Fence Ruin, a small Pueblo III habitation on a ledge in the wall of Moqui Canyon. The structures are situated in the center of the photograph, above the man who is descending into the canyon by a rope.

THE GLEN CANYON:
A MULTI-DISCIPLINE PROJECT

BY JESSE D. JENNINGS AND FLOYD W. SHARROCK

Since 1957 the University of Utah has been engaged in a massive operation to salvage scientific data from areas to be inundated by several large reservoirs. The endeavor began with rather specific objectives to be carried out more or less separately by several disciplines. Through the years, objectives were expanded on the basis of recovered data and the several disciplines became drawn together toward a common objective. This report is an attempt to relate the growth of the Project, from beginning to end.

Enabling legislation (Federal Public Law 485), passed by the 2nd Session of the 85th Congress, initiated construction of several storage basins in the Upper Colorado River drainage. The proposed reservoirs were to lie in Arizona and Utah (Glen Canyon Reservoir), Utah and Wyoming (Flaming Gorge Reservoir), New Mexico (Navajo Reservoir), and Colorado (Curecanti Reservoir). By far the most ambitious of these undertakings was the Glen Canyon. The Glen Canyon Dam lies in Arizona, but behind it, Lake Powell, with a projected shore line of 1,800 miles, lies primarily in Utah.

By the terms of the Historic Sites Act of 1935 (providing for the preservation of historic sites, buildings, objects, and antiquities of national

This report was prepared for and delivered to the University of Utah Faculty Seminar, March 31, 1964, by Jesse D. Jennings, professor of anthropology and director of archeological research in the department. It was revised for publication by Floyd W. Sharrock, assistant director of archeological research, Department of Anthropology, University of Utah. All photographs are courtesy the Department of Anthropology, University of Utah.

significance), funds were provided to the National Park Service[1] to be let on contract to qualified scientific organizations. The University of Utah Department of Anthropology began contracts with the National Park Service in 1957. Subsequently, several University departments were conducting research under these monies.

Thus began the largest, most intensive and comprehensive scientific salvage operation in the United States. Magnitude and intensity of the Project may well be dwarfed one day — we would be disappointed otherwise. But the comprehensive, multi-discipline approach, which is the subject of this discourse, will surely remain a hallmark in the history of scientific salvage endeavor. It could hardly be otherwise simply because nowhere else in the United States is so little known about so many things in so large an area.

To relate the development of the multi-disciplinary approach in its correct sequence imparts an impression that it, like Topsy, just grew. This is not the case. The following discursive account results from the diverse materials presented and an intentional emphasis upon this same diversity. The object here is to describe the job, not summarize it. An attempt to isolate the central theme which supplies a context and establishes some sort of order is relegated to the closing paragraphs.

The full and proper name of the "Project" is Upper Colorado River Basin Archeological Salvage Project. The Project includes all reservoirs of the Upper Colorado River drainage but, in fact, has been concerned chiefly with the Glen Canyon. The aim of the entire Project was to salvage no less than a representative sample of all scientific data thrown into jeopardy by the eventual formation of lakes behind the dams. The enterprise was begun in high romantic hope in an ecstatic state of expectation of adventure — a state of mind soon transmuted to a less emotional, but no less satisfying, recognition of the scholar's task of collecting, ordering, and describing an enormous body of new data even though no earth-shattering "firsts" were in prospect.

There was considerable favorable and helpful publicity about the Project in its early years. Anyone literate could hardly help being at least

[1] Financial support of the Upper Colorado River Basin Archeological Survey Project was provided through annual contracts with the National Park Service. We are particularly indebted to Charlie R. Steen, the Park Service representative during the life of the Project, whose cooperation and vision made the entire agreement pleasant, easy, and friendly. Less frequently, but no less pleasantly, we have dealt with John M. Corbett and Erik K. Reed, also of the National Park Service. Financial support for studies ancillary to the Project was provided by the National Science Foundation, the Wenner-Gren Foundation for Anthropological Research, The University of Utah Research Fund, and the American Philosophical Society. To the above and to the Project staff, other scientists and students — too numerous to mention by name — who have been involved in the Project, we extend our thanks.

vaguely aware that work was in progress. Soon, more and more of the University of Utah faculty became intimately aware of the Project as they were invited to participate, but the more general publicity waned. Published recognition of the work has, of late, been restricted to professional journals and series. So, even though the work of the Project has not been kept continuously in the public eye, except through lectures and programs, it has stayed on schedule and is now, save for several special reports, regarded as complete.

