An Archeological Assessment of Canyon de Chelly National Monument

Western Archeological Center
Publications In Anthropology, Number 5
Other titles in this series:

An Archeological Assessment of Canyon de Chelly National Monument

by
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June 1976

Western Archeological Center
National Park Service   Tucson, Arizona
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ACKNOWLEDGEMENTS

The author wishes to acknowledge the assistance of many people in the preparation of this overview. Special thanks are due to Don P. Morris and to Keith Anderson, without whose support and comments this overview could not have been written. The staffs of the Antelope House Project and of the Canyon del Muerto Survey also deserve thanks; James T. Rock, Robert Hall, Barrie Thornton, James Ambrose, Arthur Dennis, Catherine Kelley, Pamela Magers, Linda Popelish and Jeffrey Zauderer provided valuable information and many useful suggestions. Staff members of the Western Archeological Center and of Canyon de Chelly National Monument provided additional comments and support; thanks are due to George Teague, Judy Reis, Tracy Andrews, Yvonne Stewart, Byron Turpen and Herbert Yazhe. The time and effort devoted by typists Cris Bramley, Norma Bonewitz, Sheila Florio, Kay Herron and Doris Russell is greatly appreciated. Thanks are also extended to John Bancroft for the many hours he spent editing the text and to Joanna McComb and Jeannette Schloss for their illustrations.
ABSTRACT

This overview describes the natural environment of Canyon de Chelly National Monument and summarizes the ways in which it has been used by successive populations. A discussion of the ways in which past environmental conditions may have differed from those of the present and the implications of such differences for the inhabitants of the monument is included. A cultural sequence extending from a Basketmaker II occupation at about AD 300 to the modern Navajo occupation is described; the possibility of earlier occupations is examined. Paleo-Indian, Archaic, Anasazi, Hopi and Navajo cultures are discussed.

The history of archeological research in the monument and its results are also discussed, with a project-by-project summary of archeological research included as an appendix. The archeological potential of the monument has not been exhausted and this overview recommends directions for future research. There is a particular need for explanations of events described in the culture history; hypotheses relating population trends, environmental conditions, settlement pattern and subsistence are offered.
ENVIRONMENT

Canyon de Chelly National Monument is located within the Navajo Reservation in northeast Arizona (Map 1), with its headquarters at latitude 36° 09' N and longitude 109° 30' W. The monument, noted for its scenic, archeological and historical resources, contains spectacular canyons, numerous Pueblo village ruins and the homes and fields of modern Navajo.

Geology

Deep canyons cut into the Defiance Plateau are the most striking geological features of the monument. The plateau is a block of uplifted rock, approximately 160 km long and 65 km wide (Gregory 1916: 34-36). Streams on its surface eroded their channels as the plateau was uplifted, carving canyons into the conglomerates and sandstones that comprise the bedrock. The deepest of these canyons, de Chelly and del Muerto, lie within the monument.

The canyons were cut through three geological formations. The uppermost and youngest is the Shinarump conglomerate, a coarse grey sandstone and conglomerate deposited during the Triassic period (Gregory 1916: 79). The conglomerate forms a resistant cap over the northern portion of the Defiance Plateau. It contains cobbles of basaltic rock, quartzite, chert and petrified wood, which provided material for the manufacture of chipped stone tools by the prehistoric occupants of the monument. They are most commonly found eroded out on the plateau near the canyon rims and in stream gravels in the canyon bottoms.

The Shinarump conglomerate is underlain by de Chelly sandstone, a massive cross-bedded red-brown sandstone deposited during the Permian period (Gregory 1916: 79 and Plate XXI). Within the monument the sandstone is composed of three members (Peirce 1962: 18). The uppermost is referred to as the White House member, which is notable for its large-scale cross-stratification and its tendency to form sheer cliffs. It is about 175 m thick in the monument. The middle member is the Oak Springs member, composed of horizontally stratified dark-colored sandstones and micaceous silty sandstones. It is 14 m thick in the monument. The lowest member is the Hunters Point member, a cross-stratified sandstone that tends to weather into slopes; these underlie talus material in the upper portion of Canyons de Chelly and del Muerto. The Hunters Point member is approximately 60 m thick in the monument. The de Chelly sandstone contains the regional groundwater reservoir (Cooley and others 1969: A38).

Stream erosion of the de Chelly sandstone has formed high overhanging rock shelters; exfoliation along bedding planes due to groundwater seepage has formed lower, deeper recesses (de Harport 1959: 91-95). Both have hosted human activity. The shelters under high overhangs tend to be dry and spacious and were frequently used for habitation and storage. Their dryness has resulted in excellent preservation of organic materials in archeological deposits within them. Data gathered at Antelope House (CDM 10) in Canyon del Muerto show that the high rock shelters are also warmer than unsheltered canyon areas and the plateau, due to heat retention by the shelter walls. These shelters give the monument an unusually high
MAP 1: FOUR CORNERS AREA, SHOWING LOCATION OF CANYON de CHELLY NATIONAL MONUMENT AND OTHER AREAS OF ARCHEOLOGICAL IMPORTANCE.
potential for contributing to the solution of archeological problems requiring the study of organic materials, as demonstrated by recent archeological excavations at Antelope House, which recovered more than 900 kg of vegetal material. Utilization of the lower, deeper shelters, which tend to be damper, was more limited and preservation is less complete.

The lowest and oldest geological formation exposed in the monument is the Supai sandstone, composed of dark red Permian sandstones and shales (Gregory 1916:79). The Supai formation is visible at the base of Spider Rock in Canyon de Chelly and underlies spurs and benches in the canyon bottom to the east. These are often terminated by escarpments 45 to 60 m high. Rock shelters in this formation are small and the overhang is usually low, providing less habitation and storage space than do shelters in the de Chelly sandstone. The Supai formation is relatively impermeable to groundwater (Cooley and others 1969: A38).

Topography

Canyon de Chelly has been divided into three topographic zones (de Harport 1959: 81-87). The lower zone lies between the mouth of Canyon de Chelly and its junction with Canyon del Muerto (Map 2). The height of the canyon walls varies from about 10 m at the mouth to about 140 m at the junction. The canyon walls are vertical and the canyon floor is flat. The width of the canyon averages 400 m, varying from 120 m to 800 m. High overhanging rock shelters are often present on the outside of curves in the channel of the Rio de Chelly, which is braided and occupies much of the canyon floor. Arable land is limited and is generally located on the side of these curves. The channel is usually dry, except for brief intervals following storms. Water, however, can generally be found by digging shallow wells, usually no more than 1 m in depth, in the sand of the channel. During heavy summer storms the soils within the Canyon de Chelly drainage frequently become saturated and further rainfall produces flash floods. Such a flood in the lower canyon can fill the stream bed within seconds. The flow during such floods is erosive and may alter the course of the stream.

The middle topographic zone lies between the mouth of Canyon del Muerto and The Window. The depth of the canyon here varies from 140 m to 265 m; canyon walls are vertical, with some talus at their bases. The width of the canyon averages about 400 m. High overhanging rock shelters in this zone contain some of the larger archeological sites within the monument, White House (CDC 75) providing one example. A number of smaller shelters also are found in this zone; these usually are 15 m to 60 m above the canyon floor and are generally accessible by climbing talus slopes. The stream channel is generally narrower in this zone than in the lower zone, which may account for the larger number of utilized rock shelters in the middle zone; the stream intrudes into sheltered areas less frequently. The channel also is more entrenched in the middle zone than in the lower zone, with eroded banks measuring up to 4 m high. As in lower Canyon de Chelly, the stream channel is usually dry, but is subject to flash floods. Since the Rio de Chelly is more restricted, however, more arable land is available at the mouths of tributary canyons and along portions of both sides of the stream channel. In addition, some of the
MAP 2: MAJOR ARCHEOLOGICAL SITES.
runoff could be controlled before it reached the main channel by terracing talus slopes, which could be put to productive agricultural use in this manner. These factors may partially explain the presence of larger archeological sites in this zone of Canyon de Chelly than in the lower zone.

The upper zone extends from the Window to the head of Canyon de Chelly. The depth of the canyon in this zone varies from 365 m at a location 6.5 km east of Spider Rock to 6 m at the head of the canyon. Talus slopes are much higher and more extensive in this zone of the canyon than in the two lower zones. Most rock shelters are found above the talus slopes, although some small shelters are found in outcrops of Supai sandstone near the canyon floor; both were occupied. High overhanging rock shelters are not as common in this zone; this may have made the upper zones less desirable as a location for large settlements. Few archeological sites in the upper zone approach the size of the larger sites in the middle zone. Arable land is found along both sides of the Rio de Chelly and at the mouths of canyons tributary to Canyon de Chelly. The extensive talus slopes reduce the amount of flat arable land in the upper zone, relative to the two lower zones, but a greater proportion of land is suitable for terracing. Water flow is perennial in the upper zone of Canyon de Chelly, where the stream channel is underlain by the Supai formation. The flow is maintained in part by discharge from the regional groundwater reservoir in the de Chelly sandstone. Downstream from the Supai outcrops the flow percolates into the sandy alluvium (Cooley and others 1969: A38). The stream is deeply entrenched; de Harport noted that eroded banks 3 m to 6 m high are common. Thus terracing, enabling use of talus slope runoff, may have been the most practical means of providing water for crops.

De Harport did not attempt to define zones in Canyon del Muerto because limited time forced him to restrict his research to Canyon de Chelly. Information gathered during the 1975 field season of the Canyon del Muerto Survey, however, suggests that conditions similar to those in the middle zone of Canyon de Chelly extend from the mouth of Canyon del Muerto to Twin Trails Canyon and that conditions from Twin Trails Canyon to the head of Canyon del Muerto are similar to those in the upper zone of Canyon de Chelly. In contrast to the upper zone of Canyon de Chelly, the area above Twin Trails Canyon contains a number of large rock shelters and large archeological sites, including Big Cave (CDM 155) and Mummy Cave (CDM 174).

The bottoms of Canyons de Chelly and del Muerto are thus characterized by considerable variation in topography and water supply. Variation in water supply and in the number and size of dry rock shelters would have been important to all occupants of the canyons; differences in the extent of talus slopes and in the entrenchment of stream channels may have been particularly important to agriculturalists.

Within the monument the plateau exhibits less topographic variation than do the canyons (de Harport 1959: 87-88). The plateau rises from an elevation of 1675 m at Chinle to 2200 m at the eastern ends of the canyons. Areas of exposed bedrock and dune sand are present within 4 km of the mouth of Canyon de Chelly. From this point to a point near Spring Canyon the
soil is sandy and the ground surface is characterized by low undulations. To the east of Spring Canyon low ridges separate alluvial valleys. The edges of the ridges are often low cliffs and the surface relief is more rugged than at the mouth of the canyon. The plateau has no perennial streams.

Climate

Precipitation and temperatures in Canyon de Chelly National Monument show marked seasonal variation. Canyon de Chelly lies on a desert plateau almost surrounded by high mountains. Precipitation, therefore, is relatively low, averaging 245 mm per year at Chinle (Sellers and Hill 1974: 132). The wettest time of year is summer, when thunderstorms develop almost daily. An average of 33 mm of rain falls in July and 43 mm in August. The driest period is usually in June, with a mean rainfall of 7 mm. The mean rainfall for the remaining nine months is 17 mm.

The mean daily high temperature at Chinle is 20.3° C; the mean daily low is 2.7° C (Sellers and Hill 1974: 132). These figures, however, obscure seasonal variation. The mean daily high for July and August is 31.7° C and for January it is 6.5° C. The mean daily low in July and August is 15.0° C, while in January it is -8.0° C. The average interval between the last spring frost and the first fall frost is 146 days. These statistics may be somewhat misleading, however, since Chinle lies at a lower elevation than does most of the monument. Statistics for Lukachukai, which lies at an elevation of 1927 m and is about 40 km north-east of Chinle, may more closely approximate conditions within much of the monument. Lukachukai has a mean annual precipitation of 278 mm (Sellers and Hill 1974: 312). As at Chinle, the bulk of the precipitation falls during summer thunderstorms. The mean daily high at Lukachukai is 18.1° C and the mean daily low is 2.1° C. The mean daily high for July and August is 29.7° C and for January it is 6.0° C. The mean daily low for July and August is 13.5° C and for January it is -8.3° C. There are no figures for the average frost-free interval at Lukachukai.

Hack (1942: 23) has defined four climatic zones for the nearby Hopi country. In the first zone rainfall averages more than 400 mm and the growing season averages less than 120 days. In the second zone precipitation averages between 300 mm and 400 mm per year, with a growing season of more than 120 days. In the third zone precipitation is generally between 225 mm and 300 mm per year and the growing season is longer than 120 days. In the fourth zone rainfall averages less than 225 mm per year, with a growing season of more than 120 days. Hack determined that the third zone is the optimal zone for farming in the Hopi country and that the zone is favored by Hopi farmers.

The climatic statistics discussed above suggest that Canyon de Chelly National Monument lies in an area comparable to the optimal agricultural zone defined by Hack. This may account, in part, for the intensity of occupation of the monument, within which more than 500 archeological sites have been recorded. The canyons, where precipitation is supplemented by discharge from the regional groundwater reservoir into the streamflow, are particularly attractive in terms of their water supply. The growing
season is less than 146 days at Chinle, due to the higher elevations and cold air drainage down the canyons, but it seems to be greater than 120 days. The Navajo guard against crop failure due to unusually late spring or early fall frosts by planting in two stages. Some corn is planted in mid to late April. If not damaged by a late frost, it is harvested toward the end of July while it is still green, avoiding the fall frosts. The bulk of the corn is planted in late May or June and is harvested in September and October. This crop avoids late spring frosts, but may be damaged by an early fall frost. Even if damaged, it may still be harvested and consumed. Overall, conditions in the canyons are quite favorable for agriculture, a fact which may be reflected in W.W. Hill's (1938: 25, 51) observation that Navajo living in Canyon de Chelly tend to rely more heavily on agriculture than do the Navajo of other areas.

Vegetation

Halse (1973) and Ambrose (1975a) have inventoried the plant species found in Canyon de Chelly National Monument. Dennis (1975) has defined seven plant resource groups, or associations of plants presumed to have required distinct methods of exploitation, within the monument. The distribution of these groups is complex and can be accurately illustrated only on large-scale maps, a set of which is on file at the Western Archaeological Center. Map 3 illustrates the four major divisions of vegetation within the Monument.

The Canyon Bottom Communities comprise the first plant resource group. The cooler temperatures and greater water supply as one proceeds up canyon alter the composition of this group slightly and allow units coinciding with the lower, middle and upper canyon topographic zones to be distinguished. Species included in the lower canyon unit include Populus wislizenii (Cottonwood), Salix amygdaloides (peachleaf willow), Amaranthus species (pigweed), Chenopodium berlandieri (goosefoot), Cleome serrulata (bee plant), Opuntia phaeacantha (prickly pear cactus), Phragmites communis (reed), Portulaca retusa (purslane), Quercus species (oak), Sarcobatus vermiculatus (greasewood) and Yucca angustissima (narrow leaf yucca).

Ambrose (1975a) has summarized ethnographic and archeological evidence for the uses of plants found in the monument. The cottonwood and willow were introduced into the canyons for erosion control in the 1930s and 1940s, but species belonging to those genera have been recovered archeologically and are presumed to have once grown in the canyons. At Antelope House cottonwood and willow were used in the manufacture of a number of small and medium-sized wooden artifacts, such as arrow foreshafts, battens, bows and firedrills. Archeological evidence indicates that these trees were also used as beams in construction. Chenopod and amaranth seeds have been recovered from human feces at Antelope House, indicating their use as food (Fry, Hall and Gunn 1975). Ethnographic evidence indicates that the leaves of both plants can be used as greens (Ambrose 1975a: 3-4, 17-18). Cleome seeds have been found in Antelope House feces. Prickly pear fruit, seeds and pads were evidently a major food source for the inhabitants of Antelope House, as Fry, Hall and Gunn (1975: 46) report that cactus epidermis was found in 43% of the fecal samples. Phragmites was used in the brush covering of roofs and pit dwellings and for small wooden artifacts,
MAP 3: MAJOR VEGETATION COMMUNITIES.

CANYON DE CHELLY NATIONAL MONUMENT, ARIZONA

MAP 3: MAJOR VEGETATION COMMUNITIES.
such as pipestems and prayersticks (Ambrose 1975a: 55). Ethnographic evidence indicates that purslane can be used as an herb and that the seeds can be made into a bread or mush (Ambrose 1975a: 60). Portulaca seeds were found in fecal specimens from Antelope House (Fry, Hall and Gunn 1975: 45). Oak was used in the manufacture of cradleboard frames, fetishes and numerous other artifacts at Antelope House. Acorns can be eaten if properly prepared, but there is no evidence that this was done at Antelope House. Greasewood was used in the manufacture of small and medium-sized artifacts, such as awls, arrow shafts and digging sticks. Yucca angustissima was primarily a source of fiber and was used in the manufacture of rope, mats, basketry and sandals (Stier 1975).

The Canyon Bottom Communities in the middle zone contain many of the same species as does the lower zone. The drier terraces support low shrubs and grasses. Juniperus osteosperma (Utah juniper), Quercus gambelii (Gambel Oak) and Acer negundo (box elder) are scattered throughout the Canyon Bottom Communities in this zone. Juniper was heavily utilized by the prehistoric occupants of the monument. At Antelope House the bark was used for padding; wood was used for small artifacts, such as battens. The wood also was a major source of fuel and construction timber. Ethnographic evidence suggests that the berries may have been used as food (Ambrose 1975a: 40). Juniper is more abundant on the plateau, however, and that area is likely to have been the primary source. A wide range of artifacts made from box elder was recovered at Antelope House, including arrow shafts, battens, firedrills, scrapers and atlatls.

The Canyon Bottom Communities in the upper canyon zone include trees with higher moisture requirements than those in the lower zone. These include Alnus oblongifolia (alder), Betula occidentalis (water birch), Juniperus scopulorum (Rocky Mountain Juniper) and Populus angustifolia (narrowleaf cottonwood). Rods and other small artifacts of alder and water birch have been found at Antelope House. Ethnographic evidence suggests that both may have been used in the manufacture of dyes (Ambrose 1975a: 3, 12).

Talus Communities constitute the second plant resource group defined by Dennis. These can be divided into communities which face north and east and communities which face south and west. Northern and eastern exposures support plants of higher elevations and with higher moisture requirements than do southern and western exposures. Pseudotsuga menziesii (Douglas fir) is one example of a species found on northern and eastern exposures. Slopes with southern and western exposures support Juniperus osteosperma at lower elevations and Pinus edulis (pinyon) at higher elevations. Oryzopsis hymenoides (Indian rice grass), Ephedra viridis (Mormon tea), Fendlera rupicola (Fendler bush), Juglans major (walnut), Nolina microcarpa (beargrass) and Quercus turbinella (shrub oak) are also found in the Talus Communities.

