes, but not the graveyard. At Pueblo Bonito, however, this recognized P. III trait reflects a practice established by the original P. II settlement. The Late Bonitians were merely following local custom when they disposed of their dead.

If failure to locate the Pueblo Bonito cemetery has bothered me more than my predecessors it is because I have probably given more thought to the matter. Pepper had searched the two associated refuse mounds; his excavations had also proved that subfloor interment was not widely practiced here. Two other possibilities remained for consideration: A burial ground somewhat removed from the village and cremation.

Mrs. John Wetherill once related for me a Kayenta Navaho explanation that accounts both for the lack of a cemetery at Pueblo Bonito and the paucity of trees on the mesas above. The Bonitians cremated their dead, said these western Navaho who had never been in Chaco Canyon, and that is why there are very few junipers and pinyons remaining in the vicinity. Careful search, however, failed to disclose the burned spots and the fragments of calcined bones that would lend substance to this explanation.

A negative return here reflects the findings of archeologists, namely, that cremation was rarely, if ever, practiced by the Anasazis. The numerous cremated burials at Hawikuh are those of southern Indians who came to work for the Zuñi in pre-Spanish times (Hodge, 1921).

Inasmuch as some 3 feet of sand and silt had settled over the valley floor since abandonment of Pueblo Bonito, it seemed desirable at least to glance beneath this overburden. A half dozen test pits all proved barren. Therefore, unless we missed the cemetery completely, it lies more than a quarter mile from the ruin. The greedy arroyo, whose banks we examined after each summer rain, disclosed nothing of promise. We observed nothing to suggest the likelihood of burials in the talus at the base of the north cliff. Thus, with every reasonable possibility exhausted, we could only leave to the future the mystery of the missing cemetery.

Our Chaco Canyon visitors, however, were not so easily discouraged. My admission of defeat was to them a challenge. None passed the

opportunity. If their proffered solutions sometimes seemed a bit ludicrous I had only to remember my own had failed. One theorist, for example, had the dead of Pueblo Bonito floating down Chaco wash, one by one, on log rafts. Here again, as in the Navaho story, we have a single explanation that accounts both for our depleted forests and absence of a communal burial graveyard. Utterly innocent of the birch-bark canoe that carried Hiawatha on his final journey, these individual rafts floated westward down the Chaco and into the San Juan; thence, into the Colorado and Gulf of California. The alluvial fan at the mouth of the Rio Colorado is certainly one place I never thought to look for Bonitian burials.

IX. NAVAHO NOTES FROM CHACO CANYON

Chaco Canyon and its ruins are well known throughout the Navaho reservation. Many fascinating tales have been told of those ruins and the people who built them; of the canyon and its surroundings. At Kayenta, in northeastern Arizona, for example, I heard descriptions from Navaho who had seen neither canyon nor ruins. There and elsewhere interest and curiosity were awakened whenever it became known that I lived at *Tsĕ'bíya hanĭ ă'hi,* "where the cliff is braced up from beneath."

From the very beginning of our explorations we were desirous of learning what changes, if any, the "old timers" had noticed since early days in Chaco Canyon. But there were few old timers left! The Carlisle Cattle Company and the LC's, both of whom ranged thousands of cattle between Hosta Butte and the Rio San Juan in 1879 and later,[69] were gone and forgotten. The series of stone buildings under the cliff north of Peñasco Blanco, Chaco headquarters for the LC outfit, had been preempted by Old Wello before 1895. Wello is now about 80, by my calculations. (He died in December 1926.) Padilla (pl. 3, left), who lives on the opposite side of the Chaco and about a mile farther downstream, is perhaps 70 or 75. Joe Hosteen Yazi is younger but will not talk. Tomascito will talk but cannot be believed.

Superintendent S. F. Stacher, of the Crownpoint Agency, and others had urged me to seek out Hosteen Beyal who lived near the old McCoy ranch on the lower Kinbiniyol. He was described as the oldest Navaho on the eastern part of the reservation, totally blind, but possessed of an unusually keen memory. Five years passed before I succeeded in meeting Beyal and then quite by chance. He had been to a "squaw dance" out north of the Chaco; 30 miles seated on the floor of a springless wagon had wearied flesh and bones; he was glad to rest for the night on his way home.

Fatigue, a good supper, and a low fire in the crowded hogan nearly defeated my purpose. But the old man came to life again about 9 o'clock and we talked until after midnight. His son, Frank Beal, aged 38, generously acted as interpreter. Our meeting occurred October 30, 1927.

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[69] Information from John Wetherill, November 1936. He does not know when the two companies first entered the Chaco country. Both later moved to southeastern Utah. Jackson, 1878, mentions neither company nor cattle.

According to his son, Hosteen Beyal (pl. 3, right) is about 95 years old. He says he was born near The Bear's Ears, at the head of Grand Gulch in San Juan County, Utah; that when he was a boy of 9 or 10, his parents moved to Chaco Canyon and lived for a time in the valley west of Peñasco Blanco. The family had moved at least once a year, sometimes more frequently, depending upon the abundance of game and grazing.

Hosteen Beyal remembers cottonwoods and willows growing in some abundance in Chaco Canyon below Pueblo Bonito and nearer Peñasco Blanco; he recalls none immediately south of Pueblo Bonito. There were more cottonwoods in the valley west of Peñasco Blanco than in the portion above. Many yellow pines were to be seen in Mockingbird Canyon and at the head of Chaco Canyon. Beyal at first recalled only a few pines growing in Wirito's Rincon, southeast of Pueblo Bonito, but next morning (October 31) corrected himself by saying there were "quite a number" of pines in the rincon in question. Cedar and pinyon were much more plentiful in his youth than today; both varieties even occurred in the valley, at the foot of the mesas.

Beyal insists there was more rain in the Chaco country when he was a boy; that there was better grass and more wood; that the Navaho had very few livestock at that time. In his youth there was no arroyo, whatever, in that portion of Chaco Canyon above the mouth of the Escavada. Rather, the valley was covered with high grass among which were shallow basins or pools that caught rainwater and held it through most of the year. Pockets in the sandstone on top the cliffs held water longer than they do today.

According to our informant, there were no springs near Pueblo Bonito. The nearest he recalls is that now used by Dan Cly in the Rincon del Camino, a mile northwest of Pueblo Bonito. This spring is still known to the Navaho as *Tsé-ya-toh'-gi.*

A spring in a cove in the east side of Mockingbird Canyon is recalled by Beyal as still flowing a small stream in 1907. Frank Beal added that he, too, remembered this spring. It has now been dry for some years.

At the north foot of the Peñasco Blanco mesa, where Old Wello lived, is *Toh'-el-ah',* apparently the most famous spring in this section during Beyal's youth. The spring is only a small one today. Beyal says a fine series of pecked steps formerly led to this spring from Peñasco Blanco (*Talla-kin*) but that they caved off several years ago.

The Navaho name for Meyers Canyon, on the north side of the Chaco a few miles below the Escavada, is *Teés-e-chiń,* "many cottonwoods." Beyal's statement that numerous cottonwoods grew in

Meyers Canyon during his youth is confirmed by Padilla who adds that wild roses were also abundant although they have since been wiped out by Navaho who used the bushes for medicine.

Beyal remembers having seen on top of the north Chaco cliff many places where the Chacoans quarried laminate sandstone, a stone that impressed our informant very much. He described at some length its superior qualities, its fine grain, its thinness and even cleavage. He says none of this stone remains today, the old people used it all. The skill of the Chacoans as masons is what Hosteen Beyal remembers most vividly about the ruins. He says no one today could build walls like those; that we have not the patience now to use such small stones; that we are in too much of a hurry today and use large blocks that do not look so well or last so long.

The old man describes Peñasco Blanco as having been in very good condition when he first saw it. The ruin was then three stories high and most of its rooms were still roofed. Many of the rooms were in excellent shape, with hair brushes hanging from the walls and squash blossoms (not squash stems), strung on yucca cord, suspended like chilis from the walls. Sticks used for stirring mush had been stuck in wall joints; pots and bowls still stood upon the floors. The general appearance was that the inhabitants had but recently disappeared. Old Wello and other Navahos excavated a number of rooms at Peñasco Blanco while in the employ of Richard Wetherill; a white man, not named, was in charge of the work. Our informant states that these diggers found two boxes of turquoise, and indicated a wooden carton for two dozen No. 2 cans of peaches as the size of the boxes. (Other informants on other occasions were doubtless more nearly correct in describing the finds as two cigar boxes full.)

When questioned with particular reference to the early condition of Pueblo Bonito, Beyal replied that his parents had warned him that a large snake lived inside the ruin and that, in consequence, he was never to enter it. He had looked around the outside but would give no detailed information. His recollection of the details of construction under the braced-up cliff is correct except that he remembers the props as of oak, not pine.

The Navaho know a lot about the ruins as they stand today but nothing at all of the people who built them. These latter had gone long before the Navaho came.

A ditch for the conveyance of water led from the head of Chaco Canyon, according to our informant, along the south side of the valley past Pueblo Bonito. There was a smaller ditch along the south side of

the Escavada, another near Kinbiniyol, yet another back of Kin-yai, near Crownpoint.

When asked about the so-called "roads" on both the north and south cliffs, Beyal remarked that they were not really roads, although they looked like them. He says they were built by the Chaco people. One road led from Pueblo Pintado to Pueblo Bonito and on to Peñasco Blanco. Another led from Pueblo Bonito to Kin-yai; a third, from Kinbiniyol to Kin-yai; still another, from Kinbiniyol to, or through, Coyote Canyon and on to a point near Fort Defiance. On each of these "roads" one could see, until recently, cuts where the road passed through small hills.

In his youth, according to Beyal, the Navaho had very few sheep and horses. They were not as well off as they are today. For example, when his parents moved to Chaco Canyon they had no more than half a dozen sheep. Beyal remembers because he and a younger sister drove them all the way from Elk Mountain. There were many antelope and deer in the Chaco country at that time; as they changed grazing ground, the Navaho followed. Besides game, the Navaho depended upon the seeds of diverse grasses and weeds; they often had very little to eat.

Beyal said there were formerly moose and reindeer in the Black Mountains to the westward and in the mountains near Gallup. He himself had never seen them but other people had told him of them. He described the various animals, their characteristics and methods of locomotion, so accurately I suspect, in this instance at least, he unconsciously introduced into his narrative geography lessons learned from grandchildren, home from school.

The old man was tired and wanted to sleep. When I remarked that southeastern Utah was generally considered Ute country, Beyal replied that the Utes and Navaho were friends when his parents lived near The Bear's Ears; they lived together like brothers. Later, after the family moved to the Chaco country, the two tribes became enemies.[70] They fought each other and stole each other's children and women, selling the captives to Mexicans. Beyal says the Utes burned the old ruins in the belief Navaho were hiding in them. He insists with some emphasis that the Mexicans never fought the Navaho in the Chaco country; they came here to trade, bringing goods on pack horses

[70] Describing his trip down Montezuma Canyon from the Abajo Mountains in 1875, Jackson (1878, p. 428) says the Navaho Indians ". . . occupied all this country up to within a short time, within the remembrance of the older persons, and who were driven beyond the San Juan by the onslaughts of the aggressive Utes."

and in mule-drawn carts. These carts had wheels made of boards and bodies of upright sticks. The trouble between the Mexicans and Navahos started, according to Hosteen Beyal, when four Mexican traders, watering their horses near a hogan, were playfully attacked by several Navahos. These latter were bad Indians, according to our informant; they braided their hair and dressed like Utes with the intention merely of frightening the Mexicans. During the prank one of the traders was accidentally killed. The others escaped and carried word of the attack. The Navaho-Mexican war resulted.

Gentle, kindly Padilla was pressed with questions when Hosteen Beyal wearied of them. Frank Beal, again volunteering as interpreter, guessed Padilla's age as 68 or 70—about five years less than my own guess of 3 years before. Padilla was not an uninhibited informant; he confirmed many of Beyal's recollections but gave a bare minimum in addition. He said there was more rain throughout the Chaco country when he was a young man, less wind and fewer sandstorms. Grass was abundant, the entire valley was greener than today. Opposite Pueblo Bonito the arroyo was about 5 feet deep, as Padilla remembers it from boyhood. (Assuming an age of 70, he would have been 20 years old in 1877 when Jackson measured the arroyo depth at 16 feet.) The change in the topography of the canyon, according to Padilla, has been brought about because so many men live crooked lives today. They steal and drink whiskey and fail to follow the advice of the older men. Of recent years, each summer has witnessed the death by lightning of one or more Navahos; each summer, some Indian's horses are killed by lightning. Lightning never killed men or horses during his youth, according to Padilla.

When asked concerning the "roads" mentioned by Hosteen Beyal as having been made and used by the ancient Chacoans, Padilla said he has seen very few of them because they have been washed out or covered over by sand and silt. Their locations are indicated, however, by cuts through low knolls. As one rides across country, one notices a succession of these cuts.

He says he has heard of many ancient ditches in the upper Chaco but has never seen them. Ditches are still present, however, on the south side of Escavada valley, from Pueblo Pintado westward. Slab-lined ditches are still visible in Chaco Canyon just below his hogan or approximately 1 mile below the mouth of Escavada Wash. (Through sheer carelessness I never investigated this latter report. Padilla's hogan stood on the north side of the Chaco and I suspect the slab-lined ditches to which he refers are on the south side and a continuation of the one which formerly rounded the point below Peñasco

Blanco and continued thence to the westward, partially concealed by current sand dunes in Wello's cornfield, and on downvalley.)

North of Padilla's hogan is a small rincon called *Dé-chel'-ha-lon* (wild cherry). In this rincon Padilla tried to develop a small seep some years ago. He failed to get enough water, but found a number of turquoise beads while clearing away the sand. Two years ago there was a shallow pool, perhaps 2 feet across.

Under the red cliff west of Peñasco Blanco, where a large sand dune now spreads, Padilla remembers several cottonwood trees as growing during his early manhood. No surface water was visible at the place.

An unnamed spring at the foot of a large cedar tree, in a south rincon of Escavada valley, west of the present Pueblo Bonito-Farmington road, was formerly well known but has been dry these many years. This spring bubbled forth and each day brought to the surface a small turquoise bead or fragment of matrix. But someone felled the cedar and shortly afterward the spring went dry. Padilla never saw the spring actually flowing but remembers the cedar stump as pointed out by his grandfather, who told him the story. (Hosteen Beyal called from his blanket at this moment to say he had heard the same tale during his residence in Chaco Canyon.)

Three years earlier, on August 27, 1924, Padilla had been more communicative. Or perhaps he felt too deeply obligated. In 1923 his daughter, a well educated young woman with two small children, had died while on a visit to her father's hogan and Padilla had come, with tears in his eyes, to beg that I bury her in the little white cemetery at Pueblo Bonito. He didn't want her "buried in the rocks like a Navaho." In any case, on the afternoon of August 27, 1924, we sat down under the awning in front of my tent prepared to talk of many things. I guessed his age at about 75.

When our conversation finally led to the appearance of Chaco Canyon as he first remembered it, Padilla hesitated and said he could not talk of such things except in winter. He might be struck by lightning or be bitten by a snake.

When he was about 35 years old, Padilla said, cottonwoods grew along the middle of the valley in front of Pueblo Bonito. He recalls no willows but other old Navaho do. At that time the arroyo was about 5 feet deep. Cedar and pinyon then grew sparsely on both the north and south mesas but the Navaho have since cut most of them for hogans. He remembers no pines except those now growing in the gorge of the upper Chaco, 10 or 12 miles east of Pueblo Bonito. He recalls no living spring, or evidence of one, except that developed and still utilized by Dan Cly in Rincon del Camino. There was a small seep,

about like Dan's, at the head of the rincon near Rafael's hogan (a mile west of Pueblo Bonito, on the south side).

Every fall, with the first cold weather, deer and antelope came down from the north, perhaps from Mesa Verde. There was more grass in the Chaco country at that time and more rainfall. Since white men moved in, the rains have become less and less year after year.

Unlike other elders with whom I had talked, Padilla insists the ancient people had gone long before the Navaho came to Chaco Canyon. Many stories are told about the Anasazi, however, and the medicine men know a great deal. Some people believe the Bonitians moved south but he, himself, doesn't know where they went.

On the afternoon of October 3, 1925, while we were busily packing away our equipment at season's end, Padilla rode up to say goodby. As we were talking our own blend of English, Spanish, and Navaho, Old Wello happened past and was invited to stop for a last cigarette. One of our Navaho workmen was called in to serve as interpreter.

An autumn chill was in the air and our conversation naturally led to game animals and hunting. Padilla admitted he was never much of a hunter but Wello was. Every fall "about this time of year," lots of antelope and deer moved into the Chaco country. Wello was a great hunter; he went hunting every day. And Old Wello nodded and smiled in happy confirmation.