As the Project unfolded and the romance dwindled, the findings increased and in turn created problems, or more properly, questions. And it is pleasing to report that many more findings have resulted or have accrued from the original Project aims than were anticipated in the early stages. These secondary increments to knowledge do not show serendipity so much as they show a need for specialized data after routine study and interpretation of findings seemed to be incomplete or were hampered because the significance of some observations were not understood. Anthropologists, biologists, geologists, and historians who had each gone their separate ways in the beginning began to find themselves lumped as strange bedfellows: to understand their own material well it was essential to understand that of the others.

A word about the basic aims of the Project is necessary before touching on the results. With the complete agreement of the National Park Service representatives, it has been possible to include virtually all relevant aspects of science in the salvage operation. The very first contract called for attention to archeology, biology or ecology, geology and paleontology, and recent — i.e., non-Indian or white — history. Also, at all times the geographical area of concern was defined as the general region rather than being restricted to just those lands lying lower than the projected full-pool limits of the lake. (Contracts of comparable nature have been held by the Museum of Northern Arizona for a segment of the Glen Canyon region.) Such broad subject and geographic coverage has never been included in a contract of this kind prior to the Glen Canyon operation, nor is it anticipated that similar contract coverage will become standard with the National Park Service. Within a couple of years, the contract language extended coverage to sociohistorical studies of dispossessed communities and to the problem of the ethnohistory of the Southern Paiute who once roamed the land of southern Utah.

Although the annual contracts have been generous, it has been necessary to solicit other funds for special jobs — jobs beyond the legal limits of

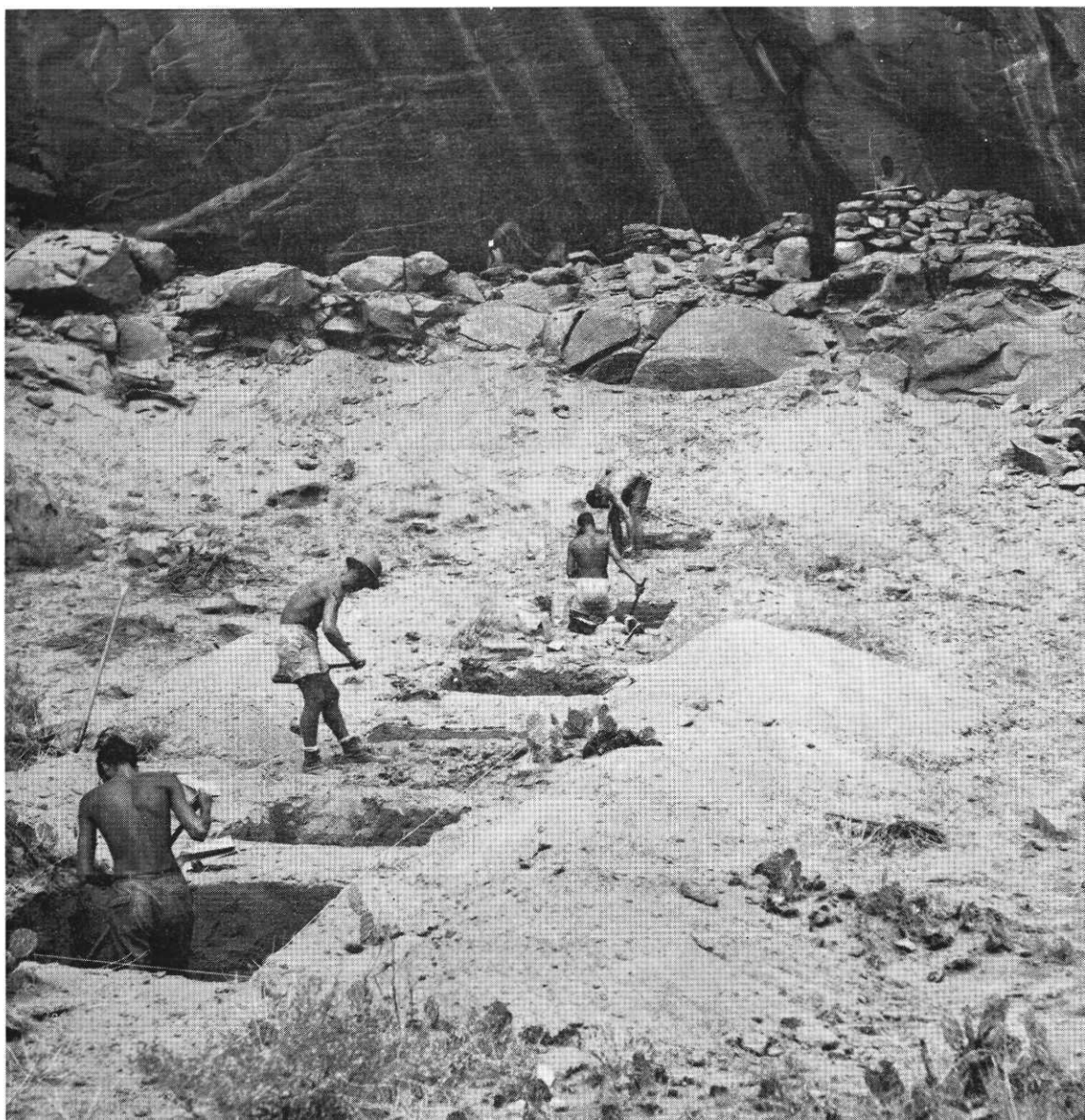
what might properly be called "salvage," such as studies of related museum collections, etc.