Douglas fir was used at Antelope House in the manufacture of wooden artifacts, such as bows, paddles and scrapers, and for roof beams. Ethnographic evidence (Steward 1938: 27; Thomas 1972: 684-691) suggests that pinyon nuts were an important food resource for non-agricultural populations in Nevada and the Antelope House fecal analysis (Fry, Hall and Gunn 1975: 10) indicates that this was also true of some agricultural groups. Pine nut fragments were found in 29% of the fecal specimens. Pinyon, like
juniper, was an important source of fuel and construction timber and is more abundant on the plateau. Indian rice grass seeds can be consumed without processing or can be ground into a flour and made into cakes. Among non-agricultural Shoshoneans rice grass seeds were second only to pinyon nuts in dietary importance (Steward 1938: 104; Thomas 1972: 692-693). Rice grass seeds have been identified in the Antelope House fecal specimens. Mormon tea can be brewed to make a beverage. Fendler bush was used extensively by the inhabitants of Antelope House to make small and medium-sized wooden artifacts, such as awls and arrow shafts. Walnuts can be used for food, although no evidence of such use was observed in the Antelope House feces. Ethnographic evidence shows that bear grass can be used in baskets and as a source of fiber for cordage.

The third plant resource group defined by Dennis, consisting of species found near Springs, Seeps, Stream Margins and Other Wet Places, is scattered throughout the monument, but does not cover large areas. Plants included in this group are Equisetum species (horsetail), Muhlenbergia racemosa (muhly), Scirpus acutus (tule), Typha latifolia (cattail) and Acer negundo. Horsetail stems have been found in human feces at Antelope House and there are ethnographic observations of its use in medicines, bread and mush (Ambrose 1975a: 28). Bundles of muhly stems were excavated at Antelope House and may have been used as brushes or brooms (Ambrose 1975a: 48). Pot rests were also made from muhly. Tule and cattail had a wide variety of uses: mats, cradleboard frames, knots and a number of other artifacts were found at Antelope House. Cattail is now found in a few restricted stands in the upper canyons. It may have been more abundant in the past, as it is quite common among the Antelope House vegetal remains.

The Pinyon-Juniper Continuum, the fourth plant resource group, covers approximately 60% of the monument, although it occurs only on the plateau. This plant resource group can be divided into three parts, characterized by "sparse," "medium" or "dense" pinyon-juniper cover. As implied by the term "continuum," the divisions are not sharp. The "sparse" division occurs at low elevations and is transitional between Low Shrub-Grassland Communities and the denser portions of the Pinyon-Juniper Continuum. This division is characterized by a tree cover of about 10%, dominated by Juniperus osteosperma. Low shrubs, such as Chrysothamnus nauseosus (rabbitbrush), Gutierrezia sarothrae (snakeweeds) and such grasses as Hilaria jamesii (galleta) and Bouteloua gracilis (blue grama) dominate the understory. In the "medium" division of the continuum the tree cover increases to 30% and there is a relative increase in Pinus edulis over Juniperus osteosperma. Artemisia tridentata (big sagebrush) becomes more common in the understory. In the "dense" division the tree cover increases from 30% to 60%, with Pinus edulis continuing to increase in frequency relative to Juniperus osteosperma. Artemisia tridentata dominates the understory. The increasing density of the tree cover and changes in the species composition of the Pinyon-Juniper Continuum are correlated with increasing elevation, increasing precipitation and cooler temperatures as the Defiance Plateau rises from west to east.

The uses of pinyon and juniper have been discussed. Since the continuum covers 60% of the monument and since the density of trees is greater in the continuum than in the other resource groups containing juniper, the
Pinyon-Juniper Continuum would seem to be a significant source of food, fuel and construction material. Ethnographically recorded uses of rabbitbrush include the manufacture of yellow dyes, basketry and the construction of windbreaks and shelters. Snakeweed also has been used to produce dyes and in medicines. Galleta and blue grama have been used for fill in coiled baskets. Blue grama has been used as forage and for brooms and brushes (Ambrose 1975a: 12). With the exception of pinyon and juniper, these materials have not been found among the Antelope House vegetal artifacts or in fecal samples.

Low Shrub-Grassland Communities, the fifth plant resource group, are located along the monument's western edge, generally at elevations below 1900 m. The dominant species is Hilaria jamesii. Chrysothamnus and Gutierrezia are also prominent. The plants in this resource group are rather limited in diversity (Dennis 1975) and utility (Ambrose 1975a). They were infrequently recovered at Antelope House, relative to plants of other resource groups.

The sixth plant resource group, the Sagebrushland Community, is the most uniform of the seven. About 3% of the plants native to the monument occur within this group, with Artemisia tridentata accounting for more than 90% of the ground cover. *Calochortus nuttallii* (segolily), *Delphinium scaposum* (larkspur), *Hordeum jubatum* (foxtail barley) and *Stipa comata* (needle and thread grass) are also found within this resource group. Ethnographically recorded uses of segolily include that of its root as food. Ground larkspur flowers are sometimes used in Hopi ceremonies. Foxtail barley has been used by the Navajo as a ceremonial medicine. The only recorded use of needle and thread grass is by Navajo children at play (Ambrose 1975a: 73). None of the plants of the Sagebrushland Community, except *Artemisia tridentata*, were noted among the Antelope House vegetal artifacts or feces.

The seventh plant resource group, second only to the Canyon Bottom Communities in diversity of species, is found on the Canyon Rims, Cliffs and Ledges. The diversity of this group is due to the influences of elevation and exposure. Its distribution is limited, however, and it is usually not found more than 200 m from the canyon walls. At elevations of about 1900 m, in areas with southern and western exposure, the vegetation includes *Juniperus osteosperma*, *Quercus turbinella*, *Cercocarpus intricatus* (little leaf mountain mahogany), *Artemisia bigelovii* (sagebrush), *Yucca angustissima* and *Yucca baccata* (banana yucca). At higher elevations with northern and eastern exposures plants include *Acer negundo*, *Amelanchier utahensis* (Utah serviceberry), *Fendlera rupicola*, *Philadelphus microphyllus* (mock orange), *Pseudotsuga menziesii*, *Quercus gambelii* and *Selaginella mutica* (selaginella). Ledges of any exposure support *Chrysothamnus* species, *Clematis lingusticifolia* (clematis), *Ephedra viridis*, *Pinus edulis* and *Rhus trilobata* (skunkbush).

Mountain mahogany was used in a number of artifacts at Antelope House, including arrowshafts, awls, battens and digging sticks. *Yucca baccata* wood was used for similar artifacts and for brushes, its leaves were a source of fiber and its seed and pod fragments were found in feces. Mock orange wood was used in slightly larger artifacts, including
digging sticks. Selaginella has not been identified in the Antelope House feces or among the vegetal artifacts and information on ethnographically observed uses is not available. Clematis was not found at Antelope House, but ethnographic evidence suggests a number of uses, including medicines and as a source of fiber (Ambrose 1975a: 20).

The distribution of plant resource groups is a complex mosaic and there is considerable variation in species abundance and diversity. At least two characteristics of the resource groups are apparent, however. The four plant resource groups found primarily in the canyons are more diverse in composition than are the three groups found primarily on the plateau. The canyon resource groups are the Canyon Bottom Communities, the Talus Slope Communities, the communities associated with Springs, Seeps and Other Wet Places and the communities of the Canyon Rims, Cliffs and Ledges. The plateau communities are the Pinyon-Juniper Continuum, the Sagebrushland Community and the Low Shrub-Grassland Communities.

The Canyon Bottom Communities contain 61% of the species known to occur in the monument; the plants of the Canyon Rims, Cliffs and Ledges are second in diversity of species. In contrast, the Pinyon-Juniper Continuum contains 15% of the plant species known from the monument, the Sagebrushland Community contains 3% and the Low Shrub-Grassland Communities contain 18% (Dennis 1975). Given the diversity of plant species in the canyons, their differing environmental requirements and the fact that many different species can be interchanged in the diet or in artifact manufacture, one would expect the canyons to be a focus for human activity, as canyon inhabitants would be insured against potential adverse effects of environmental fluctuation on any one plant resource. These expectations are enhanced by the fact that the canyon bottoms contain moisture-retaining sandy alluvium watered frequently by runoff and discharge from the groundwater reservoir. This is the best agricultural land in the monument. Finally, the availability of rock shelters in the canyons makes them more suitable for habitation, particularly during the winter.

The canyons, in fact, seem to have been preferred by prehistoric agriculturalists. Archeological surveys suggest that the largest archeological sites dating to the period between AD 700 and AD 1300 are found in the canyons. These sites, which contain up to 90 rooms, include Standing Cow Ruin (C. Mindeleff 1897: 98-100), Mummy Cave (Earl Morris 1938) and Antelope House (Don P. Morris 1976a). In contrast, the largest contemporary sites known on the plateau are the 5- to 10-room pueblos reported by Wesley Hurt (1947).

The plateau was not ignored by the inhabitants of the monument, however, due to the wide distribution of the Pinyon-Juniper Continuum, with its high potential yield of firewood, construction timber and pinyon nuts. Pinyon nuts have been ethnographically documented as a high yield staple food (Steward 1938; Thomas 1972). Pinyon supplies gathered during the fall could last a village group throughout the year if the crop was good: Thomas (1972: 684-691) determined that the pinyon crop could support 100 people per township in a good year and 50 in a fair year, assuming a 30% ground cover of pinyon trees. While these figures require adjustment to account for pinyon coverage within the monument (which is not currently known), they are useful indicators of the extent to which pinyon nuts could be relied upon as a food source. The fact that 29% of the human feces
excavated at Antelope House contained pine nut fragments suggests that agricultural populations within the monument considered pinyon an important supplement to their diet of domesticates. There are also indications that earlier hunter-gatherer populations may have relied primarily upon this or some other plateau food resource for subsistence. These will be discussed in the culture history chapter of this overview.

Game Animals

Burgess (1973; Burgess and Cockrum 1970) has listed most of the mammals reported from the monument. Game animals are not now common in the area, as a result of historic hunting. Those listed by Burgess include black bear (Euarctos americanus), mule deer (Odocoileus hemionus), cottontail rabbit (Sylvilagus auduboni), jackrabbit (Lepus californicus) and pronghorn (Antilocapra americana). Black bear sightings have generally occurred in the canyon bottoms. Mule deer have been sighted in the Pinyon-Juniper Continuum and they may once have inhabited the canyon bottoms. Cottontails are found throughout the monument. Jackrabbits are found in dry plains environments, such as the Low Shrub-Grassland Communities. Pronghorns would occur in similar areas and might also be found in less dense portions of the Pinyon-Juniper Continuum (Morris and Thornton 1976: 39).

Analysis of bone recovered from Antelope House (Sparling, Dirst and Hamblin 1975; Morris and Thornton 1976) indicates that the species named above, with the exception of black bear, were the principal game animals hunted by the inhabitants of the village. Deer and antelope provided most of the meat in the diet. Little information was obtained on patterns of selection for certain ages or sex when hunting or on techniques of hunting.

Past Environment

Discussions of the relationships between past human behavior and environmental conditions must consider the possibility that conditions in the past differed from those of the present. Ambrose (1975b: 1), however, analyzed 462 kg of macrovegetal refuse and more than 2400 vegetal artifacts from Antelope House and concluded that the past climate within the monument could not have differed greatly from today's. A drastically different climate would be detectable in a plant assemblage different from that of the present, yet of all the species and genera identified at Antelope House, less than 11% are no longer found in the monument and about half of those may be expected to occur in its immediate vicinity.

There is, however, evidence for a number of climatic fluctuations. De Harport (1959: 97-103; 1591), for example, discussed variations in total annual rainfall, building on Hack's (1942) studies of the alluvial geology of the Hopi region. Alluvial deposits in the Jeddito Valley can be divided into three formations: the Jeddito, Tsegi and Naha. The Jeddito formation is the oldest and was believed by Hack to have been deposited prior to 6000 BC. It contained Proboscidian bones thought to be those of elephants. Deposition of the Tsegi formation began after 4000 BC. Numerous Pueblo II and Pueblo III sites were found on its surface,
leading Hack to conclude that deposition had been completed by AD 1100. Deposition of the Naha formation was believed to have occurred between AD 1300 and AD 1700. The nature of the alluvial deposits and faunal remains associated with them led Hack to conclude that periods of alluviation were moist. The periods of alluviation were separated by episodes of erosion thought to be indicative of a dry climate.

De Harport studied river terraces in Canyon de Chelly and attempted to use archeological evidence to correlate them with the erosional episodes noted by Hack. Three river terraces were defined in the canyon. None were as old as the Jeddito-Tsegi erosional episode. The oldest intruded upon two archeological sites, CDC 251 and CDC 266. De Harport inferred that the date for the formation of this terrace was coterminous with or followed the last period of occupation. Both sites contained Pueblo II sherds and no later types. CDC 266 contained a sherd assemblage datable as late Pueblo II. De Harport, therefore, concluded that a period of erosion began in Canyon de Chelly sometime after AD 1100, the end of the Pueblo II period. This appeared to correlate with the erosional episode between the deposition of the Tsegi and Naha formations. Tree-ring evidence for a severe drought between AD 1276 and 1299, together with Hack's conclusion that periods of erosion in the Hopi country were periods of low moisture, led de Harport to state that the most likely time for the beginning of the period represented by the oldest terrace was the late thirteenth century. No eroded archeological sites were observed on the two later terraces. Again assuming a correlation of erosion with periods of below-normal rainfall, de Harport felt that the middle terrace was formed during one of the periods of drought that occurred in the fifteenth, sixteenth and seventeenth centuries and that the most recent terrace had been formed no more than 70 years prior to his research.

Schoenwetter and Eddy (1964) also investigated the relationship between precipitation and erosion in a study of past environments in the Navajo Reservoir District, New Mexico; their research provides additional evidence for climatic variation in the monument. Eddy, who studied the alluvial history of the district (Schoenwetter and Eddy 1964: 57-60), noted three depositional units in the major drainages. On the basis of correlations with dated strata in other areas, Unit III was dated prior to AD 1, as was the erosional episode which separated it from Unit II. Eddy felt that it might be coeval with the Jeddito formation (Schoenwetter and Eddy 1964: 61). Unit II consisted of fine-grain flood plain silts, indicating a slow-moving river. Archeological materials found within and on top of the deposit led Eddy to date it between AD 1 and 800. Comparison with modern depositional processes in the rivers Eddy studied led him to conclude that the deposits were laid down under a precipitation pattern dominated by winter rain and snow. Unit II was entrenched between AD 800 and 1050. Comparison with modern deposits led Eddy to conclude that entrenchment occurred as a result of a precipitation pattern dominated by summer thundershowers. The entrenched channels appeared to remain stable from AD 1050 to 1550. Deposition of Unit I began about AD 1550 and continued to about 1700. The deposits resembled those of Unit II and were said to reflect similar precipitation conditions. After AD 1700 the rivers in the district began to erode their channels again as a result
of heavy summer thunderstorms and abnormally high fall floods. While differing in detail, these results are consistent overall with Hack's research and with other research in the San Juan and Colorado River basins (Schoenwetter and Eddy 1964: 60-62). This suggests that the process producing the alluvial record were regional in scope and affected the monument.

Schoenwetter (Schoenwetter and Eddy 1964: 98-107) studied pollen samples from archeological sites in the reservoir district and provided information about precipitation patterns. Five major fluctuations in effective moisture conditions were detected. From AD 1 to 400 conditions were wetter than at present. From AD 400 to 700 these conditions were replaced by a climate similar to that of the present. At approximately AD 700 wetter conditions returned briefly. At some time during the eighth century AD, however, conditions became effectively more arid than at present. Between AD 975 and 1050 conditions once again became effectively moister than at present. The pollen record ended at AD 1100. Comparison with Eddy's alluvial study and with pollen studies from other areas led Schoenwetter to conclude that they could most easily be correlated by hypothesizing a shift from a winter-dominant to a summer-dominant precipitation pattern in the eighth century AD, decreasing total annual rainfall from that time until AD 975-1050 and increasing total annual rainfall after AD 1050.

A number of objections have been raised to palynological studies such as Schoenwetter's. These have been summarized by Lytle (1971: 45-54) and involve three main problems. Modern pollen samples have often failed to accurately reflect the vegetation present in the locality from which they were taken. The majority of specimens in archeological samples are frequently unidentifiable, due to deterioration subsequent to deposition, raising the possibility that the remaining identified specimens constitute a distorted pollen spectrum. Finally, most archeological pollen samples, including Schoenwetter's, have been taken from contexts such as house floors, which raises the possibility of distortion due to human activity. In the case of Schoenwetter's study, the possibility of errors introduced by the first two factors cannot be assessed. With respect to the third objection, Lytle does not effectively rebut Hevly's (1964: 106) argument that southwestern pollen studies have revealed similar fluctuations in pollen frequencies occurring contemporaneously in widely scattered areas, seeming to demand more coordination of behavior on the part of southwestern populations than seems plausible. In addition, non-palynological evidence from Canyon de Chelly National Monument indicates that at least the latter part of Schoenwetter's environmental reconstruction is accurate.

Ambrose (1975b) calculated weights per provenience volume for the Antelope House macrovegetal refuse and compared the resulting pattern with dendrochronological data for the monument and for the Southwest as a whole (Robinson and Dean 1969: Dean 1975: personal communication). The results indicated a period of above-average rainfall from AD 1100 to 1129,
during early Pueblo III times. Below-average precipitation was indicated from AD 1140 to 1189, the initial 83% of the middle Pueblo III period. During the period from AD 1250 to 1274, data from Canyon de Chelly suggested that it was experiencing drier than normal conditions, while northeastern Arizona as a whole received above-average precipitation.

An abundance of plant remains in early Pueblo III strata and dendro-chronological evidence for an extended period of above-average rainfall noted by Ambrose are in line with Schoenwetter's hypothesized increase in total annual rainfall after AD 1050. This suggests that Schoenwetter's interpretation should not be casually dismissed. Ambrose lacked a sufficient sample of macrovegetal refuse to make statements about climatic conditions before or after the Pueblo III stage.