At that time there was lots of grass everywhere; it rained more often. There were more trees of all kinds. Cottonwoods and willows were growing throughout Chaco Canyon, down the middle. There was no arroyo. You could dig anywhere and find water in a couple of feet. And Old Wello interrupted to say "the whole country has gone to pot since white men came."

Padilla remembers no yellow pine in Chaco Canyon but says Mexican sheep herders burned many pine stumps on the bordering mesas. He does not know who cut those trees. There used to be three pines west of Peñasco Blanco and one of them, just beyond Tsaya (on the north side of the Chaco below Escavada Wash) stood about 10 feet high 15 years ago. It has since died because Navaho cut off the bark for medicine.

A long time ago several small pines were growing on the mesa at the head of Wirito's Rincon (1½ miles southeast of Pueblo Bonito). There, too, three stumps marked pines cut by Wello to roof his house. (Wello says he cut only two of the three.) This must have been 30 or 40 years ago, reasons Padilla, because Wello brought from Fort Defiance the first steel ax, wagon, and scraper owned locally. In old

times the Navaho had no axes except Anasazi stone axes which were used whenever they could find one.

Many Navaho believe the Bonitians had a turquoise mine concealed by a rockfall, near Dan's hogan in Rincon del Camino. Padilla doubts this because all the rock thereabout is sandstone and turquoise does not come in sandstone.

The Utes used to come down and fight the Navaho in Chaco Canyon. Perhaps the Utes burned Pueblo Bonito. Navaho and Mexicans fought here too. The old men remember when American and Mexican soldiers went through the Chaco country to fight the Navaho at Canyon de Chelly (see Simpson, 1850).

On the west side of Peñasco Blanco, high up on the cliff, there was a fine spring many years ago. It flowed a good stream and every day a piece of turquoise came out. In those times it rained more in Chaco Canyon. The Navaho tell a story of a big pond at the mouth of Escavada Wash and everyone was afraid of it. Something in the water pulled you in if you got too close.

As for irrigation ditches, Padilla remembers best the one just below Wello's place. It was lined with slabstones and began at a rock dam on the west side of the Chaco a little above where Escavada Wash comes in. The dam washed out about 15 years ago but the ditch is still there, or part of it, under the sand in Wello's cornfield. (At or near the dam site, a single ditch slab still remained in place when I first passed by, July 20, 1920.)

Another ditch is to be seen near Joe Hosteen Yazi's hogan on the south side of Escavada Wash just east of the Farmington road. Our interpreter added a personal observation to the effect that this ditch is 6 miles long. Padilla says it was well marked when he was a youth but is largely filled with blown sand at present. In addition there is a small ditch on the east side of the rincon back of Rafael's hogan.

Beyond Tomascito's place, at the south end of The Gap, is a cut that some Navaho call a canal but it looks more like a wagon road to our informant. (It is, in fact, part of a "ceremonial highway," a type of construction to be described in a future publication.)

Pepper (1920, pp. 25-26) tells of an elderly Navaho who visited the Hyde Expedition camp in 1896 and remarked that his ancestors had been in touch with the Chaco people; that the latter had cultivated all the land in the canyon, from wall to wall, relying upon rainwater both for farming and for domestic use. There were no irrigation ditches at that time and no arroyo. The big pine beams in the ruins came from the side canyons, the rincons, and were hauled to the pueblos on little wagons whose wheels were cross sections of other logs. The Navaho,

according to this elder, believe the Chacoans left the country on account of water shortage. Pueblo Alto was the "chief's house," richest in the region, and here the ancestral Navaho were accustomed to barter game for corn and other produce.

This fiction of a "chief's house" is dominant in Navaho stories of Chaco Canyon. The myth of Noqoìlpi, the Gambler, is that most frequently told. Pueblo Alto is usually, Bonito sometimes, identified as his place of residence. The story has numerous variations but, in essence, recites the succession of events by which our legendary hero gradually won the possessions and then the population at each village. In most versions, Noqoìlpi comes from one of the southern pueblos—Zuñi, Acoma, or Laguna—and is an independent worker. However, in that recited by an old Navaho at Kin-yai, near Crownpoint, the Gambler had as wife a Jemez woman who always dressed in white. She conspired against Noqoìlpi secretly and, following his downfall, returned in triumph to Jemez. In a Kayenta variant reported by Lulu Wade Wetherill and Byron Cummings (1922), the inhabitants of the Chaco towns are recognized as ancestors of the Salt clan of the Navaho.

Two versions of the Noqoìlpi myth heard at our Pueblo Bonito camp are briefed here for their contrast as much as for the story itself. The first was told by old Hosteen Beyal on the night of October 30, 1927, with his son, Frank Beal, again translating. The story, Beyal says, is as he learned it from his grandfather. It was considerably abbreviated in translation and has been further shortened for our present purpose.

Noqoìlpi lived in Pueblo Alto on the cliff north of Pueblo Bonito. He was head man over all the other pueblo villages in this vicinity and was a great gambler. In rude watchtowers placed at intervals along the canyon rim, watchmen were stationed night and day. When strangers were seen approaching, these watchmen passed word from one to the other and thence to Noqoìlpi who immediately made preparations for gambling.

The people who lived in the several towns had come from all directions; they belonged to different tribes and spoke different languages. They had arrived at Chaco Canyon singly or in groups; Noqoìlpi had gambled with them, won all their possessions and finally their very lives. Thus, he forced them to remain and work for him as slaves.

Noqoìlpi was a master gambler. He played nine different games: (1) The basket game, in which six dice, white on one side and black on the other, were used. When the dice all fell white side up, the thrower won. (2) The post-pushing game, an exhibition of strength

in which the player sought to push over a post set upright in the ground. (3) The ring game; (4) a card game; (5) shinny; (6) broad jump; (7) a foot race; (8) stick dice; and (9) a foot race in which a stick was kicked by each runner.

One day an old woman, a Navaho, came from the north (from a place somewhere near "Shorty" Widow's store, about 11 miles north of Pueblo Bonito). The Bonitians would not take her in. They gave her no place to sleep; nothing to eat except scraps left from their own meals. They gave her nothing to wear, so she went about naked except for a short grass apron. They gave her no ornaments except a few turquoise and bone beads; no necklaces, bracelets or rings. The small boys of the village made fun of the old woman, following her around and throwing stones and otherwise annoying her.

Subjected to daily treatment of this sort, the old woman grew angry after a time. She climbed the steps to the north cliff and from that elevation shouted to the Bonitians below a detailed account of the indignities that had been heaped upon her. She reminded them of their failure to give her a bed, food to eat, clothes or ornaments to wear; she enumerated all the indignities of the boys and said that now, as she was leaving the village, she would give the people a lesson they would not forget, so when other strangers came among them they would be more considerate. Then she took the turquoise and bone beads the Bonitians had given her and threw them on the cliff. This caused the cliff to break open, and a large portion started to fall upon the village. (If Beyal told, the translator did not relate, why the cliff failed completely to fall and this point was unintentionally overlooked when the story was reviewed next morning. The blind old man knows with surprising accuracy the detailed construction under the braced-up cliff.)

Two years after her departure from Pueblo Bonito, the old woman gave birth to a baby boy. When old enough to talk, the boy asked who his father was. The old woman said she did not know, but the boy persisted until the old woman pointed to a prickly pear cactus and said "Maybe that is your father." One of the old men made a bow and some arrows for the boy and taught him to hunt. He became a great hunter and a great favorite in the village.

One day the boy ran away from home and his mother looked for him several days. Of each one he met, the boy inquired as to the identity of his father. Finally a man said, "I am your father." This man tried four different times to kill him and failed each time. Then the man said, "Since I cannot kill you, you must be my son."

When he was 4 years old, the boy told his mother that he was going down to the big village to kill Noqoìlpi. But his mother told him not

to do this since Noqoìlpi was his brother and he should not kill him. But in secret the boy learned all kinds of gambling games and one day, taking a young woman from each of the 12 tribal clans, he set forth for the village of Noqoìlpi. The boy caused strong winds to blow, causing sandstorms so dense he and his 12 companions passed the sentinels unseen and thus surprised Noqoìlpi before the latter had time to prepare for gambling.

Noqoìlpi asked the boy what he wanted and the boy said he wanted to gamble. But Noqoìlpi said he never gambled with children. Four times the boy asked Noqoìlpi to play the basket game, but each time Noqoìlpi refused. Then he said he would play and four times the boy asked him to begin. After Noqoìlpi refused four times to start, the play began. The boy wagered the 12 young women against 12 men selected by Noqoìlpi. After they had played for a time, the six dice all fell white side up and the boy won the 12 men. Then Noqoìlpi said: "Let us play a different game."

The boy wagered the 12 young women and the 12 men he had won, against 12 men and 12 women Noqoìlpi chose from his people. Again the boy won, and again Noqoìlpi said: "Let us play a different game." So they played 12 different times, each time doubling the amount of their wager until the boy won all the people controlled by Noqoìlpi. (Beyal could not explain the fact that although Noqoìlpi had only 9, he and the boy played 12 different games.)

After the boy had won all the people, Noqoìlpi rose like a bird and disappeared into the sky, never to be seen again. The boy gave the people their freedom and they were all happy to be free again and scattered to the four directions, whence they came.

My old friend, Padilla, who had heard Hosteen Beyal's rendition, volunteered his own version three days later. A neighbor from Crownpoint, James E. Matchin, kindly interpreted for us. Padilla learned the story from his uncle, Manuelito, the famous chief. It differs from Beyal's recital, Padilla says, only in details; actually the two tales are the same. Manuelito may have been no more of a moralizer than the average uncle but, as his version of the story was recounted for us, it is the Gambler that always loses. When the various tribes came to play games with him, one by one they stripped him of all his possessions and even his clothes.

All the various tribes, including the Navaho, the Mescalero-Apache, the Utes, and the Laguna, came to play with Noqoìlpi. Each tribe played in succession; in a single day they won all his possessions and all his money. Of the nine games played at that time, the Navaho received five, the other four going to the remaining tribes. Padilla does

not remember the other four games but describes those inherited by the Navaho as:

1. Foot race (a straight race in which no kicked stick was used).
2. The stick game (two marked sticks bounced from a rock).
3. Shinny, in which a crooked stick and a buckskin or rawhide ball 3 to 4 inches in diameter are used.
4. The basket game (seven or nine wooden dice colored red, black, or white, are thrown from, and caught in, a basket. The game is played by two men, each of whom, in turn, calls the number of dice of a certain color he expects to fall.)
5. Pole and ring game. (As played by the Navaho, the ring is of rawhide, wrapped with buckskin; the pole, about 8 feet long, consists of two 5-foot pieces bound together. Two pendent cords, each with five tassels, hang from the middle of each pole. Two players, each with his own pole, use a single ring. The disk is rolled forward and the poles are thrown after it. The winner is he whose pole falls under the ring; the count is the same should the disk fall on any of the pendent strings. Padilla supposes Noqoìlpi used a ring made entirely of buckskin or rawhide.)

According to Padilla, the Gambler lost his last possession with the pole and ring game. Thereafter he returned naked to his father, the Sun. On the other hand, in one of the variants recorded at Kayenta by Mrs. John Wetherill (personal communication), having lost, Noqoìlpi was banished to *Tiz-na-zinde,* "where the cranes stand up" (referring to birds pictured on the rocks 18 miles west of Pueblo Bonito), died and was buried there.

Because Pueblo Alto is today commonly pointed out as the home of the Gambler, it is of interest to note that in 1877, when Jackson asked his Jemez guide the name of the ruin, old Hosta replied that it was called El Capitan or El Jugador (Jackson, 1878, p. 447). Hosta, be it remembered, was one of the guides for Colonel Washington's military reconnaissance in 1848.

From these several versions of the Noqoìlpi tale, it is obvious a good deal of the narrator goes into each rendering. And it seems equally certain, after listening to various reminiscences of boyhood days in Chaco Canyon, that the average Navaho memory is no more reliable than memories elsewhere.

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APPENDIX A

SIZE AND PROVENIENCE OF OBJECTS ILLUSTRATED

PLATES

Plate	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
9, C	$4\frac{1}{2} \times 3\frac{1}{8}$	11.4 x 7.9	$2\frac{5}{8}$	6.6	249	350	336487
10, B	25 x $35\frac{1}{2}$	63.5 x 90.1			320	1415	335287
11, *a*	$2\frac{5}{8}-4\frac{7}{8}$	6.6—12.3			250	327	335332
b	$12\frac{1}{2} \times 6\frac{1}{2}$	31.7 x 16.5			235	240	335334
c	$8 \times 7\frac{1}{2}$	20.3 x 19.0			330	1917	335289
d	$3\frac{3}{4} \times 2\frac{3}{4}$	9.5 x 6.9			320 (Skel. 2)	1408	335312
e	$5\frac{3}{4} \times 3\frac{3}{4}$	14.6 x 9.5			300B	1079	335337
f	$9 \times 3\frac{1}{2}$	22.8 x 8.8			320B	1441	335338
g	$4\frac{1}{2} \times 2\frac{1}{4}$	11.4 x 5.7			246	358	335335
h	6×3	15.2 x 7.6			320B	1441	335338
i	$4 \times 1\frac{1}{2}$	10.1 x 3.8			246	358	335335
16, *a*, *a'*	$2\frac{1}{2} \times 2$	6.3 x 5.0			226	458	335333
b, *b'*	$2\frac{3}{4} \times 2\frac{7}{8}$	6.9 x 7.3			226	458	335333
c, *c'*	$3\frac{1}{4} \times 2\frac{1}{2}$	8.2 x 6.3			246	358	335335
17	$10 \times 4\frac{1}{4}$	25.4 x 10.7			298	1114	335354
18	$5\frac{1}{2} \times 3\frac{5}{8}$	13.9 x 9.2			246	357	335350
19, *a*[1]	14	35.6			320	1418	NGS[2]
21, *a*	$11\frac{1}{2}$	29.2			298	1135	335671
b	22	55.8			330 (Skel. 23)	2083	336033
c	$7\frac{1}{4}$	18.4			298	1139	335675
d	$12\frac{3}{4}$	32.3			298	1138	335674
e	10	25.4			298	1141	335677
f	$20\frac{1}{2}$	52.0			298	1142	335678
g	$9\frac{1}{4}$	23.4			298	1143	335679
22, *a*[3]	$\frac{13}{16}$ (D) x $\frac{7}{16}$	2.0 x 1.1			330	1863	335761
b	$\frac{13}{16}$ (D) x $\frac{1}{2}$	2.0 x 1.2			330	1864	335762
c	$\frac{3}{4}$ (D) x $\frac{11}{16}$	1.9 x 1.7			330	1865	335763
d	$\frac{3}{4}$ (D) x $\frac{13}{16}$	1.9 x 2.0			Kiva 2-D	2359	335764
e	$7\frac{1}{2}$	19.0			326 (Skel. 12)	1602	335728
f	$1\frac{1}{4} \times 1\frac{1}{16}$	3.1 x 2.6			326 (Skel. 8)	1544	335743
g	$\frac{15}{16}$	2.3			326 (Skel. 12)	1603	335744
h	1	2.5			326 (Skel. 9)	1698	335744
i	1	2.5			326	1695	335745
j	1	2.5			326	1696	335746
k	$\frac{13}{16}$	2.0			326	1697	335747

[1] Necklace.
[2] NGS in last column signifies placement in Explorers Hall, National Geographic Society, Washington, D. C.
[3] *a-h*, specimens shown on plate left to right, top to bottom; *i*, *j*, *k*, three pairs of matched pendants at bottom of plate.