As happens in any intensive study of any large unknown area, the Project permitted us to learn new things. But in a sense we knew more when we started than we do now — meaning that our predictions were more grandiose than our discoveries.

In the case of prehistory (archeology) the "learning" amounted to a restriction of our ideas. Bear in mind that by 1959, there had been approximately 52 scientific or pseudo-scientific excursions (beginning with that of John Wesley Powell in 1869) into the Glen Canyon region.[2] Most

[2] William Y. Adams, *Ninety Years of Glen Canyon Archaeology, 1869–1959: Museum of Northern Arizona Bulletin 33, Glen Canyon Series Number 2* (Flagstaff, 1960).

Doll Ruin, in Moqui Canyon. The excavation crew is shown digging an exploratory trench toward the alcove in which several storage and dwelling structures are located.



had simply floated from Hite, Utah, to Lee's Ferry, Arizona. Few journeyed into the hinterlands, and even fewer recorded their observations.

The Glen Canyon is surrounded by extensive, large ruins, such as those centering around Kayenta, Arizona; Mesa Verde, Colorado; and Hovenweep, Utah-Colorado. Hence, there was no reason to assume that similar—or even larger—sites might not also occur in the hidden recesses of the tributaries to the Glen Canyon. This was the "high romantic hope" that failed to materialize. This was soon followed by astonishment that *anyone* could and had lived in this hostile country. Once the grandiose notions were dispelled, the era of prehistoric use revealed no surprises except that it is now seen to have been of shallower time depth (A.D. 300–1250) than expected, and fits our general knowledge of later Southwest prehistory quite conformably. This is to say that the major occupancy of the region was by the Anasazi or northern Pueblo culture. As would be expected from the location of Glen Canyon, the Kayenta, Mesa Verde, and Fremont subcultures of Anasazi are all represented there. All these Anasazi variants are characterized by horticulture — corn, beans, and squash being the staples, and by great ingenuity in utilizing wild species. Masonry architecture and pit houses, extensive development of ceramic and textile crafts, and a highly developed religious ritual are also common attributes of these subcultures. All the evidence points to a simple social organization, with no system of permanent political control and no interest in warfare or other aggression.[3]

Anthropologists have divided the Anasazi into several time periods — Formative, Early Development, Full Developmental, and Classic — on the basis of the cultural increment sequences at centers such as Mesa Verde. In the Glen Canyon the Formative Stage (Basketmaker III, ending *ca.* A.D. 500–600) was poorly represented and was followed by an even more poorly represented Early Developmental Stage (Pueblo I, A.D. 700–900). But during the Full Developmental Stage (Pueblo II–early Pueblo III, *ca.* A.D. 900–1200) there was an extensive migration into and occupance of the Glen Canyon area by Anasazi coming in from the east, south, and north: the Mesa Verde, Kayenta, and Fremont subcultures, respectively. There was little or no evidence of full Classic Anasazi. Thus, use of the canyonlands coincides with the period of greatest Pueblo expansion, and its abandonment seems to parallel the abandonment of other peripheral areas. We have come to think that the Pueblo expansion was

[3] Jesse D. Jennings, "Early Man in Utah," *Utah Historical Quarterly*, XXVIII (January, 1960), 3–27; Jesse D. Jennings, "The Aboriginal Peoples," *U.H.Q.*, XXVIII (July, 1960), 211–21.

a function of improved climate, possibly in combination with new drought-resistant strains of corn (and beans) and the basic scrounging skills of the people. Their genius may have lain simply in high exploitive talents.