Work by Hack, de Harport, Schoenwetter, Eddy and Ambrose, therefore, indicates a series of climatic fluctuations in the monument area. Prior to 6000 BC the climate was probably moister than at present, as indicated by the deposition of the Jeddito formation in the Hopi country and Unit III in the Navajo Reservoir district. An interval of erosion began at about 6000 BC, evidenced by disconformities between the Jeddito and Tsegi formations and Units III and II. Hack felt that erosion ceased by about 4000 BC in the Hopi area, but in the Navajo Reservoir district it seems to have continued until approximately AD 1. This episode of erosion is believed to have been as dry as or drier than the present. Deposition of the Tsegi formation and Unit II followed, under moist conditions and perhaps under a winter-dominant precipitation pattern. In the Hopi area deposition of the Tsegi formation is believed to have continued until AD 1100, while deposition of Unit II in the Navajo Reservoir district appears to have ceased during the eighth century AD, perhaps as a result of a shift from a winter-dominant to a summer-dominant precipitation pattern. In the Navajo Reservoir district conditions became increasingly arid until about AD 1100, when the effective moisture level exceeded that of the present. In the monument, the period between AD 1050 and 1100 seems to be one of above-average annual precipitation, which tends to confirm the interpretation of Navajo Reservoir data. A series of severe droughts follow AD 1100 in the monument and in the Hopi area. These may account for the formation of the oldest river terrace noted by de Harport and for the disconformity between the Tsegi and Naha formations. Erosion ceased between AD 1300 and 1700 in the Hopi area and deposition of the Naha formation began. Deposition of Unit I in the Navajo Reservoir district began at about AD 1550, perhaps under the influence of a winter-dominant precipitation pattern. During this time some areas within the monument have experienced a brief interval of drought and erosion, represented by the middle stream terrace observed by de Harport. Deposition of the Naha formation and Unit I ceased at about 1700, reflecting a shift to a summer-dominant precipitation pattern. Erosion after 1700 probably resulted in the formation of the youngest stream terrace observed in the monument.

While these climatic fluctuations do not appear to have been severe enough to significantly alter plant or animal communities within the monument, they appear to have influenced the behavior of the monument's inhabitants in a number of ways, which will be discussed in the culture history chapter of this overview. Before the above interpretation of
past climatic conditions in the monument area is accepted, however, it will require considerable testing. It is a tentative interpretation based on the limited data currently available. Objections can be raised to the palynological analyses which serve as the basis for much of the interpretation. More significantly, while studies in the monument area have suggested a regional pattern of climatic variation, discrepancies between specific localities in the dating of individual climatic episodes must be resolved, particularly if relationships between environmental conditions and human behavior are to be discussed. Thus it is recommended that research to describe the nature of climatic and alluvial conditions in the monument throughout the span of its human occupation be undertaken. This research must be specific to the monument, since local variations in topography and hydrology influence the consequences of climatic shifts and affect the rate and extent of alluvial processes. Ideally, palynological, geomorphological, dendrochronological and botanical studies should be integrated in a single project to obtain the desired knowledge. Converging evidence from several lines of research would tend to overcome the flaws in any one method. Practically, it may be necessary to synthesize the results of several projects concerned with different time periods, and using a limited number of techniques.

Summary

Environmental conditions within the monument are unusually favorable for human occupation when compared with those of the surrounding area. They include a growing season and average annual precipitation favorable to agriculture. In the canyons, precipitation is supplemented by discharge from the regional groundwater reservoir. The vegetation of the monument includes non-domesticated species, such as pinyon, capable of producing high yields of materials for artifacts, firewood, construction timber and food; it also is diverse and includes species with varied requirements of temperature, precipitation and soil condition, which would tend to protect the occupants of the monument from environmental fluctuations by assuring the continued availability of at least some basic resources. Finally, numerous dry rock shelters suitable for habitation are present within the monument and canyons. These favorable conditions probably account for intensive human occupation of the monument. In contrast, the Chinle Valley to the west of the monument has less water, lacks the productive wild plant species of the monument, has a less diverse plant cover and lacks habitable rock shelters. The Defiance Plateau, on which the monument is located, lacks the diversity of plant species and perennial streams of the canyons and has no habitable rock shelters. While past environmental conditions within the monument do not appear to have been greatly different from those of the present, some fluctuations did occur. Additional descriptive information on these fluctuations, specific to the monument, is needed.
The intense prehistoric occupation of Canyon de Chelly National Monument has attracted the interest of archeologists for more than 100 years. In recent years the historic Navajo occupation has also been a subject of archeological inquiry. This chapter discusses past research within the monument in terms of the development of Southwestern archeology (Longacre 1970) and of American archeology (Willey and Sabloff 1974) to show the relationship between the activities of archeologists working in the monument and the goals of the discipline as a whole. This in turn facilitates evaluation of archeological research within the monument.

1492-1840: The Speculative Period

Willey and Sabloff (1974: 21-41) begin their history of American archeology with the European discovery of America, labeling the period from that time to approximately 1840 the Speculative Period. Archeological research during this period was incidental to such activities as exploration, military expeditions and ethnographic recording. Published reports were marked by unrestricted speculation about the origins of phenomena observed. Willey and Sabloff attribute this approach to a number of causes, the most significant of which were the lack of archeological data and of a tradition of archeological or scientific reasoning.

Because Canyons de Chelly and del Muerto were infrequently visited by Europeans prior to 1840, the Speculative Period is not represented in the literature about the monument, unless one wishes to include Rev. Henry M. Baum's much later work (1903). This was primarily a traveler's account, discussing the identity of Pueblo Indians and cliff dwellers, their characteristics, the time of occupation and abandonment of the canyons and the need for government protection of archeological sites. Perhaps the only correct conclusion drawn in this article was the statement that the cliff and pueblo (ground) structures were built by the same group of people. His population estimate of 15,000 grossly exceeds any other estimates, which vary between 300 and 800 people (Mindeleff 1897: 196; de Harport 1959).

The time of occupation and abandonment of the monument, as well as the cause of abandonment, are incorrectly equated with a period of widespread volcanic activity in the Southwest. Finally, Baum's well-intentioned efforts to establish government protection of the monument's archeological sites resulted in the appointment of Charles Day as custodian. Baum viewed Day as a competent custodian, but Day's pot-hunting activities discouraged archeological work in the monument for another 20 years (de Harport 1959: 148-150; Wilken 1955: 127-128; Earl Morris 1938: 129).

Baum's faulty conclusions resulted from the use of partial and elliptical explanations, in which important assumptions were left unstated and could not be critically evaluated. This sort of thought was characteristic of the Speculative Period. The fact that Baum's work does not fall within the chronological boundaries of the period proposed by Willey and Sabloff serves to illustrate their point that the phases are primarily stages of intellectual development, rather than strictly chronological periods.
1840-1914: The Classificatory-Descriptive Period

The next phase of American archeological research, Willey and Sabloff's (1974: 42-87) Classificatory-Descriptive Period (1840-1914), was characterized by a focus on the description and classification of archeological materials, particularly architecture. It coincides with the "Cushing-Fewkes" period defined by Taylor (1954) and discussed by Longacre (1970). Willey and Sabloff attribute the change in intellectual orientation to the accumulation of additional data, enabling inductive ordering procedures to be employed; to the development of archeological classificatory models in Europe, and to efforts to train professional anthropologists.

This period is well represented in the literature of the monument. The earliest explorations of the area were conducted by military expeditions, which occasionally included individuals with scientific training in order to maximize the quantity and quality of information obtained. An expedition under Maj. Robert Walker marched 10 km into Canyon de Chelly in September of 1847, but it does not appear to have recorded any archeological information (Bailey 1964: 12-13; McNitt 1972: 124-127). An expedition led by Lt. Col. J.M. Washington passed through the area in September of 1849, during which reconnaissance of Canyon de Chelly was made under the leadership of Lt. James H. Simpson of the Corps of Topographical Engineers, who kept a record of the exploration (McNitt 1964: 89-98). His party explored de Chelly to a point 15 km above its mouth, where exhaustion of the horses forced the group to turn back. Simpson explored Cottonwood Canyon, recording ruins there and at several other points in de Chelly. He briefly described White House (CDC 75) and called attention to similarities between masonry there and in the pueblos of Chaco Canyon, which also were noted by later researchers (de Harport 1959: 1555). Some of Simpson's information apparently was used as a basis for a brief description of Canyon de Chelly written in 1860 (Domenech 1860: 200-201).

An expedition under the command of Col. Edwin V. Sumner entered Canyon de Chelly in August of 1851, but he appears to have recorded no information of interest to archeologists (de Harport 1959: 133; Bailey 1964: 33-34; McNitt 1972: 193-199). This was also true of an expedition led by Lt. Col. Dixon S. Miles in September of 1858. Mile's troops entered Canyon de Chelly by way of a trail in the vicinity of Monument Canyon and marched to the mouth (Bailey 1964: 91-92; McNitt 1972: 333-362).

Some archeological information was gathered during Col. Kit Carson's 1863-64 campaign against the Navajo. A detachment of troops under Col. A.W. Pheiffer marched down Canyon del Muerto from the Tsaile area, while Carson scouted the north rim of del Muerto and the south rim of de Chelly. Pheiffer's report contains a brief description of Mummy Cave (CDM 174), which Pheiffer called Carey's Castle in honor of the expedition's quartermaster, Asa B. Carey (de Harport 1959: 134-135). Pheiffer camped in del Muerto; a Spanish inscription with the name Jose Peña, the initials N.M.V. (for New Mexico Volunteers) and a date of January 1864 may mark the site of the camp. It is located at the mouth of a small side canyon between Standing Cow Ruin (CDM 4) and Twin Trail Canyon.
The first specifically archeological research in the monument was undertaken during the 1873 Wheeler survey. L.H. O'Sullivan, photographer for the survey, visited the canyons and photographed White House. The survey publication (Putnam 1879) included one photograph of White House, as well as a description drawn from Simpson's journal and some additional information from O'Sullivan's notes. The photograph of White House was reversed through a photographer's or printer's error.

Cosmos Mindeleff (1897: 80) mentioned an account of a visit to the canyons by J.H. Beadle in 1878 and James Stevenson made ceramic collections in the area about 1880 (Stevenson 1883), but the next major archeological project in the monument was a survey in 1882, led by Col. James Stevenson and sponsored by the Bureau of American Ethnology. Canyon de Chelly was explored at least as far as Monument Canyon and 24 km of Canyon del Muerto were surveyed. Specimens were collected at Big Cave (CDM 155) and Mummy Cave. Mummy Cave and Canyon del Muerto were named when two dessicated human burials were found in a cist in the talus slope in front of the cave (Stevenson 1886). A total of 46 sites, 29 in Canyon de Chelly and 17 in Canyon del Muerto, were visited by the Stevenson expedition. Sketches, ground plans and photographs were made, but publications discussing the results of the survey were limited to short accounts lacking illustrations (Powell 1886; Stevenson 1886).

The survey was productive, despite the lack of published results, because it convinced Victor Mindeleff, a member of the survey party, and his brother Cosmos that the archeology of the canyons was sufficiently interesting to warrant further study. The Mindeleffs returned to the canyons in 1883 and 1885 (Powell 1887, 1891; C. Mindeleff 1897) in order to conduct more thorough investigations. Cosmos Mindeleff returned again in 1893. Their survey seems to have been more intensive than that of the Stevenson expedition, since the number of sites located was increased to 140. Ground plans and photographs of many sites appear in publications by Cosmos Mindeleff (1895, 1897), along with ground plans and photographs made during the Stevenson survey. Some of the architectural details, which were thoroughly discussed, were obtained through excavation during the Stevenson survey and the 1885 expedition (Stevenson 1886; Powell 1891). Cosmos Mindeleff's 1897 report also included a map showing the relationship of archeological sites to arable land and classified the sites in order to examine the role of defense in their placement.

A number of references to the archeology of the monument appear in the literature of the period from 1883 to 1886. Stevenson's and Cosmos Mindeleff's publications were the most significant. Bickford (1890) described pictographs at White House, Mummy Cave and CDC 174 on the basis of knowledge obtained in 1884 (Powell 1888). Prudden (1903, 1906) worked in the Chinle Valley and discussed sites in de Chelly in a manner that suggests first-hand knowledge (de Harport 1959: 148). Peet (1890) and Bandelier (1892) refer to Canyon de Chelly, but the information is second-hand. With the exceptions of Stevenson and Mindeleff, these authors contributed little new information about the canyons.

This was also the period when Charles Day and his son Sam, operators of a trading post at Chinle, were active collectors of artifacts from de Chelly, del Muerto and other nearby canyons. The Days did not analyze or publish their material; the collection was sold to the Brooklyn Institute.
Museum (Wilken 1955: 127-128). Specimens from the collection are referred to in Baum (1903), Fewkes (1906), Crawford (1924), Weltfish (1932) and Earl Morris (1938). The Fewkes article is interesting because it contains a discussion of Hopi ceremonial paraphernalia found in Canyon de Chelly, which Fewkes attributed to migrating Hopi groups. These artifacts are perhaps the strongest evidence available for the presence of Hopi Indians in the monument after AD 1500. Other evidence consists primarily of ceramics, which may be pieces traded to the Navajo in the canyons. Fewkes also referred to Canyon de Chelly in publications (1908, 1910) derived from Cosmos Mindeleff's work.

The next archeological research in the canyons was the excavation of Antelope House by F.M. Palmer in 1906, under the sponsorship of the Southwest Society. No scientific report on the project was written, but two popular articles (Anonymous 1907; Lummis 1907) were published and created the incorrect impressions that all sites in the canyon had been destroyed by the Days' pot-hunting and that Canyon del Muerto was named for the famous massacre at Massacre Cave (CDM 176). The published references do not give the location of the excavations, but a letter dated July 12, 1906, from Palmer to Maj. E.W. Jones, chairman of the executive committee of the Southwest Society, states that the work was done at Antelope House, indicates that a number of rooms (including a kiva) were excavated and details the artifacts recovered. The letter suggests that the sole purpose of the expedition was to collect artifacts. The only other original material resulting from the work was a photograph album, which was donated to the National Park Service in 1970 and is presently at Hubbell Trading Post National Historical Site. The final publications of the Classificatory-Descriptive Period were a series of traveler's accounts by Rollins (1911), James (1915) and McCormic (1917). These accounts contain photographs of some of the larger ruins, but they have very little descriptive information of scientific value.

Within Canyon de Chelly National Monument and throughout the Southwest the Classificatory-Descriptive Period was characterized by a concern with description of sites and by an attempt to order them on the basis of shared attributes. Cosmos Mindeleff's studies in the monument typify this approach. As has often been pointed out (for example, see Longacre 1970: 7), such ordering does not take into account all attributes of the items ordered. The traits examined in the Southwest were those which figured prominently in historic Puebloan societies, since the individuals who dominated southwestern studies during this period were primarily ethnologists and general anthropologists. The tendency to such selection was strengthened by a widespread belief in the shallow time depth of human history in the Americas, leading to a corollary belief that there had been little time for major changes in human societies from the prehistoric period to the present (Longacre 1970: 2; Cushing 1890: 157). Southwestern anthropologists were struck by the importance of clan organization and ceremonialism in Puebloan societies, which led to an archeological focus on evidence pertaining to the history of Pueblo clans (Fewkes 1896: 152). Thus, Cosmos Mindeleff (1897: 174-190) devoted considerable attention to kiva architecture in the monument. Anthropologists had also noted an apparent shift in settlement pattern from small,
scattered villages to fewer, larger towns; archeological research was
often concerned with the explanation of this change. The larger towns
were thought to have been the result of puebloans banding into larger
groups to defend against raids. Cosmos Mindeleff investigated the
possibility that similar defensive considerations resulted in the con-
struction of cliff dwellings in the monument. Mindeleff concluded that
defense was not a significant factor, since few sites contained archi-
tectural features of a defensive nature. Mindeleff did conclude that
there was a strong association of Anasazi sites with arable land.

Some of the concerns of Mindeleff and his contemporaries have become
topics of renewed interest among archeologists (Longacre 1970: 4-5).
However, the work of the Classificatory-Descriptive Period is of limited
value because of the lack of chronological information or detailed pro-
venience data needed for the solution of many current archeological problems.
Nevertheless, the research of the Classificatory-Descriptive Period in
the monument produced architectural information, ground plans and photo-
graphs that are useful today in assessing changes in site condition during
the intervening years and which may thus assist archeologists and park
managers.

1915-1960: The Classificatory-Historical Period

During the Classificatory-Descriptive Period archeological researchers
were hindered by their inability to date the phenomena they were investi-
gating; it was frequently difficult to order events and to assess rates
of change. This situation began to change with N.C. Nelson's (1916)
stratigraphic excavations in the Galisteo Basin, New Mexico. Strati-
graphic excavation provided a method for ordering events and led to a
reorientation of American archeological research toward chronology-
building. Willey and Sabloff (1974: 88-177), therefore, refer to the
period from the first stratigraphic excavations until 1960 as the
Classificatory-Historical Period. In the Southwest, the work of A.V.
Kidder (1924) exemplifies the concerns of archeologists during this period.

Stratigraphic research in the Southwest during this period demonstrated
that non-Pueblo groups, the Basketmakers, preceded Puebloan groups in the
Southwest and formed the base from which the Pueblo societies developed
(Kidder and Guernsey 1919). Something of a competition arose among south-
western archeologists as they attempted to find Basketmaker sites with
artifact inventories that would improve definitions of Basketmaker society
and that would tie it to the southwestern archeological sequence in a more
satisfactory manner. The archeological sequence at that time was con-
ceptualized as a series of sequential artifactual assemblages (Lister and
Lister 1968: 21, 86, 113-114; de Harport 1959: 175). One of the most
active participants in the competition was Earl Morris. Morris first
entered the canyons in 1923 during the American Museum of Natural History's
Third Bernheimer Expedition (Lister and Lister 1968: 111-114). Morris,
who was searching for dry cave sites in which Basketmaker materials were
preserved, initially was reluctant to enter the canyons, as he was aware
of Palmer's reports on looting of the sites. Four days, however, were
spent in the canyons, during which Big Cave (CDM 155) was inspected; a
grave, room and kiva were excavated at Mummy Cave, and collections were made at Antelope House (CDM 10). A number of other sites also were investigated (Bernheimer 1924: 166-171).

Morris' visit to the canyons convinced him that Palmer's reports on pothunting were inaccurate (letter from Earl Morris to Clark Wissler, June 13, 1923). Morris persuaded the American Museum of Natural History to finance a return trip to Mummy Cave later in 1923, during which portions of the refuse area on the Mummy Cave talus were trenched and profiled and the painted kiva in the north central portion of the site was cleared. Portions of Big Cave also were excavated and a number of smaller sites in the vicinity of Mummy Cave were examined (American Museum 1923, E. Morris 1923). Morris was primarily interested in Basketmaker materials (de Harport 1959: 174), particularly those which might be used to define early and late Basketmaker stages, but extensive disturbance of the Basketmaker remains by Basketmaker and Pueblo activities rendered the stratigraphic evidence inconclusive. The First Beam Expedition, under J.H. Jeancon, in 1923 collected dendrochronological specimens from Mummy Cave and Antelope House in the hope of closing gaps in the tree-ring chronology then under development (Peterson 1935).