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
24, a[4]	2 11/16 x 2 1/4	6.8 x 5.7	1 5/8	4.1	288	910	335849
b	3 x 2 1/2	7.6 x 6.3	1 13/16	4.6	245	345	335851
c	2 11/16 x 2 1/4	6.8 x 5.7	1 7/8	4.7	257	637	335853
d	2 3/4 x 2 3/8	6.9 x 6.0	1 7/8	4.7	325	1541	335854
e	2 15/16 x 2 3/4	7.4 x 6.9	2 3/8	6.0	325	1541	335854
f	2 3/4 x 2	6.9 x 5.0	1 1/2	3.8	325	1541	335854
g	4 1/2 (D)	11.4	5/16	0.7	226	382	335781
h	3 3/4 (D)	9.5	5/16	0.7	267	804	335790
i	4 (D)	10.1	1/4	0.6	226	821	335786
j	3 3/4 (D)	9.5	1/4	0.6	267	804	335790
k	3 (D)	7.6	1/8	0.3	256	583	335784
l	4 x 2 1/8	10.1 x 5.3	2	5.0	Misc.	201	335855
m	4 3/8 x 3	11.1 x 7.6	2 1/8	5.3	W. Ct.	2173	335856
n	3 x 2	7.6 x 5.0	1 5/8	4.1	Debris W. of 49 P. del A.	A-591	334870
o	2 11/16 x 1 3/4	6.8 x 4.4	1 3/4	4.4	304	1167	335859
p	4 1/8 x 2 1/4	10.4 x 5.7	1 3/4	4.4	306	1213	335860
q	2 15/16 x 2 1/2	7.4 x 6.3	1 3/4	4.4	304	1167	335859
25, *a*	2 1/8 x 5/8	5.3 x 1.5	7/16	1.1	318	1459	335620
b	2 9/16 x 11/16	6.5 x 1.7	9/16	1.4	318	1459	335620
c	3 x 5/8	7.6 x 1.5	1/2	1.2	318	1459	335620
d	3 3/8 x 3/4	8.5 x 1.9	9/16	1.4	318	1459	335620
e	4 7/16 x 1 1/8	11.2 x 3.0	7/8	2.2	318	1459	335620
f	3 7/8 x 3 1/4	9.8 x 8.2	1 1/8	2.8	Kiva D	229	335833
g	4 1/8 x 4 1/16	10.4 x 10.3	1 1/2	3.8	325	1537	335844
h	3 5/8 x 2 3/4	9.2 x 6.9	1 1/4	3.1	Kiva T	1582	335836
i	6 1/8 x 3 1/2	15.5 x 8.8	1 7/8	4.7	286	906	335907
j	6 5/8 x 4 7/8	16.8 x 12.3	1 3/8	3.4	300B	1077	335919
k	5 3/8 x 3	13.6 x 7.6	1 3/4	4.4	300B	1077	335919
26, A	17 1/4 x 9 3/8	43.8 x 23.8	1 1/2	3.8	West of 165	1158	335903
B	22 1/4 x 15 3/4	56.5 x 40.0	1	2.5	Kiva G	845	335900
27, *a*	11 9/16 x 5 3/4	29.3 x 14.6	3/8	0.9	Kiva Q	1293	335883
b	10 11/16 x 4 3/4	27.1 x 12.0	5/16	0.7	326	1570	335884
c	13 1/8 x 5 1/4	33.3 x 13.3	3/8	0.9	326	1571	335885
d	11 5/8 x 5 3/4	29.5 x 14.6	1/4	0.6	326 (Skel. 8)	1649	335886
e	8 3/4 x 4 7/8	22.2 x 12.3	1 11/16	4.2	325	1540	335916
f	6 7/8 x 3 7/8	17.4 x 9.8	1 1/4	3.1	307	2364	335915
g	9 11/16 x 4 3/4	24.6 x 12.0	7/8	2.2	245	328	335917
28, *a*	2 1/2 x 1 3/16	6.3 x 3.0	1/4	0.6	Misc.	2203	335495
b	1 11/16 x 13/16	4.2 x 2.0	3/16	0.4	Misc.	191	335495

[4] Letters refer to figures shown left to right in each row, consecutively.

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
28, *c*	4¼ x 2 1/16	10.7 x 5.2	3/16	0.4	323	1754	335488
d	2⅞ x 1⅛	7.3 x 2.8	¼	0.6	334	1998	335490
e	2½ x ⅞	6.3 x 2.2	3/16	0.4	326	1720	335489
f	2 9/16 x ¾	6.5 x 1.9	⅛	0.3	Bet. 249 and 251	270	335483
g	3¼ x 1¼	8.2 x 3.1	¼	0.6	Misc.	2199	335494
h	5⅝ x 1 5/16	14.2 x 3.3	¼	0.6	P. del A., 28 and 32	A-176; 181	334788
i	9⅜ x 1⅞	23.8 x 4.7	3/16	0.4	Kiva Q	2093	336041
j	7¼ x 2	18.4 x 5.0	3/16	0.4	Kiva Q	2093	336041
k	8⅝ x 2¼	21.9 x 5.7	¼	0.6	Kiva Q	2093	336041
30, A	24¾ x 19	62.8 x 48.2	2	5.0	323	1766	335901
B	14 x 12	35.5 x 30.4	4¾	12.0	307	2363	335902
32, *a*	6⅞ x ⅝	17.4 x 1.5	3/16	0.4	255	429	335181
b	4¾ x ⅝	12.0 x 1.5	⅛	0.3	255	429	335181
c	7 x ¾	17.7 x 1.9	⅜	0.9	286, subfloor kiva	2356	335182
d	7 11/16 x 2⅜	19.5 x 6.0	1⅝	4.1	255	430	335187
e	7¾ x 2⅛	19.6 x 5.3	2⅛	5.3	249	352	335187
33, *a*	5⅞	14.9			251	471	335019
b	3¾	9.5			Kiva B	146	335062
c	4 3/16	10.6			151, subfloor	6	335002
d	3¾	9.5			Kiva L	1185	335074
e	4	10.1			268	623	335027
f	6¼	15.8			Kiva Q	1330	335077
g	6⅞	17.4			290	1026	335036
h	6¼	15.8			255	409	335020
i	3 1/16	7.7			334	1984	335058
j	4 13/16	12.2			Kiva T	1775	335079
k	3⅝	9.2			334	1985	335057
l	1½ x 7/16	3.8 x 1.1			288	983	335034
m	3⅛ x ½	7.9 x 1.2	¼	0.6	290	1026	335036
n	5 x ⅝	12.7 x 1.5	5/16	0.7	E. refuse mound	928	335082
o	4 3/16	10.6			E. refuse mound	928	335082
p	4⅜	11.1			323	1557	335047
q	5 3/16 x 11/16	13.1 x 1.7	3/16	0.4	266	832	335026
r	5¾ x 7/16	14.6 x 1.1	7/32	0.5	323	1558	335048
s	4½	11.4			307	1225	335041
t	4 11/16 x ½	11.9 x 1.2			Kiva T	1775	335079
u	3 15/16 x ⅜	10.0 x 0.9	3/16	0.4	333	1809	335056
v	3¾ x ⅝	9.5 x 1.5	¼	0.6	273	727	335029
w	4⅞ x 9/16	12.3 x 1.4			272	734	335030
x	6 5/16	16.0	⅜	0.9	273	727	335029
y	3 9/16	9.0			64	1065	335001

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
z	3 15/16	10.0			Kiva B	146	335062
a_2	2 3/4	6.9			153	35	335003
b_2	2 9/16 x 5/16	6.5 x 0.7	5/32	0.3	258	642	335023
c_2	3 15/16	10.0			268	623	335027
d_2	7 11/16 x 1 1/4	19.5 x 3.1	13/16	2.0	Kiva F	778	335066
e_2	4 7/16 x 13/16	11.2 x 2.0	1/2	1.2	Kiva T	1775	335079
f_2	6 5/8 x 1/2	16.8 x 1.2	5/16	0.7	Surface	1020	335089
g_2	6 5/8 x 5/8	16.8 x 1.5	1/4	0.6	320	1437	335050
h_2	4 11/16 x 15/16	11.9 x 2.3	5/8	1.5	320	1437	335050
i_2	6 9/16	16.6			323	1731	335046
34, *a*	2 3/4 x 3/16	6.9 x 0.4	1/16	0.1	E. refuse mound	930	335083
b	2 1/2 x 1/8	6.3 x 0.3	1/8	0.3	161	903	335005
c	2 7/16 x 1/8	6.1 x 0.3	1/16	0.1	226	461	335011
d	2 11/16 x 3/16	6.8 x 0.4	1/8	0.3	315	1268	335044
e	2 1/16 x 3/16	5.2 x 0.4	3/32	0.2	Misc.	2178	335089
f	1 7/8 x 1/8	4.7 x 0.3	1/8	0.3	Kiva B	167	335062
g	1 1/2 x 1/8	3.8 x 0.3	1/8	0.3	153	33	335003
h	2 3/8 x 3/8	6.0 x 0.9	3/16	0.4	153	35	335003
i	2 1/2 x 1/2	6.3 x 1.2	3/16	0.4	E. refuse mound	2261	335084
j	2 3/4 x 1/8	6.9 x 0.3	1/8	0.3	E. refuse mound	928	335082
k	3 x 13/32	7.6 x 1.0	5/16	0.4	338	2090	335060
l	3 1/16 x 5/16	7.7 x 0.7	3/16	0.4	E. refuse mound	928	335082
m	2 7/16 x 1/8	6.1 x 0.3	1/8	0.3	256	590	335021
n	4 1/16 x 3/16	10.3 x 0.4	3/16	0.4	153	36	335003
o	5 5/8 x 1/4	14.2 x 0.6	5/32	0.3	Kiva H	631	335068
p	7 13/16 x 1/8	19.8 x 0.3	1/8	0.3	226	396	335010
q	4 1/16 x 7/8	10.3 x 2.2	11/16	1.7	326	1692	335052
r	3 11/16 x 11/16	9.3 x 1.7	7/16	1.1	E. refuse mound	2258	335082
s	3 5/16 x 5/8	8.4 x 1.5	3/16	0.4	Misc.	2267	335089
t	2 5/16 x 7/16	5.8 x 1.1	3/16	0.4	Misc.	2267	335089
u	2 3/8 x 19/32	6.0 x 1.5	1/8	0.3	328	2029	335054
v	3 5/8 x 3/8	9.2 x 0.9	3/16	0.4	153	36	335003
w	5 13/16 x 7/8	14.7 x 2.2	7/16	1.1	259	744	335183
x	4 7/16	11.2			153	37	335183
y	2 7/16	6.1	9/16	1.4	Misc.	1302	335174
z	2 7/16	6.1	5/16	0.7	251	473	335188
a_2	4 7/8	12.3	1 1/2	3.8	266	833	335184
b_2	5 5/8	14.2	5/8	1.5	Kiva X	2164	335180
c_2	2 7/8	7.3	3/4	1.9	268	624	335175
d_2	4 x 3/4	9.8 x 1.9	1/2	1.2	326	1689	335177
e_2	3 1/2 x 11/16	8.8 x 1.7	3/16	0.4	326	1689	335177
f_2	4 3/16	10.6	13/16	2.0	334	1987	335178
g_2	2 9/16	6.5	3/4	1.9	308	2209	335176

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
36, *a*[5]	5½	13.9	1 9/16	3.9	244	575	335157
b	6¼	15.8	1½	3.8	244	574	335156
c	4⅞	12.3	1⅛	2.8	244	576	335158
d	6½	16.5	1¼	3.1	326 (Skel. 9)	1685	335162
37, *a*	5⅞	14.9	1⅜	3.4	326 (Skel. 6)	1564	335161
b	6½	16.5	1¼	3.1	326 (Skel. 9)	1685	335162
c	5⅜	13.6	1 3/16	3.0	326	1687	335164
d	6⅛	15.5	1¼	3.1	326 (Skel. 12)	1686	335163
38, *a*	5/16 (D) x 5⅞	0.7 x 14.9			202	77	335219
b	7/16 (D) x 3⅞	1.1 x 9.8			202	77	335219
c	4⅛ x ⅜	10.4 x 0.9			202	75	335219
d	¾ (D) x 3⅞	1.9 x 9.8			Kiva N	1252	335225
e	1 (D) x 2⅛	2.5 x 7.3			202	65	335220
f	1 1/16 x ¾	2.6 x 1.9	¼	0.6	298	1155	335222
g	2 9/16 x 1 5/16	6.5 x 3.3	⅜	0.9	323	1760	335261
h	2⅛ x 1	5.3 x 2.5	5/16	0.7	323	1551	335261
i	5½	13.9	1¾	4.4	323	1548	335256
j	5½	13.9	1¼	3.1	246	369	335257
k	2 15/16 (D)	7.4	3/16	0.4	327	1594	335263
l	7⅛	18.0	D.⅝	1.5	Misc.	2202	335252
m	7½	19.0	¾	1.9	226	394	335255
n	14—19	35.5—48.2			320	1377	335282
o	13¼—18½	33.6—46.9			320	1412	335283
39, *a*	23 x 7⅝	58.4 x 19.3	1½	3.8	255	489	335273
b	25¾ x 5¼	65.4 x 13.3	1⅜	3.4	296	1096	335274
c	25¾ x 5½	65.4 x 13.9	1¼	3.1	296	1096	335274
d	21⅝ x 4	54.8 x 10.1	¾	1.9	300B	1078	335276
e	6 5/16 x 4 3/16	16.0 x 10.6	½	1.2	249	289	335267
f	4¼ x 3⅛	10.7 x 7.9	½	1.2	251	488	335268
g	8 x 4	20.3 x 10.1	13/16	2.0	300B	1078	335276
h	16⅝ x 3¼	42.1 x 8.2	9/16	1.4	296	1095	335272
i	4⅜ x 2¾	11.1 x 6.9	⅜	0.9	304	1168	335269
40, *a*	7½ x 7½	19.0 x 19.0			320	1410	335312
b	10½	26.6			320	1409	335312
c	6½ x 3½	16.5 x 8.8			335	1871	335316
d	5 x 4	12.7 x 10.1			335	1871	335316
41, A	13	33.0			290	1025	335336
B	6½ x 5¼	16.5 x 13.3	1	2.5	326 (Skel. 5)	1566	335308
42, *a*	1⅞ x 1¾	4.7 x 4.4			326	1565	335313
b	2⅛ x ½	5.3 x 1.2			6	98	335331
c	4 x 2½	10.1 x 6.3			323	1587	335314

[5] Letters refer to figures shown left to right.

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
42, *d*	4⅜ x 3¾	11.1 x 9.5			326	1565	335313
e	3¼ x 1¼	8.2 x 3.1			326	1567	335313
f	3⅞ x 1⅛	9.8 x 2.8			298	1116	335322
g	2¼ x 1⅛	5.7 x 2.8			326	1567	335313
h	3¾ x 2⅞	9.5 x 7.3			298B	1113	335323
i	4½ (D)	11.4			296	1098	335324
43, *a*	4¾ (D)	12.0	2¼	5.7	320	1374	335309
b	2½	6.3	2½	6.3	225	205	335310
c	4—10½	10.1—26.6			Trench S. of 154	1286	335385
44, *a*	11¼	28.5			326 (Skel. 9)	1870	335313
b, c	14 x 7	35.5 x 17.7	2	5.0	326 (Skel. 6)	1563	335306
45, *a*	5¼ (D)	13.3	8¾	22.2	320	1347	335301
b	6½ (D)	16.5	10¾	27.3	320	1348	335298
c	4½ (D)	11.4	9	22.8	320	1349	335302
d	5½ (D)	13.9	9¾	24.7	320	1402	335296
e	5¼ (D)	13.3	10⅜	26.3	320	1391	335299
f	5 (D)	12.7	8¾	22.2	320	1403	335300
46, *a*	8½	21.5			320	1375	335343
b	4¾	12.0			320	1376	335343
c	18	45.7			320	1405	335342
d	5 (D)	12.7			226	379	335317
e	5 (D)	12.7			235	238	335319
f	4 (D)	10.1			226	378	335317
g	5½ (D)	13.9			246	353	335318
50, *a*	12 (D)	30.4	15	38.1	P. del A., 65	648	334659
b	10¼ (D)	26.0	12	30.4	256	635	336536
c	11¾ (D)	29.8	13½	34.2	323	1477	336543
d	10¾ (D)	27.3	11¾	29.8	323	1610	336546
e	11¾ (D)	29.8	12½	31.7	323	1588	336545
f	10¾ (D)	27.3	11¼	28.5	323	1611	NGS
g	11 (D)	27.9	11¼	28.5	323	1543	336544
52, A, *a*[6]	9 (D)	22.8	9½	24.1	Kiva W		336574
b	6 (D)	15.2	2¾	6.9	Kiva W		336575
c	6⅝ (D)	16.8	9 1/16	23.3	Kiva W		336573
B, *d*	6¼ (D)	15.8	8	20.3	249	387	336534
e	4⅝ (D)	11.7	4¾	12.0	256	2271	336538
f	7¼ (D)	18.4	6¼	15.8	343		336552
C, *g*	7 (D)	17.7	4¾	12.0	Kiva 2-E	1333	336366
h	7½ (D)	19.0	7¾	19.6	248	494	336532
i	5⅜ (D)	13.6	5⅝	14.2	272	801	336541

[6] Letters refer to figures shown left to right in each group, respectively.