After abandonment of Glen Canyon by the Anasazi, the Navajo and Paiute drifted into the area but for several reasons were never as numerous as the Anasazi horticulturalists had been. The prehistoric human use of the Glen Canyon area can be summarized thus:

Paiute 1400 to 1910± (minimal representation)
Hopi 1500 to 1700± (minimal representation)
Developmental Anasazi ? to 650±to 1250 (maximal Glen Canyon occupancy)
Formative Anasazi ? A.D. to 650± (minimal representation)

In history the expected data were recovered but in greater than expected quantity. The Glen Canyon particularly is revealed as having been the scene of exploration and exploitation activities, not greatly different from the story of any other major western stream. The cycle is the familiar one of exploration — in this case begun in 1869 by the famous John Wesley Powell — followed by extensive, though abortive, gold and coal mining ventures.[4] One company (Robert Stanton) even surveyed the gorge as a potential railway passage to the west but this idea was soon abandoned. After the excitement of the gold search abated shortly after the turn of the twentieth century, the entire region was "rediscovered" by a swarm of explorers and adventurers: romantics who learned and reported the natural wonders of the area. The legendary Dean Cummings, of the University of Utah, stands out in this group. By 1900 the Mormon settlements in southern Utah were well-established; concurrent with the ill-fated mining operations and romantic explorations, their cattle were grazing the canyons and plateaus.

Biological researchers had relatively full knowledge of the plant inventory of the canyonlands adjacent to the Glen Canyon. On this basis they were able to anticipate the range of plants and animals of the reservoir area. Hence, no great surprises were in store for the researchers; although vastly extended collections were possible, and the distribution patterns and ecological boundaries were thoroughly and newly worked out.

This summary of the simple, standardized process of accumulation of data fails to convey the more pleasing aspects of investigation and discovery. Regardless of the dimensions of the discovery, finding any "first"

[4] C. Gregory Crampton and Dwight L. Smith, *The Hoskaninni Papers, Mining in Glen Canyon, 1897–1902: University of Utah Anthropological Papers Number 54, Glen Canyon Series Number 15* (Salt Lake City, 1961).

A masonry-walled reservoir at Creeping Dune site. The double wall is approximately five feet thick and stands five to six feet in height above the clay floor. The perforated-slab metering device on the floor at the far end of the reservoir covers a tunnel that leads to an irrigation ditch.

carries with it sufficient reward. Archeological "firsts" were perhaps most numerous for a variety of reasons, the most important being that archeological investigation was most extensive. Several of these warrant mention.

An aboriginal water storage system involving a double-wall masonry storage structure, water metering device, and irrigation ditches is unique and unparalleled in the Southwest.[5] Another phenomenon not known from the archeological literature is the "cactus bake," a practice resembling the "clam bakes" of the East, but seen in Glen Canyon at Benchmark Cave[6] where shallow hearths revealed the baking of succulent young cactus pads over a smothered, hotburning brush fire. This location was interesting, too, in suggesting heavy transient use, but little permanent settlement, of the Glen Canyon proper.

In architecture the research yielded little that was new. Perhaps the double-walled dam at Creeping Dune and the metering device would

[5] Floyd W. Sharrock, David S. Dibble, and Keith Anderson, "The Creeping Dune Irrigation Site in Glen Canyon, Utah," *American Antiquity,* XXVII (No. 2, 1961), 188–202.

[6] The co-author, Floyd Sharrock, has a manuscript in preparation titled "1962 Excavations, Glen Canyon Area."

qualify, but these tend to be engineering or agricultural achievements. The discovery of stairs or steps at a site in Slickrock Canyon, rarely reported, is of interest, as was a house "insulated" by grass placed in the crevice between a double-masonry wall. Within the normal "expected" architectural range all conceivable variations of the masonry hut and the semi-subterranean pit house were encountered. The latter were discovered to span the Formative-Classic stages, refuting prior belief that the pit house was replaced as a dwelling type by above-ground masonry pueblos.