Morris returned to Canyon del Muerto in 1924, sponsored by the American Museum and the University of Colorado (American Museum 1924; E. Morris 1924, 1925, 1938; Rodeck 1956). During that year he stabilized the tower at Mummy Cave and conducted additional excavations there; excavated five rock shelters in the vicinity of Twin Trail Canyon, including Pictograph Cave (TWT 1); excavated at Big Cave, and made a stratigraphic test in the stream bank at a site (probably the Ute Raid Site, CDM 6) about 1.6 km below Antelope House. As the primary objective was to secure Basketmaker materials, he concentrated on areas likely to yield Basketmaker graves, such as trash deposits, and avoided areas with much Pueblo architecture.

Because of the productivity of Morris' excavations, the American Museum and the University of Colorado sponsored another expedition into the canyons in 1925. Clark Wissler, the museum's director, assigned A.V. Kidder to lead the expedition because he thought Morris should work on reports of his Aztec Ruin and La Plata research (Lister and Lister 1968: 126-129). Out of respect for Morris, however, Kidder included him in the project. Refuse at Mummy Cave was probed again, the site was mapped and additional stabilization was done. Further excavations at Big Cave were undertaken and limited collections were made at Massacre Cave. Kidder did some stratigraphic testing at White House and the canyons were surveyed for promising locations for future work. At the end of the 1925 season Kidder withdrew from work in the monument, in favor of Earl Morris (E.H. Morris and A.V. Kidder 1925; Kidder 1927; Lister and Lister 1968: 129).

The 1925 fieldwork had shown that White House was desperately in need of protection from steam erosion and Morris returned in 1926 to construct dams to protect the site (American Museum 1926; E. Morris 1926). The lower unit of the site was excavated and a sequence of material from the Basketmaker II through Pueblo III stages was recovered (Kidder 1927; Magoffin and Davis 1929: 230-231). The upper unit had been thoroughly looted and was not excavated. Some digging was also done at Sliding Ruin (CDC 107).
In 1927 Morris returned to the canyons to collect tree-ring specimens. He did some additional excavation at Sliding Ruin and Cave I del Muerto (E. Morris 1927a). Morris did not work in the canyons in 1928, but in 1929 he excavated at Antelope House and most of the larger sites in the lower portion of Canyon del Muerto were tested (E. Morris 1929; A. Morris 1933: 208-230). Ann Morris copied pictographs at Antelope House, Pictograph Cave and Standing Cow Ruin (CDM 4), some of which later were published (A. Morris 1930). Of particular importance to Morris, however, were excavations at Battle Cove Ruins (CDM 7), which uncovered a large number of relatively undisturbed Basketmaker II burials and the spectacular Tomb of the Weaver (E. Morris 1948). The Basketmaker II burials were the first undisturbed materials from that period found by Morris in the canyons. Morris hoped they would enable him to refine the traits used to define the stage. The Tomb of the Weaver contained an unusually rich assemblage of artifacts, including a turkey feather blanket, five baskets, five ceramic vessels and more than two miles of cotton yarn. Charles and Ann Lindbergh flew into the canyon area during the 1929 season; they visited the Morris' camp and took aerial photographs (A. Morris 1933: 224-230, Fig. 42; E. Morris 1929; American Museum 1929; Anonymous 1930). Morris' final project in the canyons involved additional stabilization of the tower at Mummy Cave, under the auspices of the National Park Service. During this project a series of prayer sticks was found to be incorporated in the masonry of the tower, supporting Morris' belief that the tower was constructed by a group with Mesa Verde affiliations (E. Morris 1932, 1941).

No final report on Morris' work in the canyons was published, perhaps due to an initial lack of time to analyze the voluminous collections and to a later reluctance, engendered by dissatisfaction with the rather imprecise excavation methods used during the period (Lister and Lister 1968: 143). Three popular articles (E. Morris 1925, 1938, 1948), a number of technical papers (E. Morris 1927b, 1941, 1951; E. Morris and R. Burgh 1941), Morris' (1939) Archeological Studies of the La Plata District, which incorporates information from the canyons, and Ann Morris' (1933) Digging in the Southwest provide some insight into Morris' interpretations of his data.

Morris was frustrated in one of his primary objectives. Although a quantity of Basketmaker material was recovered and Morris (1939: 20) considered Canyon del Muerto the richest source of Basketmaker III materials anywhere, he was not able to distinguish between Basketmaker II and Basketmaker III materials to his own satisfaction (de Harport 1959: 176). Apparently the Battle Cove burials constituted an inadequate sample of the Basketmaker II stage. The failure to separate Basketmaker II and III may be due in part to mixture of the deposits by subsequent human activity (Morris and Burgh 1941: 57) and in part to excavation techniques which did not adequately recover stratigraphic information (de Harport 1959: 176).

On the other hand, Morris (1939: 29) felt that he could clearly distinguish the Basketmaker III and Pueblo I stages on the basis of the skeletal characteristics of their populations. Basketmaker III burials generally contained individuals with relatively long heads, while Pueblo I burials usually contained broad-headed individuals. Morris concluded that there were racial differences between the Basketmakers and the Puebloans.
and that the relationship between the two groups was one of population replacement. While the differences observed by Morris are real, his conclusions have been rejected. The adoption of practices producing cranial deformation is thought to account for the differences in anthropometric characteristics (de Harport 1959: 175; Brew 1946: 67-73). Morris (1938: 129, 131; 1941; 1948: 91) also thought that he could distinguish population movements within the Pueblo III stage. Populations from Mesa Verde were said to have dispersed during the drought of AD 1276 to 1299, with some of the groups joining the indigenous monument population for a brief period before both populations abandoned the canyons at about AD 1300. This view is somewhat more plausible than Morris' hypothesis of replacement of Basketmakers by Puebloans, due to the architectural uniqueness of the Mummy Cave tower unit within the monument and its similarity to structures in the Mesa Verde area.

Earl Morris also utilized data from the monument in a discussion of the origin of pottery in the Southwest (E. Morris 1927b) and in a study of Basketmaker figurines (E. Morris 1951). Morris (1927b) concluded that ceramics developed from unfired mud vessels and clay-lined baskets, through accidental firing or through deliberate parching of seeds in the vessels. Most of the unfired pottery discussed in the paper came from Mummy Cave and Big Cave. From the study of figurines he concluded (1951) that Basketmaker III figurines from the Prayer Rock area and Canyon del Muerto were identical and that this was expected, since he viewed the Basketmaker III culture of the two areas as identical.

Morris' work in the monument provided him much information for comparative purposes, but his publications provide relatively little information pertaining specifically to the monument, considering the amount of time Morris spent in the canyons and the size of the collections he made. The bulk of Morris' collections is in storage at the University of Colorado Museum and at the American Museum of Natural History. Copies of Morris' field notes and photographs also are on file at these institutions.

During the period of Earl Morris' work, secondary references to the archeology and history of the canyons were published by Hewett (1930), Amsden (1933) and Bender (1934). Hewett (1930: 283-284) discussed the similarity of monument sites to others in the San Juan River drainage and stated that during the historic period certain Hopi clans moved into the canyons and intermarried with the Navajo. In the latter case, it appears that Hewett overestimated the number of securely identified historic Pueblo sites. Amsden and Bender discussed Navajo-American military relations. Also during this period, the Tree-Ring Bulletin published a series of dates for sites in the monument (Peterson 1935; Douglass 1936; E. Morris 1936; McGregor 1938; Douglass 1938).

Several small-scale field projects were undertaken in the period immediately preceding World War II. During 1931, 1938, 1939 and 1940 Emil Haury and several other researchers visited the canyons and assigned Gila Pueblo numbers to some of the sites. Dendrochronological specimens also were taken (de Harport 1959; 183-184; Bannister, Dean and Gell 1966). An abortive effort to collect Navajo skeletal material from Massacre Cave for anthropometric studies was made in 1940 by James Spuhler. In 1941
Wesley Hurt did a reconnaissance, which resulted in the publication of eighteenth century tree-ring dates for several Navajo hogans on the plateau near the Spider Rock overlook road (Hurt 1942) and a paper on Basketmaker-Pueblo architectural transitions (Hurt 1947). Hurt's tree-ring specimens have been re-examined and found to date in the nineteenth century (Bannister, Dean and Gell 1966: 33; Brugge 1967). Hurt defined an evolutionary architectural sequence from Basketmaker III circular slab-lined pithouses through Pueblo I structures, with straight sides, rounded corners and coursed masonry laid on slab foundations, to Pueblo II rectangular rooms of coursed masonry. Hurt felt that these developments were indigenous to the Anasazi area.

During 1941 and 1942 a number of stabilization projects, occasionally accompanied by limited excavations, were undertaken in the monument. Most of the work was done by Charlie Steen (1942a and b). Steen stabilized White House, Antelope House and Mummy Cave. The circular central plaza at Antelope House was trenched in a search for features that would identify it as a kiva; none were found. Fill was removed from several rooms in Mummy Cave in order to relieve pressure on their walls, completing a stabilization effort begun in 1941 by Seasonal Ranger James Spuhler. A paper was published on a Navajo burial salvaged during Steen's work (Tanner and Steen 1955). In 1949 and 1950 Steen conducted a salvage excavation at Tse-ta'a (CDC 86 and 87), designed to prevent further loss of information through erosion. A description of the site's architectural features and of the artifacts recovered was published (Steen 1966).

Steen's excavations closed out a period in the history of archeology in the monument that was dominated by an emphasis on classification and chronology. These concerns also dominated American archeology as a whole (Willey and Sabloff 1974: 88-130). The influence of Franz Boas and his associates on anthropology made archeologists wary of the employment of ethnographic analogy and evolutionary explanations, which had characterized the period prior to approximately 1915, while stratigraphic excavation techniques and dendrochronology made research on chronology possible (Harris 1968: 250-289; Longacre 1970: 4-6). Emphasis was placed on the collection of facts, specifically on the dating of sites and their classification into cultures on the basis of their artifact inventories. Earl Morris' attempts to define early Basketmakers by searching for undisturbed artifact-bearing strata typify the approach. By the time Steen conducted his excavations it was possible to readily place most sites in the monument within the sequence defined by means of these procedures; that is what Steen did with the materials from Tse-ta'a.

Although an archeological sequence, formalized as the Pecos Classification, had been defined artifactually, deficiencies in knowledge remained (de Harport 1959: 186). Little was known about architecture prior to the Pueblo II period, open sites had not generally been investigated and the minor artifacts of the Pueblo II and Pueblo III periods had received little study. The nature of the Hopi occupation of the monument and the time of Navajo entry into the area remained unknown. Pictographs and petroglyphs had received little attention.

De Harport began a major, intensive survey of Canyon de Chelly with the intention of remedying some of these deficiencies. De Harport (1959: 3) originally had intended to survey Canyon de Chelly, Canyon
del Muerto and their tributaries, but an unexpectedly large number of previously unrecorded sites forced him to restrict his survey. He spent two months in the field in 1949 and 1950 and four months in 1951, but was able to survey Canyon de Chelly at the intensity he desired only from its mouth to a point 26.5 km up canyon. A portion of the plateau, bounded by the western edge of the monument, the rim of Canyon de Chelly, Spring Canyon and the Fort Defiance road, also was surveyed. Canyon del Muerto and such tributary canyons as Monument Canyon were excluded. De Harport returned in 1953 to draw three cross sections of Canyon de Chelly, showing river terraces, and briefly visited the monument and neighboring areas in 1957 and 1958. De Harport (1951, 1953) also conducted excavations at four sites: CDC 45, CDC 245, CDC 275 and CDM 4.

De Harport's work did not solve many of the specific problems he had defined. This was due principally to restrictions imposed by the technique of surface survey with limited ancillary excavations. Yet he made two extremely important contributions to archeological research in the monument. The first lies in the thoroughness and accuracy of his survey: few sites in the area examined appear to have been overlooked and those found were accurately recorded and plotted on the available topographic map, as a field check by this author showed. Thus de Harport's survey forms a valuable inventory of sites within much of Canyon de Chelly.

De Harport's second contribution was to make a major advance in the interpretation of the archeology of the monument. De Harport (1959: 45-46) stated: "If the proper goal of archeological activity is the study of cultural processes upon a variety of levels of abstraction, it appears that the semantics of our present taxonomic compartmentalization is more a hindrance than a help." De Harport felt that the archeological approach exemplified by the work of Earl Morris and Charlie Steen had served its purpose in the monument, and that it was necessary to go beyond the compilation of artifact inventories and the descriptive goals of his survey by defining the processes which produced patterns in the archeological sequence. In order to do so, de Harport investigated the relationship of sites to features of the physical environment and the relationship of sites to each other.

De Harport (1959: 48-49) studied site ecology and settlement patterns, making his work an excellent example of the concerns which characterized American archeology from the 1940s to the 1960s. During these years the influences of Julian Steward's cultural ecology and of Leslie White's materialism were felt in American archeology, manifested by increased concern among archeologists with establishing the ecological context and function of artifacts, sites and cultures. De Harport recorded 369 sites and a number of statements regarding settlement patterns were inductively derived. For example, the strong association between Anasazi sites and arable land was said to be confirmed. A movement of population up canyon during the Basketmaker II through Pueblo I stages was said to have occurred, resulting in the isolation of two hostile factions of the Basketmaker II population in Canyon de Chelly and Canyon del Muerto. Numerous other conclusions were also drawn and de Harport's research is the basis for much of what is now known about monument archeology.
1960-1976: The Explanatory Period

The years from 1940 to 1960 were an important transitional period in American archeology, in which evolutionary and ecological principles were utilized in attempts to explain archeological phenomena. However, the principles were often implicit and the research tended to consist of an inductive search for regular associations of phenomena that could be utilized in probabilistic explanations, as in de Harport's study.

This seems to reflect an attitude that powerful explanatory statements, particularly statements that would be useful for prediction or retroduction, had yet to be made in archeology. Emphasis after 1960 shifted from the discovery to the testing of explanations. A number of archeologists became more explicit in their use of explanatory principles and began to borrow them from disciplines with somewhat more formalized theories, such as systems theory and geography. These explanations were deductively tested with archeological evidence. Some of the deductively oriented archeologists confused deductive testing of hypothesized explanations with deductive explanation, further assuming that deductive explanation was the only valid form of explanation in science. In fact, it is not (Hempel 1965: 3-46, 376-412; Salmon 1967). As a result, previous archeological research was categorized as unscientific and of little value. A heated debate resulted, which served to make archeologists more aware of the role of explanation in their work. As a result, Willey and Sabloff (1974: 178-211) have labeled the years after 1960 as the Explanatory Period in American archeology.

Several projects have been undertaken within the monument since de Harport's survey. White House, Antelope House and Mummy Cave were stabilized (Richert 1957, 1959, 1961, 1964; Mayer and Waggoner 1968; Don P. Morris 1969); Alexander J. Lindsay of the Museum of Northern Arizona visited a site in Canyon del Muerto and made a surface collection (Lindsay 1967); Don P. Morris (1975) collected dendrochronological specimens from CDC 232; the Spider Rock Overlook road alignment was surveyed; a portion of a Pueblo site and a Navajo hogan within the alignment were excavated (Young 1969, 1973); V.K. Pheriba Stacy and Don P. Morris (1972) surveyed overlook road alignments along the north rim of Canyon del Muerto and recorded a number of sites, primarily Basketmaker and Navajo, several of which were later excavated by Charles James (1974 a-f; James and Lindsay 1973); eroding sites were salvaged by Don P. Morris (1975: personal communication) in Canyon de Chelly (CDC 206) and in Canyon del Muerto (CDM 140), and Robin Dempster was assigned to survey Canyon del Muerto in 1962, but the survey apparently was abandoned shortly after it began (Don P. Morris 1975: personal communication) and no records from the survey can now be located.

A second attempt at surveying the canyon was begun by William Tanner in 1968; this was soon incorporated into the Antelope House Project, the largest archeological investigation in the monument during this period in terms of time and funding. Antelope House was stabilized and its Pueblo III strata were extensively excavated under the direction of Don P. Morris, beginning in 1969. Earlier strata were also sampled. Fieldwork was completed in 1973; write-up still is in progress.
The Antelope House Project and the others cited above investigated aspects of site ecology, thereby adopting an approach similar to de Harport's. The Antelope House Project did much in this direction, since conditions at the site favored preservation of a large mass of organic material, on which environmental and ecological interpretations could be based (Ambrose 1975b).

The Antelope House Project gave rise to efforts to test deductively hypotheses conceived prior to the start of research. As part of the project, James E. Mount surveyed Canyon del Muerto. The original plan called for an intensive survey of the area within a 3.2 km radius of Antelope House, in order to describe the settlement pattern in the vicinity of the site, but the survey was limited to the canyon bottom between the junction with del Muerto and the Standing Rock Site (CDM 9) by restrictions on time and funds. It became apparent, however, that sites on the plateau, as well as in the canyon, would have to be recorded if an adequate understanding of site location patterns was to be achieved. In addition, Executive Order 11593 and 36-CFR-800 created a need to inventory all archeological sites within the monument. Thus plans for a more comprehensive survey of Canyon del Muerto were drawn up. Fieldwork for this survey began in 1974 and continued in 1975. To date a photographic survey of the canyon and a systematic transect survey of the plateau and canyon (Map 4) have been undertaken (Rock and Hall 1975; Don P. Morris 1976b; McDonald, Thornton and Morris 1976). This survey was designed to test hypotheses derived from previous archeological research in the monument (Don P. Morris and James T. Rock 1975a).

Summary

Archeological research in Canyon de Chelly National Monument has reflected the orientations of American archeology as a whole. Much of this work has had more than local significance. For example, although Earl Morris' research remains largely unpublished, it served as a valuable source of comparative information in his publications about other southwestern localities. Archaeological Studies of the La Plata District (1939) is one example.

In spite of the long history and differing orientations of archeological research in the monument, however, much work remains to be done. Knowledge of the archeology of some areas and time periods is considerably less than that of other areas and time periods. Specifically, the plateau has not been surveyed to the same extent as the canyon bottom.

Yet the plateau abounds in pinyon and juniper, resources of known value to the past and present inhabitants of the monument. Navajo utilization of the plateau is relatively obvious and preliminary results from the Canyon del Muerto Survey indicate that the plateau also was utilized by the Pueblo inhabitants of the monument. Yet few details of the ways in which the Puebloans made use of the plateau are available and further study seems warranted if its role in their occupation of the monument is to be understood. Other areas in which little work has been done are Monument Canyon and the upper reaches of Canyon de Chelly.