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
53, *a*	13¼ (D)	33.6	7¼	18.4	285	1019	336556
b	8 (D)	20.3	5	12.7	326	1661	336557
c	5 (D)	12.7	2½	6.3	329	1908	336317
c'	5¼ (D)	13.3	2⅜	6.0	329	1910	336318
d	6 (D)	15.2	2½	6.3	329	1911	336319
d'	4⅞ (D)	12.3	2⅜	6.0	329	1913	336320
e	4⅝ (D)	11.7	2⅛	5.3	329	1914	336321
e'	3½ (D)	8.8	1⅝	4.1	329	1916	336322
f	6¼ (D)	15.8	3½	8.8	326	1634	336242
g	8 (D)	20.3	2¾	6.9	307	1280	336207
54, *a*	4⅜ (D)	11.1	2	5.0	326 (Skel. 6)	1643	336250
b	4 (D)	10.1	2	5.0	326 (Skel. 4)	1645	336251
c	4½ (D)	11.4	1¾	4.4	326	1660	336271
d	4⅜ (D)	11.1	1⅞	4.7	326 (Skel. 6)	1644	336267
e	4⅞ (D)	12.3	1⅝	4.1	326 (Skel. 12)	1639	336246
f	4⅝ (D)	11.7	2¼	5.7	326	1844	336275
g	4⅞ (D)	12.3	2¼	5.7	326 (Skel. 8)	1659	336254
h	5 (D)	12.7	2	5.0	326 (Skel. 12)	1640	336247
i	4¾ (D)	12.0	2¼	5.7	326	1642	336249
j	5⅜ (D)	13.6	1⅞	4.7	326 (Skel. 12)	1637	336244
k	5 (D)	12.7	2¾	6.9	326 (Skel. 8 and 9)	1679	336262
l	5½ (D)	13.9	2¼	5.7	326 (Skel. 9)	1677	336260
m	5⅛ (D)	13.0	3¼	8.2	326	2101	336278
n	4⅞ (D)	12.3	2	5.0	326	1641	336248
o	5½ (D)	13.9	1⅞	4.7	326 (Skel. 12)	1638	336245
p	5¼ (D)	13.3	2½	6.3	326 (Skel. 8)	2100	336277
q	5½ (D)	13.9	2⅜	6.0	326 (Skel. 8)	1658	336270
r	5½ (D)	13.9	2¼	5.7	326 (Skel. 12)	1632	336264
s	5½ (D)	13.9	2½	6.3	326 (Skel. 6)	1636	336266
t	7 (D)	17.7	2⅞	7.3	326 (Skel. 5)	1671	336257
u	5⅞ (D)	14.9	2⅛	5.3	326	1678	336261
v	6 (D)	15.2	2½	6.3	326	1635	336243
w	5¾ (D)	14.6	2½	6.3	326	1633	336265
x	7 (D)	17.7	2½	6.3	326	2104	336281
y	6⅛ (D)	15.5	2⅜	6.0	326	2286	336293
z	6⅝ (D)	16.8	3	7.6	326 (Skel. 5)	1657	336269
a_2	6¼ (D)	15.8	3	7.6	326	1631	336241
b_2	6⅜ (D)	16.1	2	5.0	326	1629	336239
c_2	7 (D)	17.7	3⅞	9.8	326	1630	336240
d_2	6⅞ (D)	17.4	2¾	6.9	326 (Skel. 12)	1628	336238
e_2	6¾ x 8⅝ (D)	17.1 x 21.9	3⅞	9.8	326 (Skel. 5)	1846	336276
f_2	6¾ (D)	17.1	2⅝	6.6	326	1656	336256

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
54, g_2	7½ (D)	19.0	4¼	10.7	326 (Skel. 8 and 9)	1674	336259
h_2	6⅞ (D)	17.4	2¾	6.9	326 (Skel. 12)	1675	336273
i_2	7¾ (D)	19.6	2¾	6.9	326	2273	336292
j_2	6½ (D)	16.5	2¾	6.9	326 (Skel. 12)	1676	336274
k_2	7½ (D)	19.0	2¾	6.9	326	2103	336280
l_2	6¾ (D)	17.1	3	7.6	326	2102	336279
55, m_2	8⅜ (D)	21.2	3¾	9.5	326	1627	336237
n_2	7½ x 8½ (D)	19.0 x 21.5	3½	8.8	326	2114	336291
o_2	8½ x 9¾ (D)	21.5 x 24.7	3½	8.8	326	1653	336253
p_2	7⅝ (D)	19.3	2⅞	7.3	326	2108	336285
q_2	8½ (D)	21.5	3½	8.8	326	2111	336288
r_2	9⅝ (D)	24.4	3⅞	9.8	326	2292	336294
s_2	8⅛ (D)	20.6	4⅛	10.4	326 (Skel. 12)	1652	336252
t_2	8½ (D)	21.5	3½	8.8	326	2110	336287
u_2	9⅜ (D)	23.8	3¾	9.5	326 (Skel. 12)	1625	NGS
v_2	8¼ (D)	20.9	3½	8.8	326	1626	336236
w_2	8 x 9½ (D)	20.3 x 24.1	4	10.1	326	2105	336282
x_2	9¾ (D)	24.7	4¾	12.0	326 (Skel. 6)	1623	336263
y_2	9⅞ (D)	25.0	4⅛	10.4	326	1672	336272
z_2	9⅛ (D)	23.1	3½	8.8	326	1655	336268
a_3	9 (D)	22.8	3¾	9.5	326 (Skel. 8 and 9)	1673	336258
b_3	9¼ (D)	23.4	3¼	8.2	326	1654	336255
c_3	10 (D)	25.4	3⅞	9.8	326	2107	336284
d_3	9 x 10 (D)	22.8 x 25.4	4¼	10.7	326 (Skel. 13)	1624	336235
e_3	9⅜ (D)	23.8	3⅝	9.2	326	2113	336290
f_3	9½ (D)	24.1	4	10.1	326	2112	336289
g_3	11½ x 12¾ (D)	29.2 x 32.3	5¾	14.6	326	2106	336283
h_3	10¼ (D)	26.0	4¼	10.7	326	2109	336286
i_3	10¾ (D)	27.3	6	15.2	326	2311	336295
56, *a*	4⅞ (D)	12.3	2¼	5.7	266, Cist No. 1	884	336175
b	5½ (D)	13.9	2¼	5.7	266, Cist No. 1	888	336173
c	5½ (D)	13.9	2⅜	6.0	266, Cist No. 1	876	336168
d	5⅛ (D)	13.0	2½	6.3	266, Cist No. 1	886	336172
e	5 (D)	12.7	1⅞	4.7	266, Cist No. 1	873	336165
f	5 (D)	12.7	1⅞	4.7	266, Cist No. 1	878	NGS
g	4¾ (D)	12.0	1⅞	4.7	266, Cist No. 1	871	336164
h	5⅛ (D)	13.0	1⅞	4.7	266, Cist No. 1	880	NGS
i	5⅝ (D)	14.2	2¼	5.7	266, Cist No. 1	883	336174
j	4¾ (D)	12.0	2	5.0	266, Cist No. 1	877	336169
k	4½ (D)	11.4	1¾	4.4	266, Cist No. 1	870	336163
l	5¾ (D)	14.6	2	5.0	266, Cist No. 1	879	336170

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width: Inches	Cm.	Height or thickness: Inches	Cm.	Provenience	Field No.	U.S.N.M. No.
56, *m*	5¼ (D)	13.3	1¾	4.4	266, Cist No. 1	887	336176
n	5 (D)	12.7	2¼	5.7	266, Cist No. 1	885	336171
o	5¼ (D)	13.3	2	5.0	266, Cist No. 1	874	336166
p	5⅜ (D)	13.6	2½	6.3	266, Cist No. 1	881	336177
q	5½ (D)	13.9	2⅜	6.0	266, Cist No. 1	872	336156
r	5½ (D)	13.9	2½	6.3	266, Cist No. 1	882	336178
s	5⅛ (D)	13.0	2½	6.3	266, Cist No. 1	889	336179
t	5¼ (D)	13.3	2¼	5.7	266, Cist No. 1	875	336167
u	9¾ x 10⅜ (D)	24.7 x 26.3	4½	11.4	266, Cist No. 1	891	336180
v	9¾ (D)	24.7	3¾	9.5	266, Cist No. 1	890	NGS
57, *a*	4⅝ (D)	11.7	6½	16.5	326	1622	336433
b	4¼ (D)	10.7	5¼	13.3	326 (Skel. 5)	1620	336431
c	4 (D)	10.1	4⅝	11.7	326	1619	336430
d	4⅞ (D)	12.3	6⅛	15.5	326	1621	336432
e	5⅛ (D)	13.0	6⅜	16.1	326 (Skel. 8)	1670	336437
f	5⅝ (D)	14.2	6½	16.5	326 (Skel. 6)	1618	336429
g	5¼ (D)	13.3	6½	16.5	326	1669	336436
h	5¾ (D)	14.6	6¼	15.8	326	1845	336438
i	6 (D)	15.2	7⅞	20.0	326 (Skel. 6)	1668	336435
j	6⅝ (D)	16.8	8⅞	22.5	326 (Skel. 12)	1847	336439
k	6½ (D)	16.5	8	20.3	326	1667	336434
l	6 (D)	15.2	7⅝	19.3	326 (Skel. 9)	1617	336428
m	5¾ (D)	14.6	7¾	19.6	326 (Skel. 9)	1615	336426
n	5½ (D)	13.9	6⅝	16.8	326 (Skel. 12)	1859	336440
o	6 (D)	15.2	7	17.7	326	1616	336427
58, *a*	11⅛ (D)	28.2	3⅞	9.8	227	2297	336133
b	13 (D)	33.0	5¼	13.3	Kiva L	1606	336359
c			5⅛	13.0	Kiva H	2291	336356
d	6 3/16 (D)	15.7	5 5/16	13.4	335		336524
e	7 (D)	17.7	5¼	13.3	323	1876	336521
f	7½ (D)	19.0	7½	19.0	227-I	691	336503
g	5¾ (D)	14.6	4¾	12.0	324	1443	336522
h	9⅛ (D)	23.1	7	17.7	246		336520
i	8⅝ (D)	21.9	3¼	8.2	266	918	336154
j	9½ (D)	24.1	3¼	8.2	266	897	336155
k	8½ (D)	21.5	2¾	6.9	266	900	336147
l	8½ (D)	21.5	4⅛	10.4	266	920	336149
m	8⅛ (D)	20.6	4	10.1	266		336159
n	8⅝ x 9¾ (D)	21.9 x 24.7	4½	11.4	266	919	336151
61, *a*	6½ x 3⅞	16.5 x 9.8	2	5.0	251	519	336376
b	6⅝ x 3⅞	16.8 x 9.8	1⅝	4.1	327	2280	336388
c	8⅝ x 4⅞	21.9 x 12.3	1⅞	4.7	Trench W. side W. Court	2217	336373

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width: Inches	Diameter (D) or length x width: Cm.	Height or thickness: Inches	Height or thickness: Cm.	Provenience	Field No.	U.S.N.M. No.
61, *d*	4⅛ x 2	10.4 x 5.0	1⅛	2.8	274	751	336382
e	10¾ x 4¾	27.3 x 12.0	2	5.0	323	1612	336385
f	6⅞ x 3⅝	17.4 x 9.2	2	5.0	323	1613	336384
g	3⅞ x 1⅞	9.8 x 4.7	1¼	3.1	247	521	336374
h	10 x 4½	25.4 x 11.4	2½	6.3	323		336387
i	14¼ x 4¾	36.1 x 12.0	2¼	5.7	323	2323	336386
62, *a*	8¾ x 5⅞	22.2 x 14.9	1¾	4.4	330	1966	336396
b	2¼ x 3	5.7 x 7.6	¾	1.9	E. refuse mound	111	336371
c	8¾ x 7	22.2 x 17.7			267	2278	336397
d, d'	6 (D)	15.2	1⅛	2.8	307-I	2279	336069a
e, e'	7⅛ (D)	18.0	1 1/16	2.6	315	1298	336069b
63, *a*	4¾ (D)	12.0	6¾	17.1	151	8	336401
b	5 (D)	12.7	8	20.3	343		336471
c	5¼ (D)	13.3	6½	16.5	330	1975	336459
d	5¼ x 3⅝	13.3 x 9.2	2¾	6.9	W. refuse mound	568	336481
e	5¾ x 5½	14.6 x 13.9	3	7.6	226	556	336482
f	8 x 4¼	20.3 x 10.7	5⅝	14.2	323	1614	336483
g	8¼ x 6⅝	20.9 x 16.8	8	20.3	330	1979	336485
h	6⅝ x 4¾	16.8 x 12.0	6¼	15.8	329	1893	336484
64, *a*	10⅛ (D)	25.7	12⅜	31.4	262	2312	336504
b	13¼ (D)	33.6	13¾	34.9	266	1002	336505
c	14¼ (D)	36.1	15	38.1	326	2094	336506
d	13½ (D)	34.2	16½	41.9	326 (Skel. 12)	2095	336507
65, *a*	6¾ (D)	17.1	6⅛	15.5	213	2228	336510
b	3½ (D)	8.8	2⅞	7.3	330	1967	336517
c	6 (D)	15.2	6¼	15.8	334	1881	336518
d	10⅛ x 5	25.7 x 12.7	7¼	18.4	327	2171	336519
e	8⅛ (D)	20.6	8 3/16	20.7	325	2321	336516
f	5 (D)	12.7	3½	8.8	226	565	336511
g	8¼ (D)	20.9	7⅜	18.7	266		336513
h	8 (D)	20.3	6	15.2	317	1482	336515
66, A, *a*	5⅞ (D)	14.9	3⅜	8.5	307-I	1277	336525
b	2⅞ (D)	7.3	1½	3.8	323	2285	336526
c	4⅞ (D)	12.3	3⅝	9.2	334	2166	336527
B	9¾ (D)	24.7	9½	24.1	268	641	335291
C					Chaco Canyon		
67, *a*	7 (D) (†)	17.7	7¾	19.6	251		336488
b			6½	16.5	309		336562
c	3¼ (D)	8.2	9½	24.1	P. del A., 15	A-630	334576
d	5¾ (D)	14.6	11⅜	28.8	320	1351	334490
e	5⅞ (D)	14.9	11⅜	28.8	320	1350	334489

† For cylindrical vases, base diameter is given.

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width: Inches	Diameter (D) or length x width: Cm.	Height or thickness: Inches	Height or thickness: Cm.	Provenience	Field No.	U.S.N.M. No.
67, *f*	5¾ (D)	14.6	11⅝	29.5	320	1394	334491
g	5⅛ (D)	13.0	11¼	28.5	326	1662	334492
68, *a*	3⅞ (D)	9.8	9⅜	23.8	329	1848	336493
b	3⅞ (D)	9.8	10⅜	26.3	329	2155	336495
c	3⅞ (D)	9.8	9⅜	23.8	329	1856	336494
d	3½ (D)	8.8	9⅞	25.0	329	2156	336496
e	4⅝ (D)	12.3	8½	21.5	329	2157	336497
f	3⅞ (D)	9.8	10⅛	25.7	329	2319	336498
g	3½ (D)	8.8	9	22.8	330	1980	NGS
h	3¾ (D)	9.5	9	22.8	330	1981	336502
i	3⅝ (D)	9.2	9¼	23.4	330	1849	NGS
j	4½ (D)	11.4	9	22.8	330	1850	336499
k	5½ (D)	13.9	8¼	20.9	330	1851	336500
l	5⅜ (D)	13.6	8¾	22.2	330	1855	336501
69, *a*	4⅛ x 2⅛	10.4 x 5.3	1¼	3.1	350	2215	336372
b	4 1/16 x 2	10.3 x 5.0	⅝	1.5	307	1609	336390
c	2 (D)	5.0	1	2.5	329	1905	336314
d	3¼ (D)	8.2	1⅜	3.4	329	1904	336313
e	3 (D)	7.6	1⅜	3.4	329	1907	336316
f	3¼ (D)	8.2	1¼	3.1	14	1110	336119
g	1⅞ (D)	4.7	2½	6.3	329	1890	336474
h	1⅛ (D)	2.8	1⅝	4.1	323	1875	336473
i	1⅞ (D)	4.7	1½	3.8	330	1968	336475
j	2½ (D)	6.3	3¼	8.2	330	1969	336476
k	2⅞ (D)	7.3	4	10.1	330	2132	336463
l	2¾ (D)	6.9	3¾	9.5	W. Court Trench	2216	336478
70, *a*	3½ x 2½	8.8 x 6.3	1¼	3.1	Kiva D	225	335872
b	4 x 2¾	10.1 x 6.9	1¼	3.1	P. del A., Kiva C	A-202	334800
c	4 x 2½	10.1 x 6.3	¾	1.9	290	1043	335867
d	4 x 2¾	10.1 x 6.9	1⅞	4.7	335	2038	335868
e	4¼ x 2⅛	10.7 x 5.3	1⅜	3.4	341	2123	335869
f	4½ x 2 1/16	11.4 x 7.4	1¼	3.1	341	2123	335869
g	7½ x 3⅜	19.0 x 8.5	2¾	6.9	P. del A., 2	A-44	334863
h	8 x 3	20.3 x 7.6	3⅛	7.9	246	355	335862
71, *a*	5′3″ x 1 3/16	160.0 x 3.0	¾	1.9	298	1094	335290
b	44½ x 1 3/16	113.0 x 3.0	15/16	2.3	320	1378	335216
c	5′6″ x 2	167.6 x 5.0			296	1097	335207
d	1½ (D) x 7½	3.8 x 19.0			325	1510	335212
e	8⅞ x 1⅜	22.5 x 3.4	¾	1.9	304	1172	335243
f	8¾ x 1¾	22.2 x 4.4			320	1414	335209
g	21 x 1¼	53.3 x 3.1			325	1509	335210
h	12¾ x 1⅝	32.3 x 4.1			298	1092	335211