Out of the accumulating data, new problems, interests, and special studies evolved. One of the most interesting results of the Project was the interest taken in it by local artists. Many of the artifacts recovered were exquisite art forms, attractive by almost any set of criteria.[7] Especially noteworthy are the clean, elegant formal properties of the clay pots and wooden objects. By some artists the pictographs and figurines, both of unknown function, have been called the most exciting art forms in North America. Although they are well-decorated and beautiful examples of craftsmanship, most of these objects — even the petroglyphs and pictographs — ought, perhaps, to be thought of as being utilitarian objects with art treatment a secondary consideration. There is no strong evidence that the self-conscious concept of art for art's sake existed among these prehistoric people, unless the placing of new or little used decorated vessels in graves is evidence of this. Even then the primary function of including the specimen would have been toward religious, magical, or some other end, rather than art alone. This statement is not to deny the aborigines an esthetic awareness, far from it. It is merely to remind that in these simpler cultures the artist and the craftsman were combined in one person, and that each object created usually had a cultural purpose beyond the sheer expression of an individual esthetic drive.

Outgrowths of the original biological study were numerous. One, of general nature, was an evapo-transpiration study done by Angus M. Woodbury and his associates.[8] This study involved the identification and mapping of the varying vegetation in each reservoir prior to inundation, in order to estimate the total annual water losses through transpiration under what might be called "normal" or original conditions. This special study was done because the annual loss of usable water from vegetative breathing is, in some cases, greater than the actual evaporation loss from

[7] The Salt Lake Art Center devoted its "Show of the Year" in January 1964 to the material culture from Glen Canyon.

[8] Angus M. Woodbury, Stephen D. Durrant, Seville Flowers, *Survey of Vegetation in the Glen Canyon Reservoir Basin: University of Utah Anthropological Papers Number 36, Glen Canyon Series Number 5* (Salt Lake City, 1959).

the surface of a lake or reservoir. The net gain or loss in water is of extreme importance to dam builders. This evaporation study was among the first to be applied to an entire reservoir pool. However, the techniques and formulae involved were well-known and had been tested.

Again in the field of biology, there is the work in plant identification by Seville Flowers and Walter Cottam, by means of stem cross- and longitudinal-sections. This is an old skill — of a practical nature — practiced more by forest products men than academic types. The species usually thus studied, and readily recognized, tend to be of commercial tree and shrub species. Here the concern was with lowlier and "useless" species, common to the area. From these identifications of the materials used in hoes, sandals, baskets, and houses came considerable new knowledge as to the astonishing range of aboriginal exploitation of the indigenous flora.

In one area of biology, contributions to knowledge were unexpectedly absent. Of the hundreds of pieces of wood — roof-beams and charcoal from burned structures — collected and studied, not one yielded to dendrochronological counting. All submitted archeological specimens were nondatable species — willow, cottonwood, juniper, etc. — the only locally available trees. However, cross-sections from several very old, living trees were donated to the Arizona Dendrochronology Laboratory. Ironically, these proved helpful in interpreting some prehistoric tree rings to the south of the area studied but were useless to us, except as the southern results can be extrapolated to our own area.

A less routine biological special study[9] was an analysis of pollen found in human feces which revealed unsuspected details of diet. For example, squash, beeweed, and cactus pollen, as well as that from maize, are dominant in human excreta recovered from Lake and Moqui canyon sites, as well as from Benchmark Cave. Use of squash blossoms and beeweed as greens or salad and other unusual foods is well-attested by ethnology. All these foods are known to have been eaten by historic Pueblo peoples — the Hopi, Zuni, Sia — but now it is known that they were well-known articles of diet as early as A.D. 1200. Heavy pollen counts of squash and corn were not unexpected because squash flowers were a great delicacy, whereas corn pollen was considered to have medicinal properties. Moreover pollen is abundant on tender corn leaves which were often chewed. The unexpected high counts, in all specimens, of *Cleome* (Rocky Mountain beeweed) leads to an inference that beeweed was actually a crop and should perhaps be added to corn, beans, and squash as one of the normal

[9] Paul S. Martin and Floyd W. Sharrock, "Pollen Analysis of Prehistoric Feces — A New Approach to Ethnobotany," *A.A.*, XXX (No. 2, 1964), 168–80.

cultigens. Actually, there perhaps is no need to plant beeweed. This hardy plant appears as a volunteer wherever the soil is disturbed. It could scarcely be prevented from growing in fields, and the Indians probably let the plants come among the corn and squash and then tended them. Apparently, too, cottonwood catkins were regularly eaten in season — again presumably as greens.