Much is known about the architecture, artifacts and environment of the Pueblo III stage, thanks to the Antelope House Project. In spite of
MAP 4: EXTENT OF ARCHEOLOGICAL SURVEY WITHIN THE MONUMENT.
a lack of publications, a good deal is also known about the architecture and artifacts of the Basketmaker II and III periods because of excavations by Earl Morris and David de Harport. More perhaps could be learned through a study of Earl Morris' collections and field notes. Knowledge about the architecture or artifacts of the Pueblo I, II, IV, V and early Navajo stages is also rather scanty. These gaps in our archeological knowledge hinder attempts to answer questions about past human activities.
Archeological research in Canyon de Chelly National Monument has revealed a history of human occupation extending from approximately AD 300 to the present and there are reasons to believe that earlier occupations also occurred, although they have not yet been recognized. This chapter will discuss the history of human occupation of the monument, focusing on relationships between population size, subsistence practices, environmental conditions and site locations. This is not intended to imply that other aspects of the monument's history are not worth discussing; the discussion, however, emphasizes areas of research which show promise of providing explanations of events in the monument's history and which facilitate comparison with other areas in the Southwest.

9200-5500 BC: The Paleo-Indian Stage

The earliest generally accepted dates for human occupation of the Southwest pertain to cultures of the Paleo-Indian tradition. The oldest of these, the Clovis culture, has been dated to approximately 9200 BC at Blackwater Locality Number One near Portales, New Mexico (Haynes 1964: 1408), and at the Lehner Site near Hereford, Arizona (Haury, Sayles and Wasley 1959: 24-26). Paleo-Indian materials are relatively rare and knowledge about the tradition is limited. The first artifacts found were lanceolate projectile points associated with the remains of extinct animal species (Figgins 1927). Many subsequent discoveries were also of this nature and represent localities where large game animals, such as mammoth (Mammuthus columbi), extinct species of bison (Bison antiquus) and modern bison (Bison bison), were killed and butchered. The possession of lanceolate projectile points and the hunting of large game animals, therefore, have been incorporated into definitions of the Paleo-Indian tradition (Willey 1966: 37-51). However, Paleo-Indians did not depend exclusively on large game animals for subsistence. Analysis of faunal remains and tools from a sample of Paleo-Indian sites indicates that subsistence activities were varied and included the hunting of deer, antelope, rabbits and rodents, as well as large game animals. Plant foods also were undoubtedly gathered (Wilmsen 1968, 1970; Judge 1973). The proportions of large game animals and other foods in the Paleo-Indian diet are not known and this would be a profitable subject for archaeological research concerned with Paleo-Indian groups. This topic is especially pertinent to discussions of the transition from Paleo-Indian to Archaic societies, and will be discussed further in connection with the Archaic stage.

Research on Paleo-Indian settlement patterns suggests that they reflect an emphasis on hunting. In a study of Paleo-Indian sites in the Rio Grande Valley, New Mexico, Judge (1973: 312-318) found three environmental requisites for the establishment of campsites: water, a broad open "hunting area" and an elevated location from which to view the hunting area.

Ethnographic analogy suggests that the basic economic unit of Paleo-Indian groups was a self-sufficient family (Steward 1938: 230-237). To the extent that economically important animal and plant species did not
occur in dense and extensive patches, harvesting by larger groups would tend to decrease the per capita yield. However, in certain areas cooperation would increase the yield above that expectable from individual efforts, such as in the hunting of rabbit, antelope and large game (Steward 1938: 34-36, 38-39; Wheat 1972: 91-96), so that units larger than the family probably also existed. These may have resembled band or multiband groups (Service 1970: 46-98; Wilmsen 1970: 81-83), which associated seasonally as the appropriate foods became available. Groups of up to 30 persons may have formed at certain seasons (Irwin-Williams 1967: 442).

The absence of Paleo-Indian sites within the monument may be due to a number of factors. Archeological research in the monument has concentrated on the canyon bottoms, where erosion may have destroyed the sites. Studies of the alluvial geology of the Hopi and Arroyo Cuervo regions indicated a period of erosion subsequent to 6000 BC which may have resulted in the destruction of Paleo-Indian sites. Similar studies within the monument could be directed toward evaluating the possibility of a comparable period of erosion. Secondly, archeologists have not generally considered the possibility of a Paleo-Indian occupation of the monument and evidence for it may have gone unrecognized. Awareness of the possibility of a Paleo-Indian occupation and familiarity with the relevant artifacts and site location patterns would remedy the situation. Finally, the monument may not have contained a hunting area suitable for Paleo-Indian groups. The Chinle Valley may be more likely to contain Paleo-Indian sites than is the monument itself, since the valley has broad open areas for hunting and ridges suitable for hunting overlooks.

5500-200 BC: The Archaic Stage

Paleo-Indian sites dating later than approximately 5500 BC are not found in Arizona or in much of New Mexico. Paleo-Indians were succeeded by Archaic groups, who had a broad-based hunting and gathering economy. It has been argued that the disappearance of Paleo-Indians was due to climatic changes resulting in decreased effective moisture, which rendered the region unsuitable for a subsistence strategy based on the hunting of large game animals. Paleo-Indian groups may have withdrawn in the direction of the Great Plains (Irwin-Williams and Haynes 1970: 63-65; Irwin-Williams 1973: 4). Technological differences between Paleo-Indian sites and the succeeding Archaic sites are cited as evidence that the Archaic groups are not the end product of in situ evolution of Paleo-Indian populations in response to the disappearance of large game animals. Rather, Archaic populations are said to have moved into the region from somewhere else, perhaps from the west (Irwin-Williams 1967: 453; 1973: 4-5). In the Arroyo Cuervo region of northwestern New Mexico large slightly-shouldered projectile points replace lanceolate points during the transition from Paleo-Indian to Archaic. Later Archaic points show a trend to decreased length and serration of the edges. Increasing proportions of chopping tools, crude side scrapers and grinding tools are found in later Archaic sites. Overall, the tool kit is believed to reflect a mixed hunting and foraging subsistence. The decrease in projectile point size is felt to be correlated with increasing emphasis on hunting small game.
animals. Chopping tools and crude side scrapers are thought to be adapted to processing coarse plant foods, such as yucca hearts and cactus joints. Grinding implements were probably used in seed processing.

Archaic settlement patterns also appear to reflect a broad-based hunting and gathering economy. In the Arroyo Cuervo region early Archaic sites were located on cliff tops near canyon heads. This gave the inhabitants ready access to three resource areas: canyon rims, canyon bottoms and springs. Plant communities in these resource areas were varied and provided a diverse group of foods. The canyon rims contained such plants as yucca, cactus, juniper and pinyon. Canyon bottoms contained grasses, composites and amaranth. Plants near springs included willows, sedges and rushes. After 1800 BC, when corn appeared in the region, some cliff-base rock shelters near farmable floodplains were also occupied. Associations between Archaic sites and hunting areas were not noted in the Arroyo Cuervo research.

The basic Archaic economic unit probably was the family, although seasonally or areally favorable conditions may have allowed groups of up to 30 people to associate for limited periods of time (Irwin-Williams 1967: 442). Ethnographic analogy suggests that the structure of temporary groups resembled that of bands. Population densities probably remained low, comparable to those of Paleo-Indian groups.

Archaic tools were found within the right-of-way of the North Rim Road near the eastern end of Slim Canyon (Albert E. Ward 1975: personal communication). Given their proximity to the monument, it seems that Archaic sites have not been found within its boundaries because archaeologists have not looked for them. The Arroyo Cuervo Archaic settlement pattern noted by Irwin-Williams suggests that Archaic campsites may be found in canyon rim areas near the heads of side canyons or in other rim areas with easy access to the canyon bottoms. Such locations would have given the Archaic inhabitants access to a range of plant resources similar to those of the Arroyo Cuervo region: Canyon Bottom Communities, Canyon Rim Communities, Low Shrub-Grassland Communities and the Pinyon-Juniper Continuum. The canyon rim has generally been overlooked by archeological surveys of the monument. Some later Archaic sites may be found in rock shelters within the canyons. If they exist, they may have been overlooked in the past because they were obscured by later occupations. The Arroyo Cuervo research suggests that Archaic sites may be marked by the presence of relatively large shouldered or stemmed projectile points, points with serrated edges and large percentages of crude side scrapers and choppers. In particular, serrated points and choppers do not seem to appear in later sites within the monument (Don P. Morris 1975: personal communication). Since the principal diagnostics of Archaic occupation are likely to be lithic materials, it is imperative that the members of any survey hoping to identify Archaic sites be thoroughly familiar with Archaic tool typologies and manufacturing techniques.

A number of avenues of investigation are open for research should Archaic sites be discovered within the monument. Descriptive data on chronology, artifact function, population size, subsistence practices and social organization could be gathered. For example, it was stated previously that the relative importance of various components of the
Paleo-Indian diet could not be evaluated with certainty on the basis of present data. Much the same is true in the case of Archaic groups. Where appropriate materials are present, zooarcheological studies and lithic analyses could greatly increase our knowledge of Paleo-Indian and archaic subsistence patterns. This should enhance our ability to formulate and evaluate hypotheses about developmental relationships between Paleo-Indian and Archaic peoples in the Southwest. For example, Irwin-Williams' hypothesis, which suggests that Archaic populations replaced Paleo-Indians, draws some support from an assumption that Paleo-Indian subsistence strategies would require considerable re-adaptation following the disappearance of large game animals and that it was simpler, therefore, for Paleo-Indian groups to withdraw from northwestern New Mexico, following herds of large game into more favorable environments, such as the Great Plains. Wilmsen's work, however, has suggested that the Paleo-Indian diet was broad-based, not limited to large game species. Thus, although disappearance of those species may have had a significant impact on the Paleo-Indian diet, compensation through increased exploitation of other resources may have been a simple matter. Alternative hypotheses of Paleo-Indian migration or in situ readaptation might be tested with data from a series of Paleo-Indian and Archaic sites near or within Canyon de Chelly National Monument. In particular, information about the period from 5500 to 3000 BC might be sought. This is a little-known period in the prehistory of the Southwest and includes an erosion interval that separates Paleo-Indian from Archaic sites (Hack 1942; Irwin-Williams and Haynes 1970: 66; Irwin-Williams 1973: 4-5). The lack of knowledge about this period and the break in deposits created by the erosion interval allow for the possibility of in situ development of lithic assemblages and tends to weaken Irwin-Williams' use of dissimilarities between Paleo-Indian and Archaic tools as evidence for population replacement.

200 BC-AD 400: The Basketmaker II Stage

The end of the Southwestern Archaic is usually attributed to the introduction of domesticated plants from Mexico. Evidence from Bat Cave, New Mexico, indicates that domestic corn had reached the Southwest by 3500 BC (Dick 1965: 95). The introduction of domestic plants did not immediately alter Archaic societies. Increasing reliance on agriculture, however, eventually transformed Archaic societies to the point where new labels are applied. This transformation appears to have taken place by approximately 200 BC in portions of the Four Corners area, producing the Basketmaker II stage of the Anasazi culture. It should be noted that the beginning date for this stage has been assigned somewhat arbitrarily, since our current knowledge suggests that it did not develop uniformly throughout the Anasazi area. The date adopted here is based on dates in the second and third centuries BC for Basketmaker II sites in the Durango, Colorado, area (Dean 1975: 26-34).

Dry cave deposits of Basketmaker II origin have yielded corn and squash (Cucurbita mixta), as well as amaranth (Amaranthus sp.), sunflower seeds (Helianthus annus) and tansy mustard (Descurainia sp.), demonstrating the utilization of domesticated and wild resources in the subsistence system (Jones and Fonner 1954). Other materials also indicate the
exploitation of both classes of resource. Digging sticks are found, as are atlatls, darts and snares (Guernsey and Kidder 1921: 79-80). Architecture is also believed to reflect the addition of domesticates to the diet. Substantial architecture, in the form of pithouses, is found for the first time in the Four Corners area during the Basketmaker II stage and shows a solidity of construction and an investment of labor suggesting prolonged residence (Haury 1962: 118). Basketmaker II pithouses range from dumbbell shapes through ovals to rectangular rooms with rounded corners, measuring 25 m to 2.5 m across (Aikens 1966; Eddy and Dickey 1961; Morris and Burgh 1954). Houses were excavated as much as 3.5 m into the ground surface. Superstructures consisted of cribbed logs, jacal or brush and mud-covered timber. Basketmaker II pithouses can be contrasted with the "irregular posthole patterns suggesting simple temporary structures" that have been reported from Archaic sites (Irwin-Williams 1973: 8).

The pattern of prolonged residence inferred from construction practices presumably resulted from a necessity to tend crops for extended periods of time, from harvests that would support a group in a particular area for several months and from a tendency to repeatedly utilize areas most favorable to agriculture.

The extent of reliance on agriculture does not appear to have been uniform among all Basketmaker II groups, however. Basketmaker II settlement patterns show regional differences which suggest different degrees of reliance on agriculture. In the Virgin River area single pithouse sites predominate (Aikens 1966: 21-22, 26). These are concentrated in valley and canyon environments. Surveys of plateaus and mesas have revealed no Basketmaker II sites. Aikens suggested that this is a reflection of an economy relying primarily on floodplain farming or on dry farming, which took advantage of high water tables, and, possessing a low population density, which did not require utilization of less well-watered highland environments. In the Cedar Mesa area sites are small, with base camps located on canyon rims and summer farming camps located in rock shelters in the canyons (Lipe and Matson 1970: 130-131, 135-136). Base camps, with a high intensity of occupation and with evidence of multiple activities, provided access to both mesa top and canyon bottom resources. Lipe and Matson hypothesized that this pattern resulted from farming the canyons in the summer and hunting and gathering on the mesa top for much of the rest of the year. In the Durango area sites were found in the bottom of Hidden Valley, in rock shelters overlooking the valley and on a talus slope in the Animas Valley (Morris and Burgh 1954: Fig. 3 and p. 7). Some sites were large, with up to 35 house floors, although only a few of those floors were in simultaneous use. Morris and Burgh felt that the area's Basketmaker II inhabitants depended slightly more on hunting and gathering than on agriculture and that they were exploiting a unique combination of abundant and varied plant and animal resources, sheltered locations and fertile soils in the valleys.

Little is known about the organization of Basketmaker II groups. In reviewing literature available on the Virgin River and Kayenta areas, Aikens (1966: 21-22) concluded that the settlement pattern indicated small lineage settlements of one to several households; known sites contained
from one to five pithouses. K.C. Chang (1958: 322) arrived at a similar conclusion through a study of San Juan Anasazi village patterns.

Comparing the number of known Basketmaker sites (28) with the number of known Archaic sites (3), Aikens (1966: 21) concluded that "the introduction of the horticultural economy precipitated an expansion of population in the Kayenta and Virgin areas." While a population expansion may have occurred, Aikens does not consider the possibility that Basketmaker sites may be considerably easier to recognize than are Archaic sites, thus increasing the apparent magnitude of the population expansion. Aikens may also have reversed the causal sequence involved by attributing the population expansion to the adoption of agriculture. An alternative hypothesis will be discussed below.

The identification of Basketmaker II archaeological sites in Canyon de Chelly National Monument has been hindered by a number of problems: (1) the sites are often below thick natural and cultural deposits and are thus difficult to locate, (2) those sites which are not deeply buried have often been disturbed and mixed with later deposits by the monument's prehistoric occupants and (3) if the latter situation occurs, then the Basketmaker II occupation is difficult to distinguish because it lacks diagnostic ceramics.

Several Basketmaker II sites have been found within the monument, however, and these are currently its earliest known archaeological remains. Earl Morris excavated a number of Basketmaker II sites, the most important of which are Mummy Cave, Big Cave and Battle Cove. According to Morris (1939: 16), no houses were found at these sites, but David de Harport (1959: 1402-1403) believed that four houses excavated by Morris at Mummy Cave were actually Basketmaker II. This conclusion was based on a series of tree-ring dates for the houses reported by Smiley (1951: 24): three at AD 340-350, two at 408-409 and one at 485. These specimens have since been re-examined by the Laboratory of Tree-Ring Research at the University of Arizona. While the dates were not changed significantly, no decision was made as to whether the structures from which they came were Basketmaker II or Basketmaker III houses with re-used timber (Bannister, Dean and Gell 1966: 16, 19). Thus the dating of the structures is problematic. Morris' excavations yielded an abundance of Basketmaker II cists, graves and artifacts (E. Morris 1925, 1936: 34-35). Only at Battle Cove was the Basketmaker II material unmixed with material from later stages (E. Morris 1929: 1-6). A number of Basketmaker II cists were found in the southern portion of the alcove at the site, many of which contained burials. Some of the bodies showed signs of violent death, including one with an embedded arrowshaft. Unfortunately, Morris' failure to publish technical reports on his research limits the statements which can be made about the Basketmaker II stage within the monument. It is apparent from Morris' popular articles and field notes, however, that the monument has a high potential for yielding perishable Basketmaker II materials, because of its dry rock shelters. Baskets, bags, cordage and sandals are recorded in relative abundance in Morris' comments.

De Harport (1959: 1398) found 81 Basketmaker II sites during his survey of Canyon de Chelly. These included several sites with possible slab-lined pithouses (CDC 44, 48 and 122), numerous sites with cists
(e.g., CDC 112 and 121), lithic scatters (e.g., CDC 188) and rock art sites (e.g., CDC 14 and 302). De Harport (1959: 1410-1437) utilized his survey data, available knowledge about the Basketmaker II stage in other areas and ethnographic analogy to describe Basketmaker II society in the monument. On the assumptions that agriculture was the basis of the economy, that women did more cultivation than did men and that land tenure followed the female line, he concluded that matrilineages were the prevailing kinship unit. Analogy to Western Pueblo societies was used to support the conclusion. De Harport also hypothesized men's societies cross-cutting the matrilineages and cited as evidence the existence of a number of Basketmaker II sites with abundant pictographs. Such sites were said to be the meeting places of groups analogous to kiva societies.

The Basketmaker II population of the monument was said to have initially consisted of one community, which later separated into two hostile factions. De Harport inferred that clusters of sites represented communities. Two clusters of Basketmaker II sites were found, one in the lower zone of Canyon de Chelly and the other in the middle zone. The cluster in the middle zone was argued to be later than that in the lower zone, since it contained slab-base adobe wall structures, which were said to have been introduced late in the Basketmaker II stage. Basketmaker III and Pueblo I sites also were concentrated in the upper canyon zone, suggesting a continuing shift of population up-canyon. The middle-canyon site cluster was said to represent an up-canyon movement of one faction from the older community. De Harport believed that such movement was the result of conflict between factions in the original Basketmaker II community; these eventually separated by moving upstream, one faction moving into Canyon del Muerto and the other remaining in de Chelly. Evidence of violent death in the Battle Cove Basketmaker II burials and ethnographic evidence of factionalism in Western Pueblo societies were cited to support the conflict hypothesis.

De Harport derived minimum and maximum population estimates for the de Chelly Basketmaker II community of 20 and 180 people, respectively. The minimum estimate assumed that the Basketmaker II stage lasted 500 years, that sites were occupied for 25 years, that rock shelter sites were occupied by two nuclear families of four persons each and that open sites were occupied by one nuclear family. The maximum estimate assumed that rock shelter sites were occupied continuously throughout the Basketmaker II stage.