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
71, *i*	36⅝ x 1¾	92.9 x 4.4	13/16	2.0	326 (Skel. 8)	1591	335213
j	32⅛ x ⅝ (D)	81.5 x 1.5			320	1379	335216
k	41½ x 1½	105.4 x 3.8			326 (Skel. 8)	1590	335208
l	41½	105.4			320	1404	335215
72, *a*	7/16 (D) x 22	1.1 x 55.8			209	47	335280
b	22	55.8			209	50	335281
c	17¼	43.8			209	50	335281
d	17¼	43.8			209	48	335204
e	21	53.3			304	1170	335214
f	26	66.0			304	1171	335214
g	22¼	56.5			298	1093	335223
h	1½ (D) x 24¼	3.8 x 61.5			Kiva D	228	335284
i	25	63.5			Kiva D	228	335284
73, A	1—1¾	2.5—4.4			330 (Skel. 10)	2077	336038
B, *a*	1 5/16 x 7/16	3.3 x 1.1	3/32	0.2	Kiva G	863	335444
b	1 5/16 x 13/16	3.3 x 2.0			Kiva J	672	335446
c	1 x 9/16	2.5 x 1.4	1/16	0.1	Kiva T	1785	335450
d	13/16 x 7/16	2.0 x 1.1	⅛	0.3	Misc.		335475
e	⅞ x ⅜	2.2 x 0.9	⅛	0.3	Kiva B	147	335441
f	1⅛ x 13/32	2.8 x 1.0	3/32	0.2	330	2068	335472
g	13/16 x 9/16	2.0 x 1.4	⅛	0.3	Misc.		335475
h	¾ x ⅜	1.9 x 0.9	3/32	0.2	291	1059	335463
i	1 1/16 x 7/16	2.6 x 1.1	1/16	0.1	153	43	335452
j	1¼ x ½	3.1 x 1.2	3/32	0.2	341	2120	335474
k	1 7/16 x 11/16	3.6 x 1.7	5/32	0.3	Misc.	1319	335475
l	1 9/16 x 11/16	3.9 x 1.7	3/32	0.2	Misc.	1319	335475
m	1 13/16 x 11/16	4.6 x 1.7	3/16	0.4	Misc.		335475
n	1 x 7/16	2.5 x 1.1	⅛	0.3	251	478	335458
o	1 5/16 x ½	3.3 x 1.2	⅛	0.3	Misc.		335475
74, A	1 3/16—1⅝	3.0—4.1			330 (Skel. 9)	2078	336039
B	1 1/16—2 3/32	2.6—5.0			330 (Skel. 10)	2079	336040
77, *a*	3⅜ x 3	8.5 x 7.6			299B	1081	335339
b	2½ x 3	6.3 x 7.6			299B	1081	335339
c	3 x 5	7.6 x 12.7			299B	1081	335339
d	3¼ x 2¾	8.2 x 6.9			299B	1081	335339
e	3½ x 8	8.8 x 20.3			299B	1081	335339
78, *a*	2¾ x 2⅛	6.9 x 5.3	⅛	0.3	251	470	335233
b	2⅝ x 1¾	6.6 x 4.4	5/32	0.3	251	470	335233
c	5⅞ x 2¼	14.9 x 5.7	⅛	0.3	262	760	335234
d	3⅝ x 1¼	9.2 x 3.1	⅛	0.3	262	760	335234
e	1 11/16 x 13/16	4.2 x 2.0	3/32	0.2	262	760	335234
f	1⅜ x 9/16	3.4 x 1.4	1/16	0.1	262	760	335234
g	4½ x 1½	11.4 x 3.8			264	810	335235

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
78, *h*	1 3/16 x 1 1/8	3.0 x 2.0			264	810	335235
i	1 3/4 x 1 1/2	4.4 x 3.8			264	810	335235
j	2 7/8 x 1 1/2	7.3 x 3.8	1/8	0.3	Kiva J	686	335236
k	2 7/8 x 1 5/8	7.3 x 4.1	1/8	0.3	Kiva J	686	335236
l	3 1/8 x 1 1/4	7.9 x 3.1	1/16	0.1	Kiva J	686	335236
m	4 1/16 x 7/16	10.3 x 1.1	1/4	0.6	300B	1080	335238
n	1 3/8 (D) x 2 3/4	3.4 x 6.9			290	1052	335245
o	1 3/8 (D) x 2 7/8	3.4 x 7.3			335	2047	335246
p	2 (D) x 2 3/4	5.0 x 6.9			327	1596	335247
q	1 1/2 (D) x 2 1/2	3.8 x 6.3			327	1820	335247
r	1 3/4 (D) x 1 5/8	4.4 x 4.1			327	1819	335260
s	5/8 (D) x 1	1.5 x 2.5			323	1552	335248
t	3 1/2	8.8			323	1474	335249
u	4 1/8	10.4			323	1547	335249
v	7/16 (D) x 1 7/8	1.1 x 4.7			255	428	335250
w	1 3/4	4.4			226	422	335251
x	4 1/4	10.7			226	456	335251
79, A, *a*[7]	1 1/2 (D) x 25	3.8 x 63.5			226	525	335285
B, *a*	15 1/2 x 4	39.3 x 10.1			250	326	335362
80, A					Sinklezin		
B					Ruin No. 8		
81, *a*	11 x 4 1/2	27.9 x 11.4	1/2	1.2	153	17	335891
b	12 3/4 x 5 1/4	32.3 x 13.3	5/8	1.5	326	1648	335893
c	11 3/8 x 6 1/16	28.8 x 15.3	5/8	1.5	Kiva J	704	335890
d	9 1/4 x 4 1/2	23.4 x 11.4	1/4	0.6	326	1569	335892
e	12 3/8 x 5 7/8	31.4 x 14.9	3/8	0.9	329	1952	335894
82, *a*	5 3/8 (D) x 2 3/8	13.6 x 6.0			Kiva R	1481	336361
b	4 1/2 x 3 3/4	11.4 x 9.5	5	12.7	Kiva R	1480	336032
c	7 x 5 1/2	17.7 x 13.9	2 3/8	6.0	Surface	388	336923
d	4 (D)	10.1	4 1/16	10.3	264	818	336925
e	6 1/8 (D)	15.5	1 3/4	4.4	256	586	336924
f	5 1/2 x 4 1/8	13.9 x 10.4	3 5/16	8.4	Kiva G	846	335929
g	5 3/4 x 4 1/4	14.6 x 10.7	3 1/4	8.2	Kiva G	846	335929
h	4 1/2 (D) x 4 3/4	11.4 x 12.0			Kiva J	701	335926
i	4 1/2 (D) x 4 1/2	11.4 x 11.4			Kiva J	702	335927
j	4 1/4 (D) x 4 3/4	10.7 x 12.0			Kiva J	703	335928
83, A, *a*[8]	1 3/4	4.4			298	1117	335345
b	2 1/8	5.3			298	1117	335345
c	2	5.0			298	1117	335345
B, *a*	8 3/8 (D) x 7	21.2 x 17.7			272	752	335930
b	9 x 6	22.8 x 15.2	7 1/4	18.4	272	753	335931

[7] A, *a* and B, *a* refer to first specimen on the left in each group.
[8] A, *a*, *b*, and *c* refer to specimens shown in top row, left to right; B, *a* and *b*, left to right, respectively.

(Continued)

PLATES—*continued*

Plate	Diameter (D) or length x width, Inches	Diameter (D) or length x width, Cm.	Height or thickness, Inches	Height or thickness, Cm.	Provenience	Field No.	U.S.N.M. No.
84	4½ (D) x 5	11.4 x 12.7			330	1929	335297
85	15⅝ x 12	39.6 x 30.4	8	20.3	320	1390	335293
87, A	11½ x 10¼	29.2 x 26.0			326	1597	335294
B	8 x 6	20.3 x 15.2	3	7.6	326 (Skel. 8)	1599	335295
88, *a*, *a'*	6 x 2¼	15.2 x 5.7			329	1861	336061
b, *b'*	9¼ x 4	23.4 x 10.1	1⅞	4.7	P. del A., 27	A-140	334637
c, *c'*	8⅛ x 3	20.6 x 7.6	1½	3.8	P. del A., 27	A-141	334638
89, *a*	2 11/16 (D)	6.8			Kiva D	226	335955
90, *k*	4⅝ (D)	11.7			Kiva Q	2093	336041

TEXT FIGURES

Figure	Diameter (D) or length x width, Inches	Diameter (D) or length x width, Cm.	Height or thickness, Inches	Height or thickness, Cm.	Provenience	Field No.	U.S.N.M. No.
8	10 x 3¾	25.4 x 9.5			320B	1442	335358
9, *c*	7⅞ x 3⅞	20.0 x 9.8			251		
10	10 x 4¼	25.4 x 10.7			298	1114	335354
11	5⅝ x 3¾	14.2 x 9.5			246	357	335350
12, *a*	⅛ (D)	0.3	1/16	0.1			335730
b	7/32 (D)	0.5	1/16	0.1			335730
c	⅜ (D)	0.9	7/32	0.5			335730
d	3/16 (D)	0.4	3/16	0.4			335730
e	⅝ x 5/16	1.5 x 0.7	5/32	0.3	320	1434	335729
f	11/32 x 3/16	0.8 x 0.4	1/16	0.1	320	1434	335729
g	7/16 x 9/32	1.1 x 0.7	3/16	0.4	Kiva R, Pilaster 5	1495	336015
13	2⅝ x 1½	6.6 x 3.8	5/16	0.7	318	1451	335658
14, *a*	¼ (D) x ⅝	0.6 x 1.5			310, subfloor	1325	336028
b	⅛ (D) x 3/16	0.3 x 0.4			310, subfloor	1325	336028
c	⅛ (D) x 1/16	0.3 x 0.1			Kiva L, Pilaster 1	1187	335981
d	5/16 x 1/16	0.7 x 0.1			Kiva L, Pilaster 1	1187	335981
e	5/16 x 3/16	0.7 x 0.4			310, subfloor	1325	336028
f	5/16 x ¼	0.7 x 0.6					335688
15, *a*	¼ (D) x 11/16	0.6 x 1.7			218, subfloor	2227	335690
b	11/16 x ⅝	1.7 x 1.5			241	570	335689
c	½ x 5/16	1.1 x 0.7			Kiva X	2149	335698
d	7/16 x ⅜	1.1 x 0.9			Kiva X	2149	335698
e	9/16 x 5/16	1.4 x 0.7			246	346	335703
f	15/16 x 7/16	2.3 x 1.1			332	1796	335713
g	1 (D) x ⅜	2.5 x 0.9			329	2015	335723

(Continued)

TEXT FIGURES—*continued*

Figure	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
15, *h*	1 11/16 x 9/16	4.2 x 1.4			324	1444	335705
i	3 1/4	8.2			329	2018	335718
j	1 1/4 (D)	3.1			330	2063	335712
k	1 7/8 x 1 3/8	4.7 x 3.4			330	1867	335711
l	1 5/16 x 13/16	3.3 x 2.3			NE. wall of 186	1023	336027
m	1 5/16 x 1 3/16	3.3 x 3.0			NE. wall of 186	1023	336027
n	1 5/8 x 3/4	4.1 x 1.9			326	1701	335704
o	1 13/16 x 7/16	3.0 x 1.1			330 (Skel. 23)	2083	336034
p	2 7/16 x 1 3/4	6.1 x 4.4			330	2064	335710
q	1 5/8 x 1/2	4.1 x 1.2			298	1120	335717
r	1 7/8 x 3/8	4.7 x 0.9			330	2066	335708
s	2 1/4 (D)	5.7			323	1546	335700
t	2 5/8 (D)	6.6			153	20	335716
u	1 3/8 (D) x 2 3/8	3.4 x 6.0			Kiva L	1175	335720
16, *a*	1/2 x 1/4	1.2 x 0.6			Kiva Q	1827	335697
b	1 1/8 x 13/16	2.8 x 2.0	3/8	0.9	226	425	335702
c-f					Kiva R, Pilaster 3	1493	336013
g	9/16 x 3/8	1.4 x 0.9	1/4	0.6	311	1221	335685
17	1 5/16 x 1	3.3 x 2.5	1/2	1.2	Misc.	2193	335726
18	8 1/4 x 3 1/2	20.9 x 8.8	5/16	0.7	26	132	334829
19	11/16 x 7/16	1.7 x 1.1	1/4	0.6	Kiva I, Pilasters 1 and 6	660; 665	335966 and 335971
20, *a*	5/8 (D) x 13/16	1.5 x 2.0			W. Ct. Trench	2218	335608
b	7/8 x 7/8	2.2 x 2.2			348	2331	335604
c	11/16 (D)	1.7			Misc.	1307	335609
d	5/16 x 3/8	0.7 x 0.9	1/4	0.6	Debris over 80	1021	335592
e	1/2 (D)	1.2			323	1742	335593
f	13/16 x 5/8	2.0 x 1.5	3/8	0.9	326 (Skel. 8)	1589	335594
g	13/16 (D)	2.0	1/2	1.2	329	2010	335595
h	1 9/16 x 15/16	3.9 x 2.3			Kiva L	1177	335590
i	1 (D)	2.5	7/16	1.1	Kiva G	858	335589
j	1 3/16 x 7/8	3.0 x 2.2			333	1806	335599
k	1 3/16 x 3/4	3.0 x 1.9	3/8	0.9	333	1807	335600
l	7/8 x 7/8	2.2 x 2.2	3/16	0.4	Kiva T	1781	335591
m	1 5/16 x 3/4	3.3 x 1.9	3/16	0.4	335	2051	335602
n	1 x 5/16	2.5 x 0.7	3/16	0.4	W. Ct. Trench	2211	335607
o	2 5/8 x 2 1/8	6.6 x 5.3	5/8	1.5	336	2092	335603
p	1 3/4 x 1 3/16	4.4 x 3.0	3/8	0.9	Misc.	189	335610
q	2 5/8 x 1 1/4	6.6 x 3.1	5/16	0.7	331	1800	335597
21, *a*	3/8 (D)	0.9			249	281	335540
b	1/2 x 5/16	1.2 x 0.7			348	2343	335541

(Continued)

TEXT FIGURES—*continued*

Figure	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
21, *c*	1 1/8 x 11/16	2.8 x 1.7			153	30	335542
d	9/16 x 3/8	1.4 x 0.9	3/16	0.4	226	443	335543
22, *a*	1 5/8 x 7/8	4.1 x 2.2			272	735	335524
b	1 3/16 x 1	3.0 x 2.5			325	1515	335525
c	1 3/8 x 1/2	3.4 x 1.2	1/8	0.3	255	1719	335529
23, *a*	9/16 (D) x 9/16	1.4 x 1.4			Misc.	2263	335572
b	7/8 x 7/16	2.2 x 1.1	3/8	0.9	35	1506	335573
c	11/16 (D)	1.7			245	235	335755
d, *d'*	3/4 x 5/8	1.9 x 1.5			298	1121	335758
24, *a*	7/8 x 3/4	2.2 x 1.9			Kiva H	633	336112
b	1 1/4 (D)	3.1			282	1011	336113
25, *a*	13/16 (D) x 7/16	2.0 x 1.1			330	1863	335761
b	13/16 (D) x 1/2	2.0 x 1.2			330	1864	335762
c	3/4 (D) x 11/16	1.9 x 1.7			330	1865	335763
d	3/4 (D) x 13/16	1.9 x 2.0			Kiva 2-D	2359	335764
26, *a*	13/16 (D) x 3/16	2.0 x 0.4			325	1514	335767
b	13/16 (D) x 5/16	2.0 x 0.7			W. Ct. Trench	2212	335768
27, *a*	3/8 (D) x 2 3/16	0.9 x 5.5			290	1029	335118
b	3/8 (D) x 2	0.9 x 5.0			Misc.	2181	335113
c	3/8 (D) x 1 7/16	0.9 x 3.6			Misc.	932	335113
d	1/4 (D) x 7/8	0.6 x 2.2			Misc.	2181	335113
e	3/8 (D) x 1 3/4	0.9 x 4.4			Kiva Q	1328	335109
28, *a*	5/16 (D) x 5/8	0.7 x 1.5			229	218	335583
b	3/8 (D) x 11/16	0.9 x 1.7			E. of 152	1279	335582
c	5/8 x 7/16	1.5 x 1.1	5/8	1.5	264	812	335584
d	1 1/16 x 7/8	2.6 x 2.2	5/8	1.5	Debris S. of 55-57	1346	335581
e	7/8 x 11/16	2.2 x 1.7	5/8	1.5	Debris S. of 55-57	1346	335581
f	7/8 x 5/8	2.2 x 1.5	1/2	1.2	Debris S. of 55-57	1346	335581
g	1 1/2 x 15/16	3.8 x 2.3	5/8	1.5	Kiva A	176	335587
29, *a*	2 1/2 x 1 3/8	6.3 x 3.4	7/8	2.2	226	385	335815
b	2 1/4 x 2 1/4	5.7 x 5.7	1 1/4	3.1	255	434	335818
c	2 x 2 1/2	5.0 x 6.3	1 3/8	3.4	226	467	335818
30	3 x 3 1/8	7.6 x 7.9	1 3/4	4.4	E. refuse mound	951	335814
31	5 3/4 x 5/8	14.6 x 1.5	3/16	0.4	224	236	335631
32	4 1/2 x 3 1/4	11.4 x 8.2	1	2.5	277	948	335808
33, *a*	4 1/4 x 2 1/16	10.7 x 5.2	1/4	0.6	266	399	335664
b	3 1/2 x 2 5/8	8.8 x 6.6	5/16	0.7	248B	294	335665
34, *a*	3 1/2 x 7/16	8.8 x 1.1	1/8	0.3	P. del A.	A-130	334811
b	2 9/16 x 3/8	6.5 x 0.9	3/32	0.2	P. del A.	A-130	334811