Before leaving the subject of cultivated plants, mention should be made of the hundreds of specimens which provided data bearing on the distribution and age of prehistoric races of corn and cucurbits. These have been studied by Hugh Cutler, director of the Missouri Botanical Gardens, but not yet reported. Evidently Fremont Dent corn is the most common corn variety in the area. It is an eight-rowed, flour corn most closely related to corn from northern Mexico but not found between Mexico and Utah. Its origin is obscure and its route to Utah unknown. The story of maize seems to be very complex — being concerned with hybridization, genetics, archeological stratigraphy, etc., but Cutler thinks he has at least refined the problem.[10] He also thinks that it may well prove impossible ever to read the evidence well enough to tell the full genetic history of corn and the many varieties that exist. This is because corn appears to have derived from countless and repeated hybrid crossings of three grasses — *Tripsacum, Teosinte,* and *Maize* — over a period of 7,000 years.

In addition to the pollen studies, archeological research led to an interesting collaboration with soil scientists and botanists. This study resulted from an interesting introspective incident.

[10] Director Hugh Cutler supplied this information in a personal communication with the authors.

Adult skeletal remains (approximately A.D. 1150) typical of those uncovered in Glen Canyon excavations.

While excavating a large site in Slickrock Canyon, we noticed an odd and apparently exclusive distribution of two species of sage, but noted it merely as odd. Months later, mulling the matter, we wondered if the two distributions were related to soil resources; could the aboriginal field outlines still be preserved in these modern vegetation patterns? On a second visit careful vegetation maps were made, and extensive tests of the soil were run. The results to date are inconclusive, but we still think the hunch was good. Soils supporting *Artemesia filafolia* (old man sage) and prickly pear cactus are slightly different in chemical content, but differences are not such as to constitute proof.

In ethnology major contributions have been made by the Project. One of these was a one-year full-time study of the Southern Paiute by Robert C. Euler. The anticipated published account will include material from several years' previous research on the Paiute by Euler. An equally important contribution is the "discovery" or recovery of the manuscript of a famous Southern Paiute ethnography done by Isabel Kelly over 30 years ago with many informants now dead. This work is a recent Project-sponsored publication.[11] Thus, through the Project effort to learn the full human history of the Glen Canyon area, two highly valuable additions have been made to the long neglected study of Great Basin ethnology.

Some interesting observations have come from microgeology. In two canyons, Lake and Moqui, the archeological record seemed to be combined, or confused, with the record of geological process. For example, the Red Ant Kiva site in Moqui[12] was buried under 20 feet of sediment, and it seemed to have been built and rebuilt while the sediment continued to accumulate. Two others, Dead Tree and Lyman flats,[13] appeared to have been established beside a swamp or bog, and finally to have been abandoned because of a rise in the valley floor with an accompanying extension of the bog limits. The depth of these deposits and the short time span implied by the archeology allow us to guess that this late sedimentation occurred very rapidly. Then, using interpretations based on pollen samples taken nearby, we can suggest that the increased deposition of soil may result from local environmental change as simple as an emphasis shift from gentle winter rain to the torrential showers of summer. Summer storms

[11] Isabel T. Kelly, *Southern Paiute Ethnography: University of Utah Anthropological Papers Number 69, Glen Canyon Series Number 21* (Salt Lake City, 1964).

[12] Floyd W. Sharrock, Kent C. Day, and David S. Dibble, *1961 Excavations, Glen Canyon Area: University of Utah Anthropological Papers Number 63, Glen Canyon Series Number 18* (Salt Lake City, 1963), 79–108.

[13] Floyd W. Sharrock, Keith M. Anderson, Don D. Fowler, David S. Dibble, *1960 Excavations, Glen Canyon Area: University of Utah Anthropological Papers Number 52, Glen Canyon Series Number 14* (Salt Lake City, 1961), 79–107.

bring flood sediment and gullying; this would quickly lead to abandonment of these settlements by the aborigines because the fields would be ruined. This explanation, of course, runs contrary to stereotyped explanations of the causes of Anasazi abandonment of the Four Corners area, an event which is most often blamed on local drought. It is, nonetheless, true that tree-rings are small for a few years after A.D. 1275, but tree-ring growth measures *winter* moisture. Hence, neither the too-wet nor the too-dry theory can be proved or disproved.

Another advance in microgeology also concerns sediment. John T. Hack, a well-known geologist working in northeastern Arizona, has recognized two recent periods of sedimentation in the canyons of the Southwest.[14] One sediment layer, called the Tsegi, was laid down between approximately 1000 B.C. to A.D. 1100–1300. Then, after an erosional period, another formation or layer, the Naha, was laid down sometime after 1300. Maurice E. Cooley, in a 1958 study of the entire Glen Canyon area, thought he recognized these two sediment bodies in Lake Canyon.[15] In 1962, however, John F. Lance, of the University of Arizona Geology Department, made a more detailed study of the entire Lake and Moqui canyon drainage systems, after the archeology had been done and was more or less understood.[16] Lance did not find either the erosional break or the presence of the Naha; moreover, he had chronological control over the Tsegi available because of the archeological materials buried in the upper sediment.