The Basketmaker II population was said to have sustained itself through cultivation of corn and squash, supplemented by hunting and gathering. This conclusion was inferred from de Harport's observation that open Basketmaker II sites tended to be located near arable land.

De Harport's description of Basketmaker II society is open to a number of criticisms. Archeological evidence for matrilineal organization is nonexistent, as de Harport admitted, and the appropriateness of his use of Western Pueblo society as an analogy may be questioned. His assumption that rock art was ceremonial and painted by men is unverified. De Harport's definition of "communities" is vague, since the criteria for identifying "clusters" of sites are not explicitly stated and since the relationship
between site clusters and anthropological or sociological definitions of a community receives little discussion. Dating of the two site clusters is not sufficiently precise to support his hypothesis of community movement. Any of these problems could serve as a starting point for additional research on the Basketmaker II stage within the monument. Two other subjects, however, seem to offer at least as much promise of significant results and would make fuller use of the monument's archaeological potential. These subjects are population size and subsistence practices.

De Harport's population estimates are questionable for a number of reasons. The identification of Basketmaker II sites was difficult and the site count may be inaccurate. Generally, sites were identified as Basketmaker II only if they contained no pottery or if they contained red triangular-bodied anthropomorphic pictographs, which had been definitely associated with Basketmaker II materials (Guernsey and Kidder 1921: 113). The first identification procedure could reduce the number of Basketmaker II sites relative to sites of other stages, since re-occupied Basketmaker II sites would tend to contain pottery and would thus be eliminated from the count. Or the number of Basketmaker II sites might be inflated by the inclusion of later special activity sites lacking ceramics. The second identification procedure would tend to increase the proportion of Basketmaker II sites, since rock art motifs were not used to identify later sites. The population estimates based on the site count are more suspect, because (1) only some of the recorded sites may have been habitation sites, (2) assumptions about the size and length of site occupations may be inaccurate or (3) the duration of the Basketmaker II stage in the monument was incorrectly estimated.

No excavation data are available to support de Harport's assumption that subsistence was based primarily on agriculture. De Harport's settlement pattern evidence is weakened by his own admission that rock shelter sites, in contrast to open sites, showed less tendency to be located near arable land and by de Harport's exclusion of much of the Defiance Plateau from survey; only that portion of the plateau between the south rim of Canyon de Chelly and the South Rim Drive, from the mouth of de Chelly to Spring Canyon, was surveyed. The land on the plateau is not generally considered arable and de Harport's failure to survey the plateau as extensively as the canyon bottom may have biased his sample of site locations.

Investigation of Basketmaker II population size and subsistence practices in the monument might be integrated into a re-evaluation of the adoption of agriculture in the Southwest. It was once assumed that agriculture was rapidly adopted because it substantially reduced the amount of energy required for subsistence activities by Archaic populations:

"... the level of cultural achievement a subsistence economy that required maximum energy from a maximum number of people must have been receptive to the addition of any resource to the cultural inventory that would ease the quest for food." (Haury 1962: 113)

Despite the assumed superiority of agriculture, Haury noted that its adoption was a slow process in the Southwest. While corn from Bat Cave
in west central New Mexico is dated to 3500 BC, evidence for the presence of corn does not appear in northwestern New Mexico until after 1800 BC (Irwin-Williams 1973: 9-10). Reliance on agriculture as a primary means of subsistence does not appear to have been widespread until the Basketmaker II stage (Haury 1962: 117) and may have occurred later in some areas, including Canyon de Chelly National Monument. Haury explained the slow adoption of agriculture by suggesting that the yields of early varieties of corn were so low that agriculture offered no advantage over hunting and gathering. Widespread intensive reliance on agriculture was believed to be a result of the introduction of high-yield varieties of corn at about AD 1.

Haury was unable to cite evidence for a genetic change in corn at that time, however, and it is quite possible that other factors may have controlled the rate of adoption of agriculture in the Southwest. One set of factors is suggested by the work of Marshall Sahlins (1972), Ester Boserup (1965) and Brian Spooner (1972). Sahlins (1972: 1-39) summarizes ethnographic data which indicate that hunters and gatherers expend less energy in subsistence activities than do agriculturalists. This suggests that the adoption of agriculture would be resisted, assuming that people tend to minimize the amount of energy expended in subsistence. Thus traditional assumptions about the superiority of agriculture are reversed. Boserup and Spooner suggest population growth as the mechanism by which resistance to agricultural subsistence would be overcome. Growth, assumed to be a natural characteristic of human populations, can lead to a situation in which more people per unit of land must produce more food per unit of land in order to support themselves at the level formerly enjoyed by smaller populations. This is accomplished by "intensifying their relationship with the land (Spooner 1972: XVI);" that is, by moving from hunting and gathering through increasingly intensive forms of agriculture. The amount of labor expended per unit of yield is increased, but so also is the yield per unit of land. The causal relationship between population size and agriculture, therefore, may be the reverse of that hypothesized by Aikens. Alternatively, climatic change may decrease the resources available to a stable population and may lead to intensification of subsistence activities (Smith and Young 1972: 49-50).

Three hypotheses, then, are suggested for testing with the Basketmaker II materials in the monument. (1) An increasing population of late Archaic hunters and gatherers was forced to rely on agriculture to an increasing degree in order to support itself. This was a gradual process, since agriculture was relied on only as necessary. According to this hypothesis, there should be no sharp break between Archaic and Basketmaker II settlement patterns, social organization and technology, insofar as these are related to subsistence. (2) Climatic change forced a stable late Archaic population to adopt agriculture in order to support itself. Since the climatic change might have been gradual or rapid, the shift from hunting and gathering to agriculture could likewise have been gradual or rapid. In the latter case, a sharp break in settlement patterns, social organization and technology might occur between the Archaic and Basketmaker stages. (3) Improved varieties of corn were introduced into the Canyon de Chelly area at about AD 1, leading to rapid adoption of agriculture.
and a sharp break in settlement patterns, social organization and technology between the Archaic and Basketmaker II periods. Testing of these hypotheses requires that population trends be delineated for the Archaic and Basketmaker II periods.

Archeological survey is the most effective means of accomplishing that objective, but survey data currently available for the monument are not adequate. Some areas of the monument, such as the plateau, are relatively unsurveyed, raising the possibility that the available data are distorted. This is particularly true of the Archaic stage, for which the settlement pattern in the Arroyo Cuervo region suggests that cliff tops near canyon heads may have been a favored location for campsites. It may also be true of the Basketmaker II stage, for which the Cedar Mesa data suggest a similar pattern. Furthermore, previous archeological surveys have relied primarily on ceramics to date the sites recorded. Since these are not present on Archaic or Basketmaker II sites, such sites are likely to have been overlooked. Thus the need for additional archeological survey of the monument, covering the plateau as well as the canyon bottoms and including personnel familiar with lithic typologies, is indicated.

Plog's (1975) discussion of methods for deriving population trends from survey data may be useful in structuring archeological population research in the monument, although his recommendations will require revision before they are applied to the Archaic and Basketmaker II stages. For example, Plog's recommended method is a regression equation which includes the number of rooms or pithouses present on sites. Since rooms or pithouses are not known from Archaic sites and are difficult to discern at Basketmaker II sites, site areas may have to be substituted for room counts.

The recommended archeological survey should also record site location data believed to be indicative of changes in subsistence practices. For example, increasing utilization of Canyon Bottom Communities at the expense of other plant resource groups within the monument would be expected as greater emphasis was placed on agriculture, since the Canyon Bottom Communities have developed around a water supply which is more abundant than that in other plant resource groups. Water is a key factor in determining the productivity of southwestern agriculture; for this reason the Canyon Bottom Communities are uniquely favorable to agriculture. A probable focus of settlement prior to the adoption of agriculture is the Pinyon-Juniper Continuum, since it provides large quantities of fuel, construction materials and wild foods. Sites located in the continuum near the canyon rims would have access to a number of additional plant resource groups and it is hypothesized that occupation of the monument by non-agricultural peoples was particularly intense in that area.

The suggested hypotheses point out one way in which the studies of past environmental conditions recommended in the "Environment" chapter would contribute to the understanding of monument archeology. Since the process of adoption of agriculture does not appear to have proceeded uniformly throughout the Southwest, it appears that factors specific to particular localities played a significant role in controlling the rate of adoption. Thus testing of the hypotheses requires that local environmental change be compared with local population and dietary trends.
Discrepancies in the dating of individual climatic events in different areas have been noted, reinforcing the need for obtaining environmental data from the area being discussed if explanation of human behavior is attempted. Palynological, dendrochronological and alluvial analyses are all capable of obtaining the desired data. In addition, Earl Morris' work in the monument indicates that preservation conditions create the potential for obtaining data from macrovegetal refuse (Ambrose 1975b). Since this source of data is unavailable in many other areas, it should be used to full advantage if Basketmaker II sites are excavated.

Excavation of Basketmaker II sites within the monument could provide unusually detailed information about past diets by obtaining fecal samples for analyses similar to those undertaken by the Antelope House Project (Fry, Hall and Gunn 1975) for the Pueblo III stage. These analyses, which have provided quantitative information on the balance between wild and domesticated food sources in the Antelope House diet, would be invaluable in testing hypotheses about changes in subsistence practices.

Excavation might also yield samples of corn, which could be analyzed to test the hypothesis of genetic change. An inability to correlate genetic change in corn with a shift in subsistence to primary reliance on agriculture should lead to a reconsideration of assumptions that southwestern agriculture was superior to hunting and gathering. Correlation of increasing reliance on agriculture with increasing population or with environmental change would suggest new explanations for the adoption of agriculture. Few data are now available, either from the monument or from the Southwest as a whole, to test the hypotheses. It should be noted, however, that since 1962 no evidence has been found for Haury's hypothesized genetic change in corn (Robert L. Hall 1975: personal communication). Furthermore, the settlement pattern data previously cited for other southwestern areas do not seem to support a conclusion that agriculture represented a marked improvement over hunting and gathering. The settlement patterns suggest wide variation in reliance upon agriculture between roughly contemporaneous groups familiar with the practice. If agriculture was significantly superior to hunting and gathering, one would expect reliance upon it to be uniformly heavy.

Other aspects of Basketmaker II archaeology also require further research. For example, the lack of publications by Earl Morris has produced a shortage of descriptive data on the Basketmaker II stage, which could be corrected by re-examination of his collections or through additional excavation. Comments on de Harport's archeological interpretations were offered to suggest a number of other problems which could be investigated. Hypotheses concerning Basketmaker II subsistence were suggested because they focus on weak points in past interpretations of the adoption of agriculture in the Southwest, an event of recognized importance in the archeology of the region. In addition, tests of these hypotheses can be integrated into both excavation and survey projects. Thus they can be incorporated in current research plans, such as those for the Canyon del Muerto Survey (McDonald, Thornton and Morris 1976), and may be useful should excavation of a Basketmaker II site be necessitated by erosion or development project. The suggested hypotheses also
recognize the potential of the monument's excellent preservation conditions. Finally, the hypotheses were suggested for testing because they are based on a theme of investigating relationships between subsistence, climate and population, which is consistent with the research orientation suggested for earlier stages and which, in fact, can guide research on all stages of the monument's archeology.

AD 400-700: The Basketmaker III Stage

The Basketmaker II stage is generally defined as ending with the appearance of fired ceramics (Kidder 1924: 76-77). This may have occurred as early as AD 200 in some localities (Eddy and Dickey 1961: 100-102), but ceramics do not appear to have been widely distributed until at least AD 400 (Martin and Plog 1973: 88-89), a much more widely accepted date for the beginning of the Basketmaker III stage.

The appearance of fired ceramics is thought to be indicative of significant changes in the technology and subsistence practices of southwestern populations. Specifically, it is argued to be indicative of increasing sedentism, based on the assumption that pots would be too susceptible to breakage during the wanderings of nomads (Martin and Plog 1973: 240). Sedentism is, in turn, believed to be correlated with domination of the subsistence strategy by agriculture (Haury 1962: 115-118).

It is usually thought that southwestern populations were primarily agricultural by the Basketmaker III stage; viewing the Anasazi area as a whole, there is some evidence to support this assumption. Beans (Phaseolus sp.) and cotton (Gossypium hirsutum) were added to the crop complex during this stage (Wheat 1955: 205; Bohrer 1972: 3). Beans contain a relatively high amount of protein and, along with corn and squash, they provide a balanced diet. The introduction of beans, therefore, could decrease the necessity for hunting by Basketmaker III populations (de Harport 1959: 1480-1481). There is also a possibility that improved varieties of other domesticates were available, leading to greater reliance on agriculture (Lipe and Matson 1971: 136). Wild foods were gathered nevertheless and the list is similar to that for Basketmaker II (Guernsey and Kidder 1921: 41-109).

Architectural and settlement size data for the Anasazi area also support a greater reliance on agriculture. Pithouses are more common than during the Basketmaker II stage and appear to be the principal form of dwelling (Bullard 1972: 102). The increased energy investment in architecture is believed to reflect increased sedentism. Pithouses vary from .3 m to 1.5 m in depth and 2.7 m to 7.6 m in diameter (Bullard 1962: 119; McGregor 1965: 207-209). They range in shape from circular to rectangular with rounded sides (Bullard 1962: 114-115). Basketmaker III settlements tend to be larger than Basketmaker II settlements; settlements of up to five pithouses occur in the Virgin River area (Aikens 1966: 22), Shabik'eshchee Village in Chaco Canyon contained 18 pithouses (Roberts 1929) and Basketmaker III villages of up to 50 pithouses are known in the Quemado region (Bullard 1962: 102). Increased settlement size is believed to be a result of the ability of domesticates to produce higher yields per unit of land than wild foods, permitting a given area to support a larger population.
Variability in settlement patterns within the Anasazi area, however, suggests that the role of agriculture in the subsistence system was not uniform. Aikens (1966: 21) states that settlements in the Virgin River area continued to be concentrated in valley and canyon environments, suggesting that subsistence practices remained stable into and during the Basketmaker III stage. On Cedar Mesa, Lipe and Matson (1971: 136) noted a shift in settlement pattern from the Basketmaker II to the Basketmaker III stage. Basketmaker III sites tended to be associated with areas of deep soils on the divides between mesa top drainages. This was inferred to reflect a shift in subsistence practices to primary reliance on dry farming on the mesa tops. In Chaco Canyon (Judge, Ebert and Hitchcock 1975: 97, 111-115) Basketmaker III sites were located both on the canyon bottom and on benches along the sides of the canyon. The site distribution resembled the distribution of Navajo sites in the canyon; the latter is associated with a subsistence strategy which was not heavily reliant upon agriculture, suggesting that agriculture was less important to Chacoan Basketmaker III groups than to groups on Cedar Mesa or in the Virgin River area.

The organization of Basketmaker III groups has received little study. Aikens (1966: 21-22) believes that there were few differences, if any, between the organization of Basketmaker II and Basketmaker III groups. Chang (1958: 322) concluded that villages continued to consist of one lineage, which became stabilized in one locality. The increasing size of villages and the increasing number of sites is believed to be indicative of an increasing population.

Basketmaker III sites have been recorded in Canyon de Chelly National Monument by Earl Morris, Wesley Hurt, Charles Steen, David de Harport, James Mount, V.K. Pheriba Stacy, Don P. Morris and the Canyon del Muerto Survey. Earl Morris (1925; A. Morris 1933) excavated a number of Basketmaker III sites, including Mummy Cave and Big Cave. Hurt (1947) investigated a site near monument headquarters at the mouth of Canyon de Chelly. Steen (1966: 22-29) excavated Basketmaker III structures at Tse-ta'a. De Harport (1953, 1959: 1438-1515) recorded 33 Basketmaker III sites and excavated a pithouse during his survey of Canyon de Chelly. Mount mapped the Sonic Boom Site (CDM 28) and collected dendrochronological samples (Don P. Morris 1975: personal communication). Stacy and Don P. Morris (1972) recorded Basketmaker III sites on the Defiance Plateau during their survey of overlook road alignments on the north rim of Canyon del Muerto. Don P. Morris (1975: personal communication) excavated Basketmaker III pithouses at Antelope House and CDM 140. The Canyon del Muerto Survey (McDonald, Thornton and Morris 1976) recorded Basketmaker III materials on the plateau and in the canyon.

Architectural characteristics of pithouses excavated in the monument are similar to those of pithouses found in the western portion of the Anasazi area (Bullard 1962: 114; Aikens 1966: 24-26). The predominant shape is circular. With the exception of Earl Morris, archeologists have recovered few Basketmaker III artifacts in the monument. Morris' collection was quite large, but was never discussed in detail; it seems that Morris felt the monument Basketmaker III material did not differ significantly from that of other regions. He made no comments about major differences either in his discussion of Anasazi basketry (Morris and
Burgh 1941) or in his synthesis of the archeology of the La Plata district (E. Morris 1939), in which he made frequent comparisons with material from the monument. The lack of Basketmaker III materials from other projects appears to be a result of the fact that the projects were usually surveys or excavations of open sites. Rock shelter sites such as those excavated by Earl Morris at Mummy Cave and Don P. Morris at Antelope House have yielded quantities of perishable items that again call attention to the preservation potential of the monument.

The most complete description of the Basketmaker III stage in the monument is provided by de Harport (1959: 1438-1515), who located 33 Basketmaker III sites, including sherd scatters, sites with pithouses and cists and "great kiva-like" sites. De Harport (1959: 1484-1485) stated that this was approximately 1/3 of the number he had expected, assuming a steady population growth from Basketmaker II through Pueblo I times, since he found 81 Basketmaker II and 161 Pueblo I sites. De Harport hypothesized that this might have been a result of difficulties in identifying Basketmaker III sites, as the principal indicator of that occupation was the presence of Lino Gray sherds, which could not be distinguished from body sherds of Kana'a Neck Banded, a Pueblo I type. Basketmaker II sites suffered from a similar lack of diagnostic ceramics, but often possessed characteristic rock art motifs; Basketmaker III sites had no comparable diagnostic attribute. De Harport (1959: 1486-1487), however, ultimately concluded that the Basketmaker III population actually was lower than he expected, since he also recorded a lower-than-expected number of early Pueblo I sites, which did contain diagnostic ceramics. De Harport estimated that the Basketmaker III population of Canyon de Chelly was 73 persons, utilizing procedures similar to those applied to the Basketmaker II data.

De Harport concluded that population movement up canyon continued during the Basketmaker III stage, based on the fact that the majority of Basketmaker III sites were located in the upper zone of the canyon. De Harport (1959: 1479-1482) suggested several explanations for this movement, including (1) exhaustion of the soil in the lower portions of the canyon; (2) a decreased need for animal protein due to the addition of beans to the diet, which enabled Basketmaker III populations to live further from assumed hunting areas at the mouth of the canyon, and (3) continued conflict between Basketmaker communities in Canyon de Chelly and Canyon del Muerto, which forced the communities to separate by moving further upstream. De Harport favored the last hypothesis.