(Continued)

TEXT FIGURES—*continued*

Figure	Diameter (D) or length x width: Inches	Diameter (D) or length x width: Cm.	Height or thickness: Inches	Height or thickness: Cm.	Provenience	Field No.	U.S.N.M. No.
35, *a*	3 3/16 x 1 1/16	8.0 x 3.0	1/8	0.3	293	1076	335625
b	3 1/4 x 1 1/16	8.2 x 3.9	3/32	0.2	293	1076	335625
36, *a*	1 11/16 x 1 1/8	4.2 x 2.8	3/16	0.4	320	1421	335498
b	7/8 x 13/16	2.2 x 2.0	1/4	0.6	348	2339	335498
c	1 15/16 x 1 3/8	4.9 x 3.4	5/8	1.5	E. refuse mound	934	335499
d	1 x 3/4	2.5 x 1.9	1/4	0.6	E. refuse mound	2262	335499
37	1 7/8 x 1 1/4	4.7 x 3.1	1/16	0.4	W. refuse mound		(Palmer)
38	7 3/4	19.6			225	204	335170
39	2 1/8 x 3/4	5.3 x 1.9			334	1989	335146
40, *a*	5 1/2 x 9/16	13.9 x 1.4	3/4	1.9	Kiva L	1173	335265
b	7 3/16 x 15/16	18.2 x 2.3	11/16	1.7	Kiva L	1173	335265
41	10 1/2 x 1 5/8	26.6 x 4.1	5/8	1.5	225	206	335241
42, *a*	2 7/8 (D)	7.3	1/8	0.3	226	455	335262
b, *b'*	2 13/16 (D)	7.1	3/16	0.4	266	830	335231
43	5/8 (D)	4.1	1/16	0.1	298	1156	335230
44	4 5/8 x 3 1/4	11.7 x 8.2	3/8	0.9	226	420	335292
45	4 5/8	11.7			296	1101	335227
46	18	45.7			320	1405	335342
47, *a*	1 9/16 x 1 3/16	3.9 x 3.0			Trench, E. refuse mound	953	336099
b	2 x 1	5.0 x 2.5			W. Ct. Trench	2256	336099
48	2 1/2 (D)	6.3	1 1/8	2.8	335	2053	336081
49	3 3/4 x 3	9.5 x 7.6			256	599	336144
50, *a*							336558
b	6 1/2 (D)	16.5	2 1/2	6.3			336558
c	4 7/8 x 4 1/4	12.3 x 10.7					336558
d	4 1/2 x 2 3/8	11.4 x 6.0			151	9	336558
e					SW. cor., Kiva V square	2168	336558
f	2 7/8 x 2 1/2	7.3 x 6.3			248	372	336558
g					Kiva J	776	336558
51, *a*	1 3/4 (D)	4.4	5/8	1.5	Kiva B	351	336091
b	1 3/4 x 1 1/2	4.4 x 3.8	1 3/16	3.0	272	765	336096
c	1 13/16 x 1 3/16	4.6 x 3.0	1 1/16	2.6	290	1040	336096
52	7	17.7	2 3/4	6.9	Misc.		336562
53, *a*	1 7/16 (D)	3.6	15/16	2.3	W. refuse mound	507	336090
b	1 1/2 x 7/8	3.8 x 2.2	15/16	2.3	Kiva 2-E	1285	336092
c	1 1/2 (D)	3.8	1 1/8	2.8	Kiva T	1790	336093
d	1 1/16 (D)	2.6	5/8	1.5	226	491	336094
e	7/8 (D)	2.2	3/4	1.9	290	1063	336095
f	1 3/4 x 15/16	4.4 x 2.3	1/2	1.2	323	1756	336097
54, *a*	2 x 2	5.0 x 5.0	2 1/8	5.3	323		336088
b	1 x 7/8	2.5 x 2.2	1 5/16	3.3	Misc.		336088

(Continued)

TEXT FIGURES—*continued*

Figure	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
54, *c*	1 1/8 x 3/4	2.8 x 1.9	1 5/8	4.1	Misc.		336088
d	2 x 1 3/4	5.0 x 4.4	1 1/2	3.8	Misc.		336088
e	4 1/8	10.4	3 7/8	9.8	Misc.		336088
55, *a*	2 x 1 7/8	5.0 x 4.7	2 1/2	6.3	Misc.	2206	336088
b	1 5/8 x 1 1/8	4.1 x 2.8	1 3/4	4.4	326	1724	336088
c	3 x 1 3/4	7.6 x 4.4	2 1/16	5.2	Misc.		336088
56	7 x 3 1/4	17.7 x 8.2	3 1/4	8.2	Misc.		336088
57, *a*	1 3/4 x 1 1/4	4.4 x 3.1	1 1/2	3.8	Trench, E. refuse mound	949	336088
b	2 x 1 3/8	5.0 x 3.4	1 1/2	3.8	290	1038	336088
58	1 1/2 x 1 1/16	3.8 x 2.6	3 1/2	8.8	Trench, E. refuse mound	500	336088
59, *a*	1 x 1	2.5 x 2.5	1 3/16	3.0	Misc.	2206	336088
b	1 3/8 x 1 5/8	3.4 x 4.1	3/4	1.9	Misc.	2206	336088
60	1 5/8 x 2 5/8	4.1 x 6.6	3 1/16	7.7	316	1274	336089
61, *a*	2 1/4 x 1 1/2	5.7 x 3.8			226		336089
b	7/16 (D) x 2 1/16	1.1 x 5.2			Kiva J	710	336089
c	1 1/2 x 7/8	3.8 x 2.2	1 5/16	3.3	Misc.		336089
d	1 5/8 x 1	4.1 x 2.5			Misc.	2266	336089
e	3/4 x 1/2	1.9 x 1.2	2 1/4	5.7	Misc.		336089
f	1 x 7/16	2.5 x 1.1	1 13/16	4.6	316		336089
g	1 x 5/8	2.5 x 1.5	3	7.6	329		336089
62, *a*	1 7/16 x 1 3/4	3.6 x 4.4			Misc.	2206	336089
b	1 1/4 x 2 1/16	3.1 x 5.2			Kiva H		336089
c	1 13/16 x 2 7/8	4.6 x 7.3			Misc.	2206	336089
d	1 1/4 x 2 1/8	3.1 x 5.3			Misc.		336089
e	2 1/16 x 1 1/8	5.2 x 2.8			251	475	336089
f	5 7/8 x 3 1/2	14.9 x 8.8			Kiva E		336089
63	2 x 1 5/16	5.0 x 3.3	1 1/16	2.6	326 (Skel. 5)	1646	336067
64, *a*	1 (D)	2.5	1 3/4	4.4	200	118	336058
b	1 1/8 (D)	2.8	1 5/8	4.1	248	339	336059
65, *a*	6 1/8 x 3 1/8	15.5 x 7.9	7/16	1.1	272	733	335627
b	5 1/16 x 2 3/8	12.8 x 6.0			347, subfloor	2349	335873
66	3/8 (D) x 18	0.9 x 45.7			209	49	335203
67	5/16 (D) x 6 1/2	0.7 x 16.5			226	421	335200
68					330	2210	335196
69	2 13/16 x 7/16	7.1 x 1.1			334	1986	335190
70	7	17.7			298	1118	335205
71	9/16 (D) x 3	1.4 x 7.6			202	76	335219
72, *a*	1/2 (D) x 3	1.2 x 7.6			320	1423	335217
b	1/2 (D) x 3 7/16	1.2 x 8.7			320	1423	335217
c	5/16 (D) x 2 3/4	0.7 x 6.9			304	1169	335224
d	3/8 (D) x 4 7/8	0.9 x 12.3			203	56	335218

(Continued)

TEXT FIGURES—*continued*

Figure	Diameter (D) or length x width, Inches	Diameter (D) or length x width, Cm.	Height or thickness, Inches	Height or thickness, Cm.	Provenience	Field No.	U.S.N.M. No.
72, *e*	½ (D) x 7⅝	1.2 x 19.3			320	1413	335217
f	3/16 (D) x 7⅛	0.4 x 18.0			202	66	335229
74	3½ x 3¼	8.8 x 8.2			299B	1081	335339
75, *a*	3 3/16 x 1⅜	8.0 x 3.4	3/16	0.4	246	368	335232
b	2 7/16 x 2⅜	6.1 x 6.0	3/16	0.4	246	368	335232
76	4¾ x ¾	12.0 x 1.9			Kiva L	1208	335237
77, *a*	1⅞ (D) x 3⅜	4.7 x 8.5			226	377	335244
b	5/16 (D) x 6 7/16	0.7 x 16.3			323	1550	335254
78	12¾ x 1¼	32.3 x 3.1			226	400	335242
79	1½ x 1⅝	3.8 x 4.1			255	415	335229a
80, *a*	1 x ⅜	2.5 x 0.9	1/16	0.1	149	216	335126
b	¾ x ¼	1.9 x 0.6	1/16	0.1	Misc.	2243	335132
c	11/16 x 5/16	1.7 x 0.7	3/32	0.2	Misc.	546	335132
d	13/16 x 5/16	2.0 x 0.7	1/16	0.1	Misc.	2189	335132
e	11/16 x ⅜	1.7 x 0.9	1/16	0.1	348	2342	335133
f	11/16 x 7/16	1.7 x 1.1	3/32	0.2	348	2342	335133
g	⅞ x 7/16	2.2 x 1.1	3/32	0.2	348	2342	335133
h	⅝ x 5/16	1.5 x 0.7	1/32	0.07	Kiva Q	1829	335134
i	⅞ x ⅜	2.2 x 0.9	3/32	0.2	Kiva X	2148	335134
j	⅜ (D)	0.9	3/16	0.4	205	84	335123
k	5/16 (D)	0.7	⅛	0.3	204	123	335123
l	⅜ (D)	0.9	¼	0.6	326	1709	335125
81, *a*, *a'*	1 (D)	2.5	11/16	1.7	290	1030	335139
82	2⅝ x 1¾	6.6 x 4.4	¼	0.6	266, subfloor	820	335575
83, *a*	1¾ (D)	4.4	1⅛	2.8	323	1553	335632
b	2¼ (D)	5.7	1	2.5	Kiva T	1791	335636
84, *a*	7/16 (D) x 1 1/16	1.1 x 2.6			326 (Skel. 8)	1727	335577
b	7/16 (D) x 1 7/16	1.1 x 3.6			326 (Skel. 8)	1727	335577
c	⅜ (D) x 1 9/16	0.9 x 3.9			326 (Skel. 8)	1727	335577
d	⅜ (D) x 1¾	0.9 x 4.4			326 (Skel. 8)	1727	335577
85, *a*	½ (D) x 4 1/16	1.2 x 10.3			266	834	335612
b	2¼ x 7/16	5.7 x 1.1	¼	0.6	298	1153	335614
c	5/16 (D) x 3 3/16	0.7 x 8.0			298	1154	335615
d	13/16 (D) x 4⅝	2.0 x 11.7			Kiva G	861	335618
86, *a*	6 3/16 x 1⅜	15.7 x 3.4	7/16	1.1	6	58	335630
b	⅞ x 9/16	2.2 x 1.4			6	59	335534
87	3⅞ x 2 15/16	9.8 x 7.4	½	1.2	325	1524	335646
88	4½ x 2⅜	11.4 x 6.0	2⅛	5.3	Kiva R	1479	335643
89	4¾ x 1¼	12.0 x 3.1	½	1.2	336	2006	335826
90	3⅛ x 2¼	7.9 x 5.7	1⅜	3.4	Kiva L	1209	336060
91, *a*	1 (D) x ⅞	2.5 x 2.2			326	1730	336080
b	1⅛ (D) x 2	2.8 x 5.0			48		340003
92	2 x 1¾	5.0 x 4.4	1¼	3.1	329	1862	335753

(Continued)

TEXT FIGURES—*continued*

Figure	Diameter (D) or length x width		Height or thickness		Provenience	Field No.	U.S.N.M. No.
	Inches	Cm.	Inches	Cm.			
93	3½ x 2⅜	8.8 x 6.0	1¼	3.1	308	1255	336083
94, *a*	⅞ (D) x 1⅝	2.2 x 4.1			Trench, E. side, W. Ct.	2328	336056
b	13/16 (D) x 3⅜	2.0 x 8.5	1¼	3.1	320	1420	336045
c	1⅜ x ⅝	3.4 x 1.5	¾	1.9	282	1010	336043
d	1 (D) x 3	2.5 x 7.6	1⅛	2.8	Kiva G	860	336052
e	1⅜ (D) x 2⅞	3.4 x 7.3			Kiva R	1497	336053
f	11/16 (D) x 2¼	1.7 x 5.7			Kiva V	1982	336055
g	3⅜ x 1⅛	8.5 x 2.8	15/16	2.3	Trench, E. side, W. Ct.	2358	336056
95	1⅝ (D) x 4¾	4.1 x 12.0			Kiva R	1498	336054
96	8⅝ x 1¾	21.9 x 4.4			Kiva G	859	336051
97, *a*	¾ (D) x 1 11/16	1.9 x 4.2			201	85	336042
b	1 (D) x 2	2.5 x 5.0	1	2.5	332	1797	336047
b'	7/16 (D) x ⅝	1.1 x 1.5			332	1797	336047
c	¾ (D) x 3⅜	1.9 x 8.5	1¾	4.4	Misc.	1157	336057
d	7/16 (D) x ¾	1.1 x 1.9			332	1798	336048
98			See pl. 84				
99			See pl. 85				
100, *a*, *a'*	3⅝ x 2 13/16	9.2 x 7.1	1⅜	3.4	330	2131	336063
b	3⅝ x 2 13/16	9.2 x 7.1	1¼	3.1	350	2214	336062
c	1½ x ¾	3.8 x 1.9	½	1.2	347	2350	336064
d	2⅝ x 1½	6.6 x 3.8	⅞	2.2	E. refuse mound	2205	336065
101	1½ x 1½	3.8 x 3.8			300	1112	335359

APPENDIX B

CANID REMAINS FROM PUEBLO BONITO AND PUEBLO DEL ARROYO

By GLOVER M. ALLEN[1]

Among the bones recovered in the course of excavations at Pueblo Bonito and Pueblo del Arroyo are many limb bones, fragments of skulls, and a few nearly complete skeletons of doglike mammals. A large part of these are from Kivas F and I, Pueblo del Arroyo, with a few from other rooms designated by number. These bones include skulls and leg bones of at least two red foxes (*Vulpes*), a few bones of gray fox (*Urocyon*), other fragmentary skeletons representing at least 30 coyotes and about 12 Indian dogs. A few parts of skulls and limb bones represent also a bay lynx (*Lynx*) and Berlandier's badger (*Taxidea*). Whether the coyotes and the badgers burrowed into the rooms after these were abandoned by the Indians, making use of them for shelter and eventually dying in them, may not be possible to tell, but it is noticeable that nearly all the coyote remains are those of adult or even old animals. The dog bones are nearly all of one type, representing a medium-sized dog with slender muzzle and high, elevated forehead, apparently the same as that I have in a previous paper (Bull. Mus. Comp. Zool., vol. 63, p. 449, 1920) called the Plains Indian dog, or perhaps the long-haired breed (ibid., p. 456). In view of the considerable number of skulls and limb bones available from this single locality, it seems worth while to add the following notes and measurements for comparison with those of similar remains from elsewhere.

Urocyon cinereoargenteus scottii Mearns, Scott's gray fox.—A characteristic piece of the cranium, and a few leg bones were among the fragments submitted.