The fact is that Cooley either misread Hack's original findings or interpreted them too rigidly because in some areas, such as Jeddito Wash, Pueblo ruins occur in the Tsegi, as is true in Lake Canyon. What Project research showed, then, is that Cooley may have been mistaken as to the presence of the Naha sediments. It would seem that the local environment of Lake Canyon did not result in extensive local erosion after 1300 A.D. — hence, no Naha sediment. We can now postulate a more or less stable prehistoric climatic rainfall pattern boundary lying somewhere between Lake Canyon and Jeddito Wash, a distance of 100 miles, because the sediment pattern is markedly different. The importance of Lance's work would seem to be that it provides more evidence to add to that already at hand,

[14] John T. Hack, *The Changing Physical Environment of the Hopi Indians of Arizona: Papers of the Peabody Museum of Archaeology and Ethnology* (Cambridge, 1964).

[15] Maurice E. Cooley, *Late Pleistocene and Recent Erosion and Alluviation in Parts of the Colorado River System, Arizona and Utah: Geological Survey Professional Paper 450–B* (Washington, D.C., 1962), 48–50.

[16] John F. Lance, "Alluvial Stratigraphy is Lake and Moqui Canyons," in Sharrock, *et al., 1961 Excavations, Glen Canyon Area: Anthropological Papers Number 63,* 347–76.

A kiva (ceremonial chamber) at the Steer Palace site in Castle Wash. The excavation cut at the right reveals the maximum depth dug by the Indians, which was then floored with prepared clay. The piles of stones forming pillars around the bench supported a ground-level roof.

that the Arizona-Utah line is about where the effect of the Mexican monsoons usually stop. If this is true, attempts to explain Utah geological phenomena with central or even northern Arizona findings will continue to be misleading.

In the sociohistorical field perhaps one of the most interesting undertakings was an extensive study of portions of Daggett County affected by the Flaming Gorge Reservoir. The results of the study were an informative and fascinating combined sociological and historical study, but publication of the findings would be inappropriate since many of the people are still alive. The community was seen to have derived almost entirely from discontended men, essentially cut-off from Utah until very recently by the lack of roads in the Uinta Range. Isolation, and a certain vestigial Old West self-sufficiency rooted in direct action, kept the community

pretty well out of the mainstream of Utah progress. Into this self-sufficient, sometimes brutal, stability, the new community of Dutch John and the creation of Flaming Gorge Dam, both imposed by federal agency, burst with shattering impact. At the polls, at school, in civic affairs, and in buying power, the newcomers who were building the dam dominated the community. The long lake created by Flaming Gorge Dam has actually divided the original Daggett County country physically; the same lake drowned the richest lands and drove many families from old ancestral homes. The frustration, tension, and friction that developed over this situation can scarcely be imagined. These can perhaps one day be ameliorated, but the remembered hardships will keep bitterness long alive. Most of the Daggett County folk did not leave the area, but found new homes on less desirable lands and will continue to resent the social and political tension changes caused by the construction. A report on social behavior under extreme stresses of deprivation has emerged from this study.