The organization of Basketmaker III groups was said to be similar to that of Basketmaker II groups (de Harport 1959: 1495-1501), although de Harport believed that there was an increasing emphasis on ceremonialism involving the entire Basketmaker community. This inference was based on the appearance of "great kiva-like" sites, which are isolated circular depressions 9 m to 27 m in diameter. These were identified as great kivas because of their size and shape (de Harport 1959: 1469), although none of the structures were excavated; they could also be large pithouses (de Harport 1959: 1461-1464) or reservoirs (Rohn 1963: 448-451). De Harport suggested that the "great kivas" served as focal points for the ceremonial activities of men's societies, integrating the entire Canyon de Chelly Basketmaker community.
A number of criticisms of de Harport's description of the monument's Basketmaker III stage suggests themselves. His site count may be inaccurate, as a result of the absence of adequate Basketmaker III diagnostic ceramics, which may have led to incorrect conclusions about population trends. His attempts to estimate population size are further complicated by his use of site counts as a population index (Plog 1975); some sites may not have been habitation sites and differences in site size are not adequately accounted for. The Defiance Plateau was not well-represented in de Harport's survey sample and may well contain a number of Basketmaker III sites. Such sites have been recorded on the plateau by Don P. Morris and Stacy and by the Canyon del Muerto Survey. De Harport's hypothesis about population movements in Canyon de Chelly is also weakened by his use of site counts as a population index. Furthermore, his favored explanation for the movement, conflict with a similar community in Canyon del Muerto, is inconsistent with other statements about the relationship between the two communities:

Members of the two communities probably functioned together under a single leader for cooperative economic activities, such as certain types of hunting, and there was probably much visiting between the groups especially upon ceremonial occasions. (de Harport 1959: 1497)

De Harport fails to discuss the conditions creating conflict or leading to its resolution and to cooperation, thereby making his arguments somewhat confused. Finally, de Harport's discussion of "great kivas" in Canyon de Chelly is interesting but is perhaps premature, since his hypothesis has not been confirmed through excavation. If de Harport is correct, his discussion of the role of great kivas could be elaborated upon. Gwinn Vivian (1970: 82) has suggested that great kivas in Chaco Canyon served to integrate a moiety system engaged in the construction and maintenance of large irrigation systems. Plog (1974: 122-127) has suggested that great kivas developed as the Anasazi economy changed from a reciprocal to a redistributive system (Polanyi 1957), in conjunction with an increasing reliance upon agriculture. The kivas may have been storage or redistribution centers.

A research program focusing on the relationships between population, climate and subsistence would provide information useful in solving these and other problems. Variation in Anasazi settlement patterns, indicative of variation in reliance on agriculture, has been cited above as evidence that the adoption of agriculture is not inevitable and that it is controlled by forces present in different degrees in different localities within the Anasazi area. Population and climatic conditions have been suggested as two of those forces.

With reference to Canyon de Chelly National Monument, two hypotheses may be proposed on the basis of current archeological theory and data. (1) The population of the monument grew steadily during the Basketmaker III stage. The size of the population led to increasing reliance on agriculture as a means of increasing the yields of lands within the monument, although wild foods continued to be a significant resource. Increasing reliance on agriculture may have resulted in the development of a
redistributive economic system, with great kivas serving as redistribution centers; intensified agricultural efforts may have included the construction of reservoirs. (2) An improvement in climatic conditions during the Basketmaker III stage made it possible for the monument's population to rely heavily on wild food resources and to remain relatively independent of canyon-bottom agriculture.

Tests of these hypotheses would involve field research essentially similar to that suggested for testing hypotheses about Basketmaker II population and subsistence. The evidence in support of either hypothesis is limited.

The first hypothesis assumes that de Harport's population data are incorrect. The hypothesis of steady growth is based on current anthropological assessments of the nature of human populations (Spooner 1972: XV-XXVII). The statement that wild foods continued to be a significant resource is based on the presence of Basketmaker III sites and ceramics on the Defiance Plateau (James 1974a; McDonald, Thornton and Morris 1976). Such sites are in the Pinyon-Juniper Continuum, which is not prime agricultural land, but which does produce high yields of wild foods.

The presence of Basketmaker III materials on the plateau also serves as a basis for the second hypothesis, which assumes that de Harport's low estimate of the Canyon de Chelly Basketmaker III population is correct, but that it applies only to the canyon itself. Improved climatic conditions may have increased yields of wild foods to the point where energy investment in agriculture could be reduced. There is no evidence for such an improvement of climate within the monument at the appropriate time. Studies in the Navajo Reservoir District of New Mexico, however, indicate that effective moisture levels higher than those of the present prevailed during the first half of the Basketmaker III stage and that effective moisture levels similar to those of the present existed during the second half (Schoenwetter and Eddy 1964: 105). Similar studies might be undertaken within the monument to determine whether comparable conditions existed in the monument and to determine their effects on the monument's population.

AD 700-900: The Pueblo I Stage

At one time it was believed that the Basketmaker III stage was brought to an end by an influx of new peoples into the Anasazi area (E. Morris 1939: 29). This conclusion was based on the occurrence of simultaneous changes in architecture, artifacts and skeletal morphology during the eighth century AD, which define the Pueblo I stage of the Anasazi sequence. The most important evidence in support of this interpretation was the change in skeletal morphology. However, the adoption of artificial cranial deformation during the eighth century produced the change in skeletal morphology, rather than the movement of new people into the Anasazi area.

No new domesticates appeared in the Anasazi area during the Pueblo I stage, but the architecture and settlement patterns characteristic of the stage suggest increased reliance on agriculture throughout the Anasazi area. Pithouse villages were replaced by villages with above-ground clusters of contiguous habitation and storage rooms arranged in arcs or
rows. These were frequently associated with pit structures, which appear to have been kivas. Some of the villages were quite large, those in the Mesa Verde and Alkali Ridge areas having as many as 200 rooms (Hayes 1964: 89-91; Brew 1946: 152-202). Architectural changes did not occur uniformly through the Anasazi area, however. At Kiatuthlanna in the Upper Little Colorado river area both pithouses and above-ground jacal houses were utilized (Roberts 1931: 172-173). These were grouped into clusters of three to six houses, with pithouses and above-ground jacal structures occurring in the same cluster. In the Kayenta area villages consisted either of one to several pithouses, with one to six surface storage units, or of above-ground pueblos, containing two to five dwelling rooms and several storage rooms. The pueblos were built from coursed masonry, jacal or adobe and were arranged in a straight line. Pit structures were often associated with the pueblos (Aikens 1966: 38-39). Construction of masonry pueblos is believed to be a continuation of the trend toward increased energy investment in agriculture. The greater size of the villages is assumed to reflect the increased yield per unit of land resulting from increased use of domesticates.

Settlement patterns reflect increasing reliance on agriculture through the concentration of sites in agriculturally favorable areas. For example, Chaco Canyon Pueblo I sites are concentrated in the canyon bottom, in contrast to Basketmaker III sites, which are found on the north and south benches, as well (Judge, Ebert and Hitchcock 1975: 97, 111). On Wetherill Mesa, 83 percent of the Pueblo I sites were located on that portion of the mesa which had the deepest deposits of loess soil (Hayes 1964: 109) and which was considered to be prime dry-farming land. An exception to the pattern of site concentrations on agriculturally favorable land was noted by Aikens (1966: 37-38) in the Virgin River and Kayenta areas, where sites were found on plateau and mesa tops for the first time. These were believed to be hunting and gathering camps established in response to population expansion. No Pueblo I sites have been found on Cedar Mesa (Lipe and Matson 1971).

Pueblo I communities are believed to have been composed of lineages belonging to larger kinship groups for matrimonial purposes (Chang 1958: 322; Plog 1974: 117-132). The existence of house clusters within villages is assumed to indicate the development of communities with more than one residence group.

Many Pueblo I sites have been recorded within Canyon de Chelly National Monument, but few have been excavated. Earl Morris encountered Pueblo I materials during the course of his Basketmaker research, but he had little to say about them. Hurt (1947) discussed architectural developments from Basketmaker III to Pueblo I on the basis of surface evidence and sites visible in eroded banks. Steen (1966: 31-32) excavated Pueblo I structures at Tse ta'a, Don P. Morris (1975: personal communication) found a number of jacal-walled Pueblo I structures at Antelope House and the Mount and Canyon del Muerto surveys recorded a number of Pueblo I sites. De Harport (1959: 1454-1455), who bases the only comprehensive discussion of the Pueblo I stage in the monument on his survey research, recorded 162 Pueblo I structures, more than were recorded for any other stage. The majority of these sites lacked evidence of substantial
architecture, leading de Harport to infer that they represented ramadas or other insubstantial structures and to suggest that the Pueblo I stage was characterized by temporary, shifting settlement. Of the Pueblo I sites with substantial architecture observed by de Harport, 10 show evidence of pithouse structures only, six have both pithouses and surface masonry rooms and three have masonry surface rooms only. The number of rooms in these sites ranged from one to six, with most sites having one room. The structures are commonly constructed of upright base slabs capped with several courses of horizontal masonry. They tend to be rectangular with rounded corners. Structures of this type also were excavated by Steen and were observed in an eroded streambank by Hurt.

The large proportion of Pueblo I pithouses is typical of Anasazi sites west of Canyon de Chelly. De Harport noted that the pithouses showed a bimodal size distribution, with one class of structures ranging from 3.7 m to 5.5 m in diameter and a second class ranging from 9.1 m to 27.4 m in diameter, as indicated by depressions on the site surfaces. The latter were labelled "great kiva-like" sites; six (CDC 181, 211, 282, 301 and 343) were said to be in existence by the end of the Pueblo I period. De Harport also recorded a number of "open retaining wall" sites. These were found on exposed slopes, where the retaining walls served to create level areas. Based on analogies with similar walls in rock shelter sites (E. Morris 1938: 128), de Harport inferred that the walls were built to increase the amount of level ground available for house construction.

Pueblo I sites observed by de Harport were concentrated in the upper zone of Canyon de Chelly. As in earlier stages, sites tended to be located near, but not on, arable land. Rock shelter sites were more common in the lower canyon, while in the middle and upper zones open sites on benches and spurs predominated. This may be due simply to a greater frequency of rock shelters in the lower canyon. As substantial architecture was more common in sites in the lower and middle zones, de Harport suggested that those sites were the winter homes of populations which in the summer farmed the upper zone, living there in jacal or brush structures. De Harport estimated the early Pueblo I population of Canyon de Chelly at 183 people, while the late population was estimated to be 344. Early and late Pueblo I sites were distinguished by assigning sites containing White Mound Black-on-white ceramics to the early Pueblo I stage.

De Harport believed there was considerable continuity in social organization between the Basketmaker III and Pueblo I stages in Canyon de Chelly. Steadily increasing emphasis on ceremonialism was inferred from the construction of four "great kivas" during the Pueblo I stage, bringing the total in use to six. Because the number of "great kivas" in use declined during later stages, Pueblo I was said to represent a climax of community ceremonial activities. The single major change in social organization was said to be a shift from nuclear to extended family domestic groups, indicated by the construction of contiguous-room settlements.

De Harport's discussion of the Pueblo I stage is in need of revision. While his hypothesis of seasonally shifting occupation of Canyon de Chelly appears plausible, it might be tested through a more detailed examination of architecture and artifact assemblages from a sample of sites throughout
the canyon than was possible within the framework of his survey. The upper canyon sites should contain a greater proportion of agricultural implements than do lower canyon sites, allowing for the possibility of differential preservation. Lower canyon sites should also show a larger proportion of enclosed space devoted to storage, arising from the necessity to store food throughout a season when opportunities to gather or to harvest were restricted or non-existent. Tests of this hypothesis are desirable; while it is plausible, it appears to be inconsistent with arguments advanced in support of de Harport's hypothesized up canyon movement of the Canyon de Chelly Basketmaker community. De Harport (1959: 1479, 1482-1483) pointed to the Pueblo I site concentration in the upper zone of Canyon de Chelly as evidence that the similar concentration observed for the Basketmaker III stage was not simply a fluke. If the upper canyon Pueblo I sites are summer farmsteads, however, with winter habitations in the lower canyon, the upper canyon Pueblo I concentration is not evidence for community movement, since the communities are implied to be base camps and the farmsteads are not base camps.

De Harport's description of social organization also requires further comment. De Harport (1959: 1504-1505) stated that "studies of inventories and proveniences of artifacts from pithouses... has not been made in terms of determining the nature of resident groups." This remains true and de Harport's argument for a shift from nuclear to extended family organization must be viewed with caution. The nuclear family is not the universal social unit it once was thought to be (Buchler and Selby 1968: 23-28) and it cannot be assumed that early Anasazi groups were so organized. De Harport's statements regarding community ceremonialism may also require revision, pending confirmation of his hypothesis that the large circular structures observed during his survey are, in fact, great kivas. It must be remembered that the only evidence that these structures are great kivas is their size and shape, attributes which are shared by other structures, such as reservoirs.

In keeping with research suggested for other stages of the monument's archeology, it is suggested that future investigations of the Pueblo I stage focus on relationships between environment, subsistence and settlement pattern. Preliminary data from the Canyon del Muerto Survey (McDonald, Thornton and Morris 1976) suggest that a major shift in subsistence practices occurred during the Pueblo I stage. The survey located substantial quantities of Lino Gray ceramics on the Defiance Plateau, suggesting rather heavy Basketmaker III utilization of the area, probably for pinyon gathering. In contrast, there were relatively few Pueblo I ceramic types, suggesting a marked decrease in Anasazi utilization of the plateau; this may have been due to the onset of adverse climatic conditions: Schoenwetter and Eddy's (1964: 98-107) hypothesized shift from a winter-dominant to a summer-dominant precipitation pattern between about AD 650 and 800. Such a shift is usually interpreted as an adverse climatic change, since summer precipitation is considered less useful to plants. Winter precipitation generally falls as gentle rain or snow and is usually absorbed by the soil, making it available to plants. Summer precipitation generally falls during thunderstorms, with such rapidity that much of it runs off before it can be absorbed; runoff contributes
little to plant growth. A shift from winter-dominant precipitation would thus be likely to decrease the availability of plant food resources.

It is hypothesized here (1) that the shift in precipitation pattern inferred by Schoenwetter and Eddy did, in fact, take place and that it occurred in the monument, as well as in the Navajo Reservoir District, and (2) that this shift decreased the yield of wild food resources, particularly pinyon nuts (Broman 1972: 2), on the plateau and that it led to more extensive exploitation of the canyon bottoms for subsistence, since the water supply within the canyons is more dependable than that on the plateau.

There is no evidence for changes in the Pueblo I precipitation pattern in the monument. Alluvial, palynological and vegetal analyses have previously been recommended as a means of obtaining environmental information crucial to testing this hypothesis and a number of others. Survey data to confirm a decrease in utilization of the plateau are also needed. The present hypothesis of a change in utilization of the plateau is based on qualitative survey data, which need quantitative support (McDonald, Thornton and Morris 1976). Excavation of Pueblo I sites with suitable preservation characteristics might focus on the recovery and analysis of a sample of Pueblo I fecal material as a means of determining dietary patterns. This information might then be compared with similar data for the Basketmaker III stage, to test for the possibility of a change in diet.

The results of such a study are potentially valuable for understanding developmental processes in other localities within the Anasazi region. For example, a shift in settlement pattern similar to the shift in the monument has been noticed within Chaco Canyon. Judge, Ebert and Hitchcock reported that Basketmaker III sites were frequently found on the benches within the canyon, while Pueblo I sites were not. The Pueblo I sites were concentrated in the canyon bottoms, as were those in Canyon de Chelly. It is possible that a shift in precipitation pattern led populations in both areas to rely more heavily on agriculture and gathering in relatively well watered canyon bottoms. In fact, it is possible that this shift gave a final impetus to the adoption of agriculture in many Anasazi areas, completing a trend that began in response to a growing population during the Archaic. Thus the intensive agricultural activities of the Pueblo I stage may be the result of a much more gradual process than that envisioned by Haury (1962), beginning with some reliance on agriculture in response to rising population in the Four Corners area at about 1800 BC, followed by a steadily increasing reliance as a result of continued population increases and a further marked increase in agricultural activities in response to a climatic change in the eighth century AD.

**AD 900-1100: The Pueblo II Stage**

Changes occurred in the settlement patterns in several Anasazi localities between AD 900 and 1100. Large Pueblo I villages, such as that at Alkali Ridge, were replaced by small communities of a few rooms and a kiva, capable of housing only a few families. These changes characterize the Pueblo II stage of the Anasazi tradition (Willey 1966: 207). The changes are more apparent in northern and eastern Anasazi areas than in
southern and western areas. At Wetherill Mesa, for example, Pueblo II dwellings consisted of compact, one-story rectangular surface structures of several rooms, in contrast to the crescentic Pueblo I villages. The average number of rooms per village decreased from eight to six and the distance between villages increased. These changes represent a dispersal, and perhaps a reduction, of the mesa population (Hayes 1964: 109). In contrast, Pueblo I village layouts were preserved in Chaco Canyon and population aggregation appears more likely than population dispersal. Construction began on several large villages, including Chetro Ketl, Penasco Blanco and Pueblo Bonito (Robinson, Harrill and Warren 1974: 24, 30, 35). In the Kayenta area, sites from the tenth and eleventh centuries show little evidence of either population dispersal or aggregation. Population aggregation is noted in the twelfth and thirteenth centuries, when such large sites as Kiet Seel were constructed (Bannister, Dean and Robinson 1968; Dean 1969). Thus the Pueblo II stage, defined in terms of population dispersal, may be limited in areal extent.

Settlement pattern data for the Pueblo II stage are limited. In Chaco Canyon the Pueblo II settlement pattern is very similar to that of the Pueblo I stage. Sites were concentrated on the canyon bottom (Judge, Ebert and Hitchcock 1974). At Mesa Verde the percentage of sites located on deep loess on the top of Wetherill Mesa decreased from 83 to 32 percent (Hayes 1964: 109). Sites appear in greater numbers on stony ridges, on the mesa edges and on talus slopes. Early Pueblo II sites are not found on Cedar Mesa; late Pueblo II sites are found in locations similar to those of Basketmaker III sites (Lipe and Matson 1971: 130-131).

The dispersal of some Anasazi populations during the Pueblo II stage is believed to have produced a fragmentation of the social structure. Large lineages and multilineage communities split into small groups and dispersed widely (Chang 1958: 322).