Vulpes fulva macroura Baird, western red fox.—Two slightly

[1] Dr. Allen, then curator of mammals, Museum of Comparative Zoology at Harvard College, submitted this preliminary report in 1927 and expected to add to it. Ten years later, when advised that I had resumed preparation of the present volume, Dr. Allen wrote that he had no changes to make. The remains he describes were divided equally between the institution he represented and the U. S. National Museum. Dr. Allen died in 1942 without, to my sincere regret, having seen in print this further contribution to his life-long study of the American Indian dog. Miss Barbara Lawrence, of the Museum of Comparative Zoology, has kindly proofread these pages.—N.M.J.

broken skulls and some leg bones from Room 334 agree almost exactly in size with corresponding parts of the eastern red fox, of which, there seems no doubt, *macroura* is to be regarded a subspecies as Bailey has done (North Amer. Fauna, No. 35, 1913).

One of the skulls measures: Palatal length, 68 mm.; back of last molar to front of canine, 64; length of last premolar (p^4), 14; zygomatic width (circa), 73; width outside first molars, 37.5; width outside canines, 22; length of nasals, medially, 48; across frontal shield, 34; occipito-nasal length, 125; basal length (circa), 127; width of brain case, 48.

The limb bones measure: Humerus length, 127 mm.; radius, 110; tibia, 140; femur, 137.

Canis lestes Merriam, mountain coyote.—While bones of wolves are apparently absent from the collection studied, those of a large coyote of the *nebrascensis* type are the most numerous of all the canids represented. Several nearly complete skulls, many jaws, and numbers of limb bones agree in being slightly larger than the corresponding parts of two coyote skeletons from Kansas taken to represent the Nebraska coyote (*Canis latrans nebrascensis* Merriam). In the present uncertain status of the various forms of large coyote, the bones may be referred to *Canis lestes,* typical in Nevada, but supposed to have a wide range to the northward and southward, reaching the Mexican boundary. The skulls are characterized by their long, slender muzzle, low, hardly elevated forehead, and relatively compressed teeth, which are smaller than those of a wolf but larger and sharper-cusped than those of the dog. The limb bones are longer than those of the dog, but much more slender than those of a wolf. At the distal end of the humerus the olecranal foramen is always a large perforation, whereas in the Indian dogs it is usually much smaller, or it may be entirely filled in by bone. In the tables following are given the dimensions of several of the less-broken skulls as well as measurements of limb bones.

The longest of associated metapodials measured 81 mm.; transverse width of atlas, 71; greatest length of scapula, 126; its width, 60.5. In one case a third lower molar, instead of having a simple peglike root, had this portion nearly divided by a deep vertical groove.

Since most of the coyote skulls were of full-grown adults, it is assumed that some of the variation in size is correlated with sex, the smaller bones probably those of females. A large part of the bones are somewhat injured at the ends, so that a relatively small number were sufficiently perfect to measure.

Canis familiaris Linnaeus, Indian dog.—Two nearly complete skeletons were found in addition to four other skulls in fair condition, as

*Measurements of coyote crania (mm.)**

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
Occiput to gnathion	..	..	..	..	199	203	..	..
Basal length	..	..	..	..	177	182	..	..
Palatal length	98	96	93	94	..	..	96	..
Length, back of p^4 to front of canine	73	72	68	68.5	68	73	..	72
Length of p^4	20.2	20	20.5	19.5	20.5	21	20.3	20
Zygomatic width	..	..	94	99	..	..	..	..
Width outside first molars	54	55	54	53	57	57	58	56
Width outside canines	32	31.5	30+	29	33	32	34	..
Mastoid width	61	..	..	..	62	68	..	61
Width of frontal shield	..	43	..	..	52	..	51	..
Width of occipital condyles	35	..	..	..	..	..	35	..
Width of brain case	..	..	..	..	57	56+	59	63

* Pueblo Bonito: *a* is Field No. 1484, shallowly buried in Kiva R; *b-d* are from debris of occupation in Room 334. Pueblo del Arroyo: *e, f, h,* from Kiva I; *g,* unidentified.

Measurements of coyote jaws †

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
Condyle to front of alveolus of incisor	144	132	139	140	146	148	150	150
Back of last molar to front of canine	99	92	95	96	99	102	102.5	102
Length of first molar	23	22.5	22.5	22.5	21.5	23.2	23.5	23.5

† Pueblo Bonito: *a* is part of No. 1484, Kiva R; *b-d,* from Room 334; *e,* from Room 323. Pueblo del Arroyo: *f-h,* from Kiva I.

Measurements of coyote bones

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
Humerus, length	151	157	158	156	162	163	163	167
width distally	32.5	29	29	27.5	29	29	29	29.5
Radius, length	164	170	171	172	174	175.5	162	180
Ulna, length	175	119	190	196	196	203	195	...
Femur, length	164	170	180	180	182	178	...	...
width distally	31	29	29	30	30	29	...	...
Tibia, length	170	169	181	184	185	188	195	188
width of head	33.5	30	32.5	30	31	31.5	31	34
Fibula, length	151	...	...	...	...	...	...	...
Pelvis, greatest length	123	129	129	142	...	...	...	...

well as a number of associated limb bones, which are clearly of the domestic dog. One nearly perfect skull is that of a puppy with milk dentition. The skulls are all of one type, representing the common, medium-size breed of dog, probably here similar to what I have called the Plains Indian Dog, or the long-haired variety such as Dr. Kidder and Mr. Guernsey found mummified at White Dog Cave, Arizona.[2]

[2] Pap. Peabody Mus. Amer. Archaeol. and Ethnol., Harvard University, vol. 8, No. 2, p. 44, 1921.

It has a skull considerably smaller and with smaller teeth than the coyote's; the forehead is well elevated above the plane of the rostrum; the muzzle is rather slender and delicate; and the brain case has a strong sagittal ridge, which is reduced slightly behind at the occiput. The lower jaw, in addition to its smaller size and shorter-crowned carnassial, usually differs from that of the coyote in having the tooth row much more obviously bent outward with the apex of the bow at the region of the first molar. One of the skeletons is that of an immature dog with the epiphyses still free, a smallish animal; another differs from the other specimens in being much larger and heavier-boned, with stout jaws, and a large skull, with, however, the usual high forehead and strong sagittal crest. It is so different from the other remains that it might be thought to represent another breed of dog. The associated limb bones, presumed to belong to the same individual, are longer and heavier than usual, about equaling those of a coyote in length, but not so slender. The humeri are widely perforate distally. The dimensions of this specimen are those given last in the following tables. The possibility that this was a hybrid between dog and coyote may not be overlooked, but although such crosses are said to occur, no skeletons of these mongrels are available for comparison. A few among the limb bones referred to dogs are much shorter than the average and may represent a smaller breed, or perhaps smallish females, but no evidence was found of any dog of the smaller type—"techichi' or short-nosed dog (*"Pachycyon"*). In most of the humeri, the olecranal perforation was relatively less than in the coyote; in some cases it was very small and again was absent altogether, a trait common in the American Indian dogs. No abnormalities in the number of teeth were noticed.

These dimensions are slightly smaller than those published in my previous paper for dog remains from Pecos, N. Mex., and from San Nicolas Island, Calif.; but in size of teeth agree with those of the short-legged dog of the eastern and northern parts of America.

The scapula measured in two specimens is 101 mm. in greatest length, and 52 mm. in greatest width. The pelvis is 120 and 122 mm., respectively, in two cases, but in the large dog mentioned is 149. The length of the longest metapodial is 60 to 62 mm. There is some variation in the details of the cusps on the teeth; in one case the anteriormost lower premolar has a small secondary cusp. Compared with limb bones from eastern United States these New Mexican bones are considerably shorter than those of the larger Indian dog, but agree very well with what I have called the short-legged Indian dog, except for the large specimen, which equals the former in size.



PLATE 101.—Dog skeleton on floor of Kiva F, Pueblo del Arroyo. (Photograph by O. C. Havens, 1925.)

*Measurements of Indian dog crania, Pueblo del Arroyo (mm.)**

	a	*b*	*c*	*d*	*e*	*f*
Occiput to gnathion	161	162	166	168	173	185
Basal length	146	146	147.5	146	149	168
Palatal length	..	82	83	82	83	95
Back of p^4 to front of canine	56.5	72	60	56	58	69
Length of p^4	16.5	17	17.5	17	16	22
Width outside first molars	..	59	58±	56	58.5	67
Width outside canines	..	35	34	..	33	42
Width of brain case	51	55	50.5	53	53	58
Mastoid width	59	58	59	59	58	69
Width of condyles	..	..	..	31	32	41
Zygomatic width	..	..	90	93±	..	..
Width of frontal shield	45	..	..	47	..	..
Jaw, condyle to base of incisor	122	120	125	124	125.5	144
Back of last molar to front of canine	81	81	84	80	80	96
Length of first lower molar	19.6	20.5	21	20	18	25.5

* *a*, from Room 37; *b*, Kiva I; *c-e*, Kiva F, *e* (No. 484) being seen in situ on plate 101; *f*, unidentified.

Measurements of Indian dog bones

	a	*b*	*c*	*d*	*e*	*f*
Humerus, length	...	130	140	127	119	158
width distally	23	28.5	27.5	22	25	35
Radius, length	119	129	115	126	139	159
Ulna, length	155.5	153	130	150	...	188
Femur, length	143	...	...	137	148	173
width distally	25.5	...	...	24.5	28.5	34
Tibia, length	148	140	141	141	...	173
width of head	29	28	30	27	...	38
Fibula, length	...	...	126	127	...	158

INDEX

Abraders, 86, 97, 118-124; pls. 25, 26
Agriculture, 59, 60, 68
  See also Farming
Alkali, black. *See* Sodium carbonate
Allen, Glover M., 65, 385
  Canid remains from Pueblo Bonito and Pueblo del Arroyo (Appendix B), 385-387
Alluviation and erosion, alternating, 5, 6
Altar (?) fragments, 275, 276; pl. 78
Altar-stick tassels (?), 272-275; pl. 77
American Museum of Natural History, viii, 27
Amsden, Monroe, ix, 177, 180
Anderson, Capt. R. P., ix
Andesite. *See* Temper, pottery
Antelope, effigies of, 218
  use of, for food and clothing, 64
Architecture, 19, 23, 30-36, 39-44, 46
  doors, 41-44, 46; pl. 8
  Late Bonitian, 19, 30-32, 40-41
  Old Bonitian, 19, 30-32, 40-41
  post-and-mud walls, 30, 34, 40
  slabs on end, 30
  ties with north, 32-35
  ties with south, 33-36
  ventilators, 44, 46
  wattled walls, 41
  whitewash, 41
  windows, 39
Arrowheads, 252, 253; pls. 73, 74
  See also Projectile points
Arrows, 252-253
Arroyo in Chaco Canyon, prehistoric, 3, 5, 13-14
  present, 3, 5, 9, 12, 52, 61
Arthritis, 68, 335
Awls, 66, 140-145; pl. 33
Axes, 239-240; pl. 70
Azurite, 102, 103, 285

Baake, William, xi
Balls, clay, on sticks, 294, 295
Ban, Cecil, ix
"Bark strippers," 146
Basket Maker times, 72, 174, 201, 265
Basket Maker village, 15, 137, 183
Baskets, bark, 172
  bifurcated, 307-316; pls. 85, 86, 87, 88, 92
  burden (carrying), 171
  clay-coated, 321
  coiled, 22, 162-171, 306, 307, 321
  conical, 170
  cylindrical, 105, 166-171, 306, 307; pls. 45, 84, 92
  painted, 306, 321; pl. 84
  plaited, 159-162
  ring, 159-161; pls. 35, 40, 41
Basketry, 159-173
  ceremonial, 306-324
  coiled, 162-165
    bowls, 162-165
    cups, pl. 43
    trays, elliptical, 165, 166, 306; pl. 44
    vessels, pl. 42
Beadmaking, 86-87, 108
Beads, bone, 107, 108, 109
  clay, pl. 21
  shell, 28, 83, 87-92; pl. 21
  stone, 90; pl. 21
  turquoise, 83-85; pls. 9, 19, 22
Beal, Frank, 343, 347, 351
Beam Expeditions, viii
Beams, age of, iii
Bear effigies, 221; pl. 66
Bear meat taboo, 65
Bear remains in Pueblo Bonito, 64, 65, 324
Beds and bedding, 39, 50-51
Bells, copper, 109-115
Benavides, 64, 261
Benches, 47
Beyal, Hosteen, 5, 10, 58, 247, 343-347, 351-353; pl. 3
Bird bones, 263-267; pl. 76
Bird effigies, 296, 297, 333

Bird feathers, 263-267
Black House. *See* Kinklizhin ruin
Blankets, cotton, 72, 73
feather, 72
rabbit-fur, 39, 72, 73
Blom, Frans, ix
Board ends, 156-157; pl. 39
Bone implements, 139-152
Bone objects, 279-280
Bone scrapers. *See* Scrapers, bone
Bonitians, Old and Late, 38
Bottles, gourd, 159
Bowl handle, four-armed, 209
Bowls, basketry, 162-165
pottery, 22, 25, 175, 177, 189-200; pls. 51-56, 58, 63, 69, 82
Bows, 248-251; pls. 71, 72
Bracelets, shell, 94, 107
turquoise, 98; pl. 22
Breazeale, J. F., 11, 59, 60
Bridge, Josiah, 129
Briggs, Lyman J., iv, 111
Bryan, Kirk, geological studies in Chaco Canyon, iv, ix, xi, 5, 6, 13, 14
Burial rooms, 26, 28, 191, 192, 254, 325-345
Hyde Expedition, 337-342
Burials, human, miscellaneous, 336-337; pls. 91-100
infant, 336; pl. 100
intramural, 325-342; pls. 91-100

Calahan, Dolores, ix
Calcite, ornaments of, 101
Canid remains from Pueblo Bonito and Pueblo del Arroyo (Appendix B), 385-389
Canis species, 386-389.
Canteens, 159, 207-208; pl. 65
Canyon del Muerto, 271, 320
Castañeda, 128-129
Cattlemen in Chaco Canyon, 5, 343
Celtlike object, hematite, 283
Chaco Canyon, vii
aboriginal occupancy of, 14-18, 29
arroyo in, 3, 5, 9, 12-14, 52, 61
Basket Maker village in, 15, 137, 183
biota of, 2, 4, 10, 61, 64, 65, 140, 247, 266
Chaco Canyon, cattlemen in, 5, 343
description of, 1-2, 4, 67
discovery and exploration of, 6-9
erosion and alluviation in, 5, 13, 15
floodwater farming in, 52-56
forests in, 2, 3, 344
P1 pit house in, 15, 18, 33, 186, 205
small-house sites in, 15, 33
soil of, 12, 59-61
topographical survey of, ix
water resources of, 4, 9-12, 52, 59, 61, 344, 348
water samples from, analysis of, 11-12
Chaco Canyon National Monument, 1, 8
Chaco Canyon ruins, xii, 1, 4, 8, 15
Chaco game animals, 247, 349
Chaco Plateau, 2
Chaco River, 1; pl. 4
Chettro Kettle ruins, 8, 15
Chischilly-begay, Tom, 55, 56; pl. 12
Chisels, bone, 146
Claystone, ornaments of, 101
"Cliff House" sandstones, 2
Climate, 2, 5, 6, 12, 68, 344
Cloisonné work, 230
Clothes racks, 45, 46
Clothing, 69-80
worn by Tiguas, 1581, 69
Cloud blowers, 299-304
Club heads, pl. 21
Clubs, 259, 260; pl. 12
Cly, Dan, 53, 54, 57
Cockelshell and contents, pl. 89
Collins, H. B., Jr., ix
Conant, Kenneth, ix
Containers, miscellaneous, 172-173
Cooking pots, 186-189; pls. 50-53
Cooper, G. A., 129, 291
Corn, 56, 62, 63; pl. 15
Coronado, 64, 70, 133, 259
Cotton, 69-71
Cougar effigy, 222
Coville, Frederick V., ix, xi, 61
Coyotes, 65, 66, 385-389
Cradle (?), 49; pl. 9
Culinary ware, banded neck, 177, 186
corrugated coil, 179, 187, 197
Cultural relations, 29-38

Culture sequences, terminology used, 15
Cupboards, 46
Cups, concretionary, 283, 284
Cylinders, sandstone, 283; pl. 82
wooden, 276, 277; pl. 78

Daggers (?), 259
Deer, effigies of, 218
use of, for food and clothing, 64
Deer and antelope corral near Escavada Wash, 64, 247
Dibbles. *See* planting sticks
Dice, bone, 279, 280
Digging sticks, 241-243
reworked fragments of, 153, 154
Disks, pottery, 228-229
Dodge, Richard E., x
Dogs, 65, 66, 385-389
Doll (?), wooden, 157; pl. 38
Doors, 41-44, 46; pl. 8
Douglass, Andrew Ellicott, iii, viii, xi, 2, 3, 6, 19, 68
Drawknife, bone, 146; pl. 32
Dress and adornment, 69-116
Drills, 87, 132; pl. 20