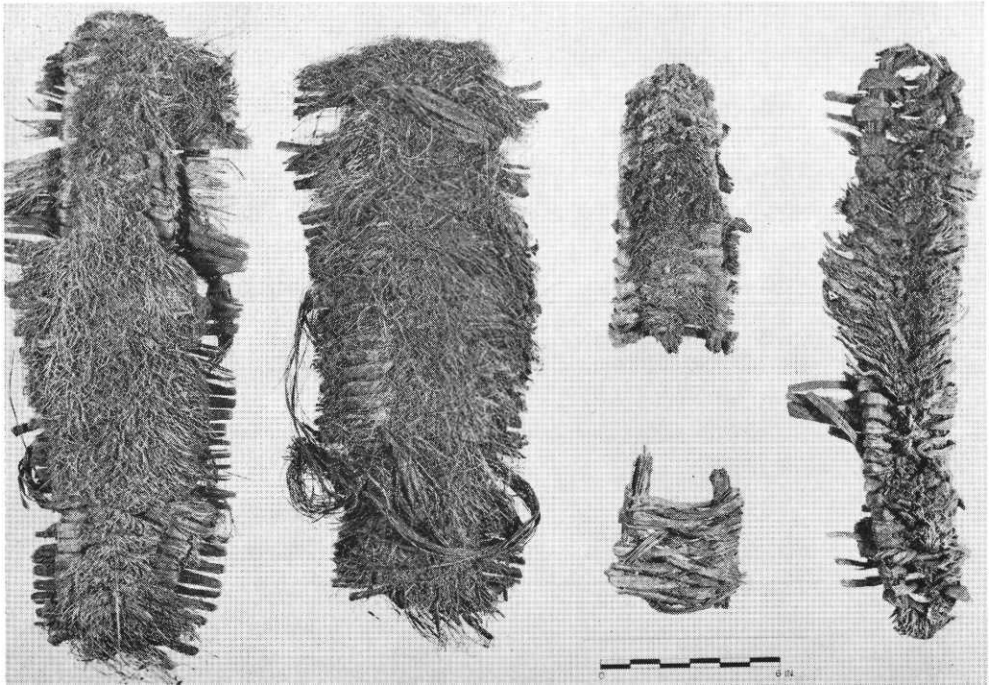
A host of lesser, but no less important, ancillary studies and analyses has also resulted from the Project. We can only mention the cooperation received from chemists in helping through spectroscopy to determine the ingredients of prehistoric paints; the searching for correlations in our data done by the computer center; the yeoman assistance of the Biology Department of the University of Utah in identification of mammal bones; the work of Lyndon Hargrave, of the National Park Service, and William Behle, of the University of Utah, in bird bone and feather identification; and mineral identifications by Norm Williams, of the University of Utah.

Although biological, geological, historical, ecological, and anthropological researches have been considered separately and as separate contributions to knowledge, the core of the study is seen as anthropology. We have called on mammalogists, botanists, ornithologists, and pollen experts in the effort to understand subsistence and diet. The findings of ethnobotanists and ethnohistorians are merely extensions deep into time, but we have thus welded more firmly together two sets of anthropological data — data from the living and dead cultures. Geologists have studied microgeological situations to help us interpret time lapse and localized climate and weather conditions. Soil scientists have investigated a hunch about prehistoric agriculture. Chemists have aided in detection of paint pigment sources and in establishing the genuineness of some pictographs. Computers have helped us arrive at a host of correlations we could never have taken time to learn without electronic help.

One thing to remember is that most of these specialist researchers have worked on problems set for them by other problems. The extent to

Implements of the prehistoric Puebloans. At the top are sickles, which were used in seed gathering. Below are digging sticks, the tips of which were bound to wooden handles. The tools were manufactured from mountain sheep horns.

Sandles from the Glen Canyon. Such footgear was made from yucca leaves with the rough ends turned under to create padded soles.



which their findings have sharpened our perceptions is obvious. We assume that the invoking of so wide a spectrum of skills has been equally fruitful for each of the collaborators.

In all areas the publication record is particularly pleasing. Exclusive of several special articles, 4,978 pages have already been published. These are divided as follows: archeology 2,627, history 741, biology/ecology 1,610. Manuscript on hand in sociohistory and pollen studies, totals 150 pages. There are about eight overdue reports in progress, or in prospect, in history, archeology, ethnobotany, and ethnohistory. These will add approximately 1,500 or more pages to the printed total. Several doctoral dissertations are being derived as well.

It is now apparent that the subtitle of this paper "A Multi-Discipline Project" has two separate meanings in connection with the Project. In the beginning phases of the study, "multi-discipline" meant broad salvage coverage of the several fields first mentioned — biology, geology, anthropology, history. Then as research continued and the aid of specialists was solicited, the "multi-discipline" aspect shifted and became the focusing on special segments from a wide spectrum of knowledge into a single beam to illume better the behavior of men. Either of these uses of "multi-discipline" is legitimate but it seems proper to make their distinctive natures explicit.

Little emphasis has been placed on archeology as such here because the intent was to emphasize the full range of Project research and achievement without dwelling unduly on any one aspect of it. Prehistory has been taken for granted in order to highlight the ancillary developments because these latter have so greatly increased our understanding. Although Project operation has provided raw data for biologists and ecologists, ethnobotanists, ethnohistorians, historians, geologists, climatologists, chemists, and computer specialists, the focus has never wavered from human behavior — the anthropologist's first and only goal. In view of the number of non-anthropologists who have contributed to the study of the Glen Canyon, many may ask the legitimate question, "so what did the anthropologists contribute?" They provided the problem: the study of man.