Very little attention has been devoted to the Pueblo II stage in Canyon de Chelly National Monument, as work generally has been incidental to research on earlier or later periods. Steen (1966: 36-41) reported on the excavation of two Pueblo II rooms and two kivas at Tse ta'a. These structures apparently were considered to be Pueblo II because of their architectural characteristics, but Steen did not state what the definitive characteristics were. Don P. Morris (1975: personal communication) excavated seven, tenth and eleventh century rooms at Antelope House. These rooms were arranged around a rectangular plaza with a central kiva. Architecturally, the rooms were similar to Pueblo III rooms and Morris classified them as Pueblo II on the basis of tenth and eleventh century tree-ring dates.

Pueblo II sites have also been recorded by de Harport, Mount and the Canyon del Muerto Survey. De Harport's (1959: 1516-1583) research is again the basis for the most comprehensive discussion of this stage in the monument. De Harport recorded 139 sites with a Pueblo II component in Canyon de Chelly. Assuming that half the masonry rooms were occupied by an average of four persons at any one time and assuming that sites without such rooms were occupied for 25 years by an average of four persons, he calculated that the average Pueblo II population of Canyon de Chelly was 323 persons. Sites without an apparent Pueblo III occupation, based
on their ceramic assemblages, were used to discuss Pueblo II settlement characteristics. The sites ranged in size from one to eight rooms, which was not seen as a significant departure from the Pueblo I stage. Open sites appeared to have no formal arrangement or directional orientation. Rooms in rock shelters were constructed along the rear wall of the shelter. If the shelter was deep enough, kivas were placed in front of the room block; if not, they were placed at one end. The Pueblo II sites observed by de Harport continued the pattern of location near, but not on, arable land. The upper canyon zone contained the greatest number of sites, but these were primarily sherd and lithic scatters, without evidence of permanent structures. In contrast, sites in the middle and lower canyon zones frequently included masonry architecture. De Harport again concluded that the sites in the upper canyon were seasonal farming shelters.

The presence of tenth and eleventh century multi-roomed structures was interpreted by de Harport as an indication of the continued importance of the extended family as the basic socio-economic unit. By analogy with modern Western Pueblo populations, inheritance was said to be matrilineal and residence matrilocal. Community ceremonialism was believed to have been on the wane, since ceramic assemblages indicated that only four "great kiva-like" sites were in use during the Pueblo II stage, compared with six during Pueblo I.

Archeological research on the Pueblo II stage in the monument has suggested few differences between it and the Pueblo I and Pueblo III stages, other than stylistic changes, such as those in ceramics. Pueblo II architecture, for example, is similar to Pueblo III architecture and appears to represent a gradual evolution from that of the Pueblo I stage. Pueblo II village sizes and layouts observed by de Harport resembled those of the Pueblo I stage. There was no apparent dispersal of population similar to that on Wetherill Mesa. The lack of distinctiveness of the Pueblo II stage in the monument may be due partly to a lack of archeological research focused specifically on the stage, resulting in a lack of detailed knowledge. Research has always been conducted within the framework of projects with other objectives. For example, the Antelope House Project was primarily concerned with understanding the Pueblo III environment of the site, the responses of its occupants to that environment and their social organization (Don P. Morris 1975: personal communication). Alternatively, it is possible that the available data on the Pueblo II stage are not representative, due to the small sample of excavated sites and to the fact that de Harport's discussion of site size and settlement patterns was based on sites that were not reoccupied.

A third alternative is a hypothesis that the lack of differentiation, particularly in terms of site size and settlement pattern, was due to relatively stable environmental conditions from the latter part of the Pueblo I stage through much of the Pueblo II stage. Palynological and alluvial research in the Navajo Reservoir District indicate that conditions effectively more arid than the present, with a summer dominant precipitation pattern, prevailed during a period contemporaneous with the late Pueblo I and early Pueblo II stages in the monument (Schoenwetter and Eddy 1964: 105-106). Schoenwetter and Eddy hypothesize an increase
in total annual rainfall beginning about AD 1050, late in the monument's Pueblo II stage. Evidence for a fairly high total annual precipitation within the vicinity of the monument during late Pueblo II and early Pueblo III times was noted in an analysis of vegetal artifacts from Antelope House (Ambrose 1975b). It is at this time that the Canyon del Muerto Survey observed changes in the monument settlement pattern (McDonald, Thornton and Morris 1976). Evidence for an early Pueblo II occupation of the Defiance Plateau was limited, as was evidence for a Pueblo I occupation, as few ceramics of either stage were found. The bulk of the plateau ceramics were Sosi and Dogoszhi styles, indicative of a late Pueblo II occupation. It is hypothesized, therefore, that the early Pueblo II inhabitants of the monument maintained a subsistence and settlement system similar to that of the Pueblo I stage. This system, oriented toward the consumption of agricultural products and of wild plants native to the canyon bottoms, resulted from the greater reliability of water supplies in the canyon bottoms during a period of low annual precipitation dominated by summer thundershowers. An increase in total annual precipitation late in the Pueblo II stage, perhaps coupled with a shift to winter-dominant precipitation, increased the reliability of plateau water supplies and, consequently, the productivity of the plateau's wild food resources. This led to heavier reliance on plateau resources by late Pueblo II populations in the monument and to an increase in the number of sites found on the plateau.

The hypotheses were inferred from the environmental and settlement pattern data presented above. Additional data on the Pueblo I and early Pueblo II climate in the monument must be gathered, however, since Ambrose's sample for these stages was not adequate for analysis and since extrapolation from distant areas, such as the Navajo Reservoir District, is dangerous. The Canyon del Muerto Survey settlement pattern statements are based on qualitative data, which require statistical testing. The survey data are not amenable to such tests in their present form, although plans have been formulated to gather appropriate data during the next field season (McDonald, Thornton and Morris 1976). Finally, fecal samples could be obtained to determine dietary trends. Such tests of the hypotheses would require excavation, survey and paleoenvironmental studies. The results of the testing proposed above may well be pertinent to settlement and subsistence studies in other Anasazi localities. It was stated previously that no Pueblo I or early Pueblo II sites were found on the top of Cedar Mesa, while late Pueblo II sites were present and were found in environmental settings similar to those of Basketmaker III sites. These locations may have been dry-farming areas (Lipe and Matson 1971: 130-131, 136); their abandonment may be related to the shift in precipitation seasonality and to the decrease in effective moisture noted by Schoenwetter and Eddy, and their reoccupation to an increase in total annual precipitation late in the Pueblo II period. Research on the nature of, and relationships between, environmental conditions, subsistence and settlement systems in the monument may provide evidence for a widespread climatic alteration during the late Basketmaker II or early Pueblo I stages, which may lend credibility to the proposed explanation of Cedar Mesa settlement pattern changes.
AD 1100-1300: The Pueblo III Stage

The trend toward population dispersal noted at Wetherill Mesa during the Pueblo II stage began to reverse itself late in the eleventh century, at about the time of the climatic change hypothesized by Schoenwetter and Eddy (Hayes 1964: 94, 109). After approximately AD 1100 many other Anasazi areas experienced an increase in site size and a decrease in the number of sites. The aggregation process resulted in the construction of large cliff dwellings and pueblos, which are a fundamental component of the Pueblo III stage of the Anasazi sequence (Kidder 1924: 47-73).

During the latter part of the Pueblo II stage cliff houses were built with increasing frequency on Wetherill Mesa and the average number of rooms per village increased. By AD 1150 cliff house predominated. These sites were begun as small villages in the backs of rock shelters and were enlarged through unplanned additions of rooms, resulting in an irregular village layout (Hayes 1964: 109-110; Kidder 1924: 58-49). Villages contained up to 200 rooms.

Population aggregation began somewhat earlier in Chaco Canyon than at Mesa Verde. Dendrochronological specimens from Pueblo Bonito, Chetro Ketl and Penasco Blanco include ninth century cutting dates, suggesting some construction activity at that time. Clusters of cutting dates at Pueblo Bonito and Penasco Blanco indicate major construction episodes at those sites during the early tenth century and seem to mark the beginning of the aggregation process. Chetro Ketl has yielded evidence of a major construction phase in the mid-eleventh century and Pueblo Bonito and Penasco Blanco were enlarged at that time, demonstrating a continuation of the aggregation process (Robinson, Harrill and Warren 1974). The Chaco towns adhered to a common layout: rooms around three sides of a plaza were terraced, with one-story rooms fronting the plaza, rising to three or four stories at the rear. The fourth side of the plaza was bordered by an arc of one-story rooms (Kidder 1924: 49-50). The Chaco towns contain as many as 800 rooms and may have housed up to 1200 people. The population of the canyon may have numbered 10,000 (Willey 1966: 208; Hawley 1934: 9). Most of the Chaco towns are located on the north side of the canyon.

One of the enigmas of Chaco archeology is the presence of 200 to 400 villages, contemporary with the towns and located on the south side of the canyon (Vivian 1970). The villages rarely contain more than 25 rooms and do not seem to have had a common plan. Vivian has suggested that the differences between the towns and villages reflect differences in social organization resulting from irrigation practices. Towns are associated with reservoirs and canals; villages are not. Construction and maintenance demands created by these irrigation works are said to have favored the existence of large social units, whose capabilities could also be employed in town planning and construction. Vivian hypothesized that the towns were occupied by several lineages, organized into two societies sharing governmental and ceremonial responsibilities, while small villages may have been occupied by localized lineages. Whatever the explanation for the town-village dichotomy, it appears that Chacoan towns are qualitatively and quantitatively different from villages in Chaco and elsewhere in the Anasazi area.
The trend toward population aggregation appears to have begun later in the Kayenta region than on Wetherill Mesa or in Chaco Canyon. Lindsay (1969: 379) notes that small household units prevailed until AD 1200, when the average size of villages began to increase as the number of villages decreased. The new villages contained from 10 to 200 rooms and were located in elevated positions, such as on buttes, mesas, ridges and in alcoves in the sides of canyons. There was a tendency to avoid building on arable land. The villages had two patterns (Lindsay 1969: 381-382). Plaza-oriented communities consisted of houses in linear room blocks, arranged around a plaza with a central kiva. Lindsay believed that this type of community may have been the residence of a localized lineage and that it may have been the traditional village form in the Kayenta area. Courtyard communities were composed of clusters of rooms, arranged around small irregular courtyards. Lindsay believed that the courtyard communities represented an amalgamation of groups from several localities. Dean has discussed the processes contributing to the disruption of traditional Kayenta communities and to the growth of courtyard communities: erosion was hypothesized as a force behind the organized migration of existing communities and independent movements of single households into courtyard communities (Dean 1969: 189-196).

The construction of large towns was a relatively short-lived phenomenon at Chaco Canyon, Mesa Verde and in the Kayenta area. The latest cluster of tree-ring dates from a Chaco town are early twelfth century dates from Pueblo del Arroyo (Robinson, Harrill and Warren 1974). The latest dates from the Mesa Verde and Kayenta areas fall in the last quarter of the thirteenth century (Bannister, Dean and Robinson 1968; Robinson and Harrill 1974). Construction activity ceased and population movements occurred in these and other localities, leading to the abandonment by the Anasazi of much territory. The routes of these population movements have been extensively discussed. Ford, Schroeder and Peckham (1972) summarized the discussions and reviewed the evidence provided by ceramics and language, concluding that the inhabitants of Chaco Canyon moved south and west to form the Keresan pueblos (such as Acoma, Laguna, Santo Domingo and Zia). Mesa Verde groups first expanded into the area abandoned by Chacoan populations, as evidenced by a series of mid-thirteenth century dates from Aztec Ruin and by the construction of Mesa Verde-style pueblos, within Chaco Canyon (Robinson, Harrill and Warren 1974). They later moved south and west to add to the Keresan population. The inhabitants of Tsegi Canyon and of other Kayenta localities are said to have moved toward Black Mesa and the Hopi Mesas.

Explanations for the abandonment of large portions of the Anasazi area have been hotly debated, providing a major research topic for southwestern archeologists (Willey 1966: 210-211; Martin and Plog 1973: 318-333). The least satisfactory explanations involve warfare, either with nomadic intruders (Kidder 1924: 129) or among the Anasazi themselves (Willey 1966: 210). Willey points out that nomadic groups probably did not possess the numerical strength to drive the Anasazi out of their territory. There also is no archeological evidence for the presence of intruders in such areas as Chaco Canyon at the time of abandonment. While this suggests that inter-pueblo
warfare may have been a factor in abandonment, warfare alone is not a sufficient explanation, as the occurrence of warfare between Anasazi groups after several hundred years of apparently peaceful existence would itself require explanation. Environmental factors may provide the answer.

On the basis of early dendrochronological research, it was concluded that a severe drought, often referred to as the Great Drought, occurred in the Four Corners area between AD 1276 and 1299 and that this led to the abandonment of much of the Anasazi region by rendering it unsuitable for agriculture. This was intended as a comprehensive explanation for the abandonment, but it fails as such because abandonment of some Anasazi areas occurred before the drought. The apparent cessation of construction activity during the twelfth century in Chaco towns suggests that the abandonment process began there much earlier than AD 1276. In the Kayenta area, Monument Valley was almost completely abandoned by AD 1250 and the population of the Klethla Valley declined sharply after that date (Dean 1969: 193).

Erosion has also been proposed as a cause of abandonment. The period of erosion between AD 1100 and 1300 noted by Hack and others has been argued to have affected the entire Four Corners area. Arroyo cutting during the erosion process would have restricted spring floods, which formerly spread out to water fields. Topsoil would have been lost and the water table would have been lowered, further reducing the productivity of farmland. Irrigation from deeply-entrenched streams would have been difficult. Dean (1969: 194-195) has argued that this hypothesis does not account for local variations in environment, hydrology, subsistence techniques and social organization, which would cause significant variation in the effects of an episode of erosion. Dean argued that a hypothesis of arroyo cutting as a cause of abandonment must meet several conditions before it can be accepted: erosion must be demonstrated in the right place at the right time, the consequences of arroyo cutting must be assessed locally in terms of geology and topography and the agricultural practices of the people experiencing erosion must be considered. Dean applied these considerations to the abandonment of Tsegi Canyon and concluded that erosion was a possible cause of abandonment there. He did not attempt to generalize his results to the Anasazi area as a whole. At present there seems to be no single conclusive explanation for the abandonment process; it is possible that there is no single cause.

Pueblo III sites have been excavated in Canyon de Chelly National Monument by Earl Morris, Kidder, Steen and Don P. Morris. Their work indicates that the Pueblo III stage in the monument was marked by the expansion of several villages, including White House. Kidder and Earl Morris excavated White House, which consists of two units: a cliff dwelling and a cliff-base pueblo. The lower unit contains 17 ground-floor rooms and four kivas. Many of the rooms may once have been three stories high, with four- and five-story towers against the cliff face allowing access to the upper unit. Allowing for the upper stories and for the fact that the front of the pueblo has been extensively damaged by stream erosion, the lower unit may have contained 60 rooms (Richert 1957: 3). The upper unit contains 21 rooms and has not been excavated by professional archeologists, although the deposits have been extensively
disturbed (Don P. Morris 1969: 1). A number of dendrochronological dates have been obtained for White House. There are no dates prior to AD 1045 and most fall in the last half of the eleventh century, indicating that the village was probably constructed at that time (Bannister, Dean and Gell 1966: 27-28). While this precedes generally accepted dates for the beginning of the Pueblo III stage, White House possesses the characteristics of later aggregated villages. The lower unit is also Chacoan in style, possessing core and veneer masonry similar to that in sites at Chaco Canyon. It has previously been stated that the Pueblo III stage, defined in terms of population aggregation, seems to have begun earlier in Chaco Canyon than in most other Anasazi areas. De Harport (1959: 1537, 1578-1580), noting the similarities between masonry at White House and at Chaco Canyon, argued that Chaco groups moved into Canyon de Chelly, basing his argument on the assumption that masonry styles are the product of local groups and do not normally spread through diffusion.

Other indications of Pueblo III migrations into the monument were found by Earl Morris (1938) at Mummy Cave. Pueblo III structures are found in both alcoves and on the central ledge at this site. The western alcove contains about 20 rooms and a possible kiva. The western alcove contains about 50 rooms and three kivas. The central unit contains seven rooms, including a three-story tower. The masonry in the central unit consists of large stone blocks shaped by pecking and closely resembles the style found in the Mesa Verde area. The tower also resembles Mesa Verde structures. Tree-ring dates from the central unit indicate a construction date close to AD 1284, within the period when Mesa Verde was abandoned (Bannister, Dean and Gell 1966: 16-19). The evidence has been interpreted as indicative of the migration of a Mesa Verde group into Canyon del Muerto, where they settled at Mummy Cave and built the tower unit. The tree-ring dates indicate no construction later than that of the central unit within Mummy Cave and the site is thought to have been abandoned by AD 1300. The abandonment may have been the result of violence, as Earl Morris (1938: 137) found skeletons with fractured skulls and broken long bones within the central unit. These individuals were probably clubbed to death.

Steen (1966: 37-53) found what he saw as evidence for the influence of both Chaco and Mesa Verde groups at Tse ta'a. Both the north and south room blocks at that site contained core-and-veneer masonry interpreted as Chacoan in style. Other walls were built with large stone blocks shaped roughly by pecking, which were said to be Mesa Verde in style.

De Harport (1959: 1516-1583), who recorded 126 Pueblo III sites during his survey of Canyon de Chelly, noted at many sites architectural details indicative of migration into the canyons during the Pueblo III stage. Masonry similar to the Chacoan masonry at White House was found at Wild Cherry Ruin (CDC 101). De Harport also noted what he believed to be ceramic evidence of immigrant populations: Mesa Verde-style pottery accounted for approximately 12 percent of his sherd collection, Chaco types comprised 45 percent and Kayenta types made up 40 percent. In spite of their relatively low representation in the total collection, Mesa Verde sherds occurred in high proportions at several sites (CDC 47, 49, 176, 184, 217, 224, 312, 316, 329 and BAC 12). De Harport, therefore,
argued that these sites were occupied by Mesa Verde immigrants. Earl Morris (1948: 91) noted a similar phenomenon at BLR 1. However, since ceramics can be easily traded, such statements based on ceramic evidence should be viewed with caution. Aside from the apparent influx of people into the canyons, de Harport concluded that the Pueblo III stage in the monument was characterized by patterns of site location, social organization and economy that were present during the Pueblo II stage. The greatest number of sites, primarily sherd and lithic scatters, was again observed in the upper zone of Canyon de Chelly. Most masonry structures were found in the lower and middle canyon zones. De Harport noted a marked increase in the number of permanent rooms during the Pueblo III stage and estimated that the population increased from its tenth and eleventh century average of 323 to a maximum level of 808.

In contrast to the research cited above, Don P. Morris (1975: personal communication) concluded that while the village at Antelope House expanded during the Pueblo III stage, the expansion was not the result of immigration from outside the monument. This conclusion was based on the continuity of masonry style throughout the occupation of the site. The masonry at Antelope House consists of irregularly