Eardrops, shell, 93, 95
turquoise, 85; pls. 9, 19
Effigies, antelope, 218
bear, 221
bifurcated basket, 316-318, 320; pl. 88
bird, 296, 297, 333
deer, 218
earthenware, 216-227, 297, 298, 316-320
frog, 297
jet, 100, 101
human-effigy vessel, 224-227
pottery vessel, 215-227
rattlesnake, 278
stone, 227, 292, 295-298
toad, 223
tortoise, 223
turquoise, 98, 99, 296
wooden "doll," 157
Effigy vessels, 216-227,
Erwin, A. T., 61
Escavada River, 58
Escavada Wash, irrigation ditches on, 58
Expeditions, iii, vii, x, 7-9, 16, 17, 25, 53, 245
annual symposia, x
collections, xi
field staff, ix
Indian workmen, x
reports, iv, xi

Fajada Butte, 4
Farming, floodwater, 3, 52-56; pl. 13
Feathers, 266, 267
color control of, 263
eagle, 266
parrot and macaw, 81, 263-265, 267
prayer, 267
turkey, 263, 266
Fewkes, J. W., vii, 172, 282
Figurines, 199, 295-299
"Files," sandstone, 87, 123
Fire-making, implements of, 152, 153
Fireplaces, 32, 44-45
Flutes, wooden, 305
Forests, ancient, 2-6
Foshag, W. F., xi
Fossils, 291
Footprint, fossil, pl. 100
Friedmann, Herbert, 263
Frogs, effigies of, 297
Fruits, 61-63
Furniture and furnishings, 39, 49-52

Galena, 102
Gallegos, 69-70, 204
Games: basket, 354
foot race, 354
Navaho, 354
pole and ring, 354
shinny, 354
stick, 354
Goodwin, Mrs. James W., xii
Gourds, canteens made from, 159
painted rind, 279
Graves, Old Bonitian, 28
Great Drought, 6, 68
Gregg, Josiah, 6
Grosvenor, Gilbert, iv, viii, ix
Guthe, Carl E., 175

Hammers, stone, 117-118; pl. 24
Hammond, L. C., ix
Hand stones, pl. 27
Haury, Emil W., 87
Havens, O. C., ix, 35
Headband. *See* Tumplines
Hearths, fire-drill, 152-153
Hematite, stick of, 286, 287
Henderson, E. P., xi, 90, 285
Hewett, Edgar L., 56-58
Hoes, shoulder-blade, 243
  stone, 243-245
  See also Tcamahias
Holmes, W. H., vii
Holsinger, S. J., 8, 56, 58
Hosta, Old, 6
Hough, Walter, 39
Household tools and utensils, 117-173
Houses, Late Bonitian, 19, 20, 27, 28, 30-31
  Old Bonitian, 17, 19, 20, 27, 28, 30-31
  Pueblo I pit, 15, 18, 29, 31, 32
  Pueblo II pit, 33, 34, 35
Humeri, scrapers. *See* Scrapers, bone
Hyde, B. T. B., x, 7, 16, 22
Hyde, Frederick E., Jr., 7, 8
Hyde Exploration Expeditions, x, 7, 8, 16, 17, 25, 53, 245

Implements, agricultural, 241-246
  antler, 152
  bone, 139-152; pls. 32, 33, 34, 36, 37
  field and chase, 239-260
  stone, 117-139, 239; pls. 20, 23-28, 30, 31, 70
  wood, 152-159; pls. 38, 39
Irrigation ditches, 55-59, 345, 347, 350; pl. 14
  See also Farming, floodwater

Jackson, W. H., x, 4, 5, 6, 10, 13, 346
Jar covers, 22, 127-128, 204, 230; pls. 24, 53
Jar rests (or potrests), 173, 228; pl. 46
Jar stopper, 230
Jars, 204-208; pls. 58, 64, 66
  San Juan kiva, 26
  See also Ollas

Jeancon, Jean Allard, 34
Jet. *See* Ornaments, jet, and lignite
Johnson, David H., xi, 64, 149
Judd, Anne Mackay, xii
Judd, Neil M., iii, iv

Kachina dancers, 261
Kaolin, 184, 185, 286
Kellogg, Remington, xi, 64
Kidder, A. V., vii, 35
Kin Yai ruins. *See* Pueblo Viejo
Kinbiniyol ruin, 1, 56
Kinbiniyol Valley, 55; pl. 13
  irrigation, 56, 57
  Juan's Lake, 55
  Navaho farms, 55-56
King, P. B., 129
Kinklizhin ruin, 57
Kirk, Edwin, 129
Kiva Q, 21, 27, 130, 176
Kiva R, 27, 66, 268
Kivas, Great, 35, 36
  Old Bonitian, 33-34
  pre-Zuñi at Hawikuh, 35, 37
  under West Court, 176-177
Knives, 128-131, 289; pl. 28

La Gorce, John Oliver, ix
Ladd, Robert N., xii
Ladders, 42
Ladles, 201-202; pls. 61, 62, 69
Linsley, A. H., ix
Loom anchors, 155-156; pl. 39
Loom bars, 154-155; pl. 38
Loos, Leta B., xii
Luxán, 62, 70, 190

Macaw clan, 263
Macaws, 263-265; pls. 75, 76
Maize, 39, 64, 132
Malachite, 102, 103, 285
Malcolm, Roy I., 14
Mammals, 64-66, 140, 324
Manos (mullers), 132, 138
Manuelito ruins, 36
Martin, George B., ix, 35
Masonry, 19, 23, 24, 26, 30, 34; pls. 5, 7, 8, 14
Matriliny, 40

Mats and matting, 50, 51, 325, 326, 327, 329, 330, 331, 332, 334; pls. 10, 11
Mauls, 240-241
McFarlane, Robert, ix
McLellan, George M., ix
McNaughton, J. B., ix
Mealing bins, pl. 29
"Medicine stones," 286-289, 291
Meggers, Betty Jane, xii
Meggers, William F., 111-115
Menefee formation, 2
Mental telepathy of Indians, 84-85
Merriam, C. Hart, ix
Mesa Verde mugs, 26; pl. 7
Metates (mills), 132-138; pls. 26, 30, 31
Mica, 102
Micaceous schist, 291, 292
Miera y Pacheco, Don Bernardo, map, 6
Miller, G. S., Jr., xi
Milling bins, 133-134
Milling stones. *See* Metates
Mindeleff, Victor, x, 6, 39, 40, 41, 48, 49
Minerals, 280-294
Morgan, Lewis H., 6
Morley, Sylvanus G., vii, ix
Morris, Earl H., vii, 33-35, 172, 234, 271
Morrison, Lt. C. C., 57
Mortars, 139; pl. 82
Morton, C. V., xi, 61
Mosaics, 104-105
Mountain-lion effigies, 222, 295; pl. 83
Mountain-lion remains, 64, 65, 324
Mugs in Room 32, 26; pl. 7
Mummy Cave Tower, 271, 320
Musical instruments, 304-306
  flutes, wooden, 305
  trumpets, shell, 305-306
  whistles, bone, 304-305

"Napkin rings," 227
National Geographic Society, Beam Expeditions, iii, viii
  Chaco Canyon reconnaissance, iii, vii
  Committee on Research, iii, iv, viii
National Geographic Society, Pueblo Bonito Expeditions, iii, vii, 8-9, 175
Navaho in Chaco Canyon, 3, 4, 14, 67, 343, 350
  (Hosteen Beyal), 5, 10, 58, 247, 343-347, 351-353
  Mexicans and, 347, 350
  Noqoilpi story, 351-354
  (Old Wello), 5, 83, 247, 343-345, 349
  (Padilla), 343, 347-350, 353, 354
  Utes and, 346, 350
Navaho irrigation ditches, 57-59, 347, 350
Necklaces, 84, 85; pls. 9, 19, 20, 22, 98
Needles, bone, pl. 34
Nelson, N. C., 16, 17, 232

Ocher, 286
Ollas, 204-207; pl. 64
Ornaments, 80-109; pls. 9, 19, 21, 22
  bone, 107-109
  calcite and selenite, 101, 102
  clay, 90; pl. 21
  claystone, 101, 102
  fluorite, 103
  jet, 99, 100, 101; pl. 22
  lignite, 101
  manufacture of, 86-87, 97
  miscellaneous, 103
  potsherd, 104
  seed, 90, 103
  shell, 28, 81, 83, 87-96, 107; pl. 21
  stone, 83, 84, 87, 90, 91, 101-103; pl. 21
  turquoise, 81-85, 88, 89, 96-99; pls. 9, 19, 22
Osteoporosis symmetrica, 68, 328, 335

Padilla (Navaho informer), 58, 59, 343, 347-350, 353, 354; pl. 3
Paints, 115, 186-190, 283-286
Palette, paint, 285
Palmer, Edward, 129
Parrot feathers, 263, 264
Parsons, Elsie Clews, 262, 269
Peñasco Blanco, 5, 58
Pendants, 85, 90, 93-96, 99, 102, 104, 229; pl. 22

People, 18-29, 36, 179
Late Bonitians and Old Bonitians, 38
Pepper, George H., ix, 7, 8, 16, 22-27, 45, 47, 51, 64, 124, 172, 202, 267, 271, 272
Pine trees, 2, 3; pl. 2
Pins, bone, pl. 34
Pipes, 299-304
Pitchers, 22, 25, 127, 177, 191, 202-204; pls. 6, 52, 57, 63, 69
Plan, 16, 17
Planting sticks, 241
Plants, xi, 61-63
Plume holder, clay, 293, 294
Polishers, pottery, 125
Potatoes, wild, 63
Potrests, (or pot rings). *See* Jar rests
Pots, cooking, 177, 181, 186-189, 198
Potsherds, 104, 177, 178, 181, 209, 228; pls. 48, 49, 62
Pottery, 21-28, 31-34, 127-128, 174-238; pls. 24, 48-58, 63, 69
ancestral Zuñi, 36
basket imprinted, 198-199; pl. 52
black-on-white, 184, 204, 228
black rim line, 33, 178, 191
brown-with-polished-black-interior, 197, 198
"Chaco-San Juan," 21, 179, 180, 183, 190, 198, 203, 231, 232; pl. 49
Corrugated-coil, 21; pl. 52
foreign, 195; pls. 50, 58
"Gallina," 196
imported, 194-195, 232-233
Late Bonitian, 21, 22, 179-180, 201, 203, 206, 231, 203, 205, 206; pl. 50
Little Colorado polychrome, 36
"Mancos black-on-white," 33
"Matte" decorated, 196, 197
"McElmo black-on-white," 194, 206
Mesa Verde, 21, 179, 180, 232; pl. 58
miniature, 191, 214-216; pl. 69
Old Bonitian, 21, 22, 32, 178-180, 201, 203, 205, 206, 208, 231; pl. 50
Pottery, painted, 177, 178, 200
Plain-banded, 21
pre-Pueblo, 177, 191; pl. 48
San Juan, 36
Solid, 21
straight-line hatched, 178, 180, 233, 234; pl. 49
stratigraphy of, 16, 176-180, 230-232
terminology of, 177
"Transitional," 21, 30-32, 36, 177, 178, 183, 191, 205; pl. 48
Tularosa black-on-white, 36
"typical" Chaco, 233
Prayer feathers, 267
Prayer meal, 261
Prayer sticks, 261-272
Projectile points, 253-257; pls. 73, 74
Provenience of objects illustrated, 365-384
Pueblo Alto, 2, 354
Pueblo del Arroyo, vii, xi, 4, 7, 8, 9, 13, 185, 199, 207, 244, 385-387; pl. 4
canid remains from, 385-387
Pueblo Pintado, 1
Pueblo Viejo, 1
Pueblo Wejegi, 4
Punches (?), bone, 145-146
Putnam, F. W., 7

Quartz crystal, 289

Rabbits, 64, 141, 246
Rattlesnake effigy, 278
Reeside, J. B., Jr., 129, 291
Rehder, Harold A., 89
Religious articles, 261-324
Religious ceremonies, 261
Ribs, worked, 146; pls. 32, 33
Rings, 106, 107; pl. 22
Rio Chaco, 4
Rio San Juan, 1
"Roads," prehistoric, 346, 347, 350
Roberts, Frank H. H., Jr., ix, 15, 34, 36, 177, 184
Roberts, Henry B., ix
Root, W. C., 110-111
Rowland, Lucy H., xii
Ruppert, Karl, ix
Rubbing and smoothing stones, 125; pls. 25, 27

Sacrificial offerings, 65, 83, 89, 90, 95, 99, 254, 255, 322-324, 327-329, 331, 332, 334
San Juan kiva jar, typical, 26
San Juan River, 2, 5, 29, 34, 35, 37, 281
Sandal designs, 40, 41, 74, 75, 281-283
Sandals, 73-80; pls. 16-18
Sanidine basalt, 181-183
Saws, sandstone, 124, 125, 130, 131
Scofield, Carl L., ix, 10, 11, 59, 61
Scrapers, bone, 146-151; pls. 32, 36, 37
  end, 146-152; pl. 32
  stone, 131, 132
  pottery, 153, 184, 185, 228; pl. 38
Selenite, ornaments of, 101, 102
Setzler, Susan P., xii
Shale, red. *See* Claystone
Shamel, Harold H., xi, 64
Sheldon, Charles, ix
Shells, 89
Shelves, 45, 46
Shepard, Anna O., 181-183, 234-238
Shields, 260
Silicified wood, use of, 292
Simpson, Lt. James H., 1849, 4, 5, 6
Size and provenience of objects illustrated, 365-384
Skeletal remains, animal, 324, 385-389; pl. 101
  human, 326-339; pls. 91-100
Smith, Hugh M., ix
Smith, Philip Sidney, ix
Soil, 12, 59-61
  analysis of, 60
Spatula, wood, 153
Spearhead, "ceremonial," 289, 290
Spears (?), 259-260
Spindle whorls, 153-154, 155, 156
Stamps, earthenware, 229
Staves, *See* Sticks, ceremonial
Stewart, B. Anthony, xi
Sticks, bent, 269, 270
  "Ceremonial," 267-272; pls. 71, 72
  sinew-wrapped, 157, 158
Stone artifacts, 290-293
Stone carvings, pl. 80
Stone implements, 117-139
Stone objects and minerals, 280-294
Stone ornaments, 83, 84, 87, 90-91, 101, 103; pl. 21
Storage, 47-49, 62
Subsistence and living conditions, 39-68
Sudworth, George B., wood identified by, 172

Tablets, sandstone, 121, 125-126, 280-282, 286; pls. 27, 81
Tassels, altar-stick (?), 272-275
Tcamahias, 282-283
  See also Hoes
Temper, pottery, 174, 180-183, 195, 235
Thackery, Frank A., 63
Tiguas, clothing worn by, 69
Toad effigy, 223
Tobacco, 304
Tools, agricultural, 241-246; pl. 71
Torches (?), cedar-bark, 276-278; pl. 79
Tortoise effigy, 223
Toys, 157, 209, 228; pls. 38, 69
Trade, in parrot feathers, 81, 88, 265
  in pottery, 182, 233
  in shells, 81, 88
  in turquoise, 81-82, 88, 265
Trait comparisons, 30-31
Trash, disposal of, 20, 21
Travertine, 287-288
Trays, elliptical, 165-166, 306
Tree-ring dates, xi, 14, 19, 24, 36
Trumpets, shell, 305-306; pl. 82
Tumplines, 171, 172; pl. 46
Turkeys, 66
Turquoise, 81-99; pls. 9, 19, 20, 22
Turquoise necklace, 84, 85; pls. 9, 19, 22, 98

Ulrich, E. O., 129
Una Vida, 4, 58
Urocyon species, 385
Utes, relations with Navaho, 350, 353

Vases, 22, 25, 127, 210-214, 321-322; pls. 6, 67, 68
Vegetables, 61-63
Ventilators, 44, 46
Vessels, pl. 7. (*See also* under names of various kinds of vessels)
Vulpes species, 385

Wall pegs, 46
Walls, 30, 34, 40, 41; pls. 5, 6, 7

Walnut shells, 103
Walsh, Oscar B., ix, 53, 54, 55, 57
Washington, Lt. Col. John M., 4
Water resources, 4, 9-12, 52, 59, 61
Water samples, analysis, 11, 12
Weapons, 258-260
Weather ceremonies, 261
Weaving techniques, clothing, 69
  sandals, 77-80; pls. 16, 17, 18
Wello, Old, 5, 83, 343-345; pl. 3
Wells, Rafael's, 11, 61
  Wetherill's, 10, 12; pl. 4
Wetherill, John, 5, 10, 343
Wetherill, Richard, 1, 7, 8, 9, 58
Wetherill's dam, 1, 10, 58; pl. 1
Wetherill's well, 10, 12; pl. 4
Wetmore, Alexander, iv, xi, 264
Whistles, bone, 304-305
Whitewash, 41
Windows, 39, 44
Wirito's Rincon, 2, 3; pl. 2
Wissler, Clark, viii, ix, x, 16
Woodbury, Richard B., xii
Wooden objects, 157-159, 276, 277; pls. 38, 78
Work slabs (?), 46-47, 126-127
Wrist guards, 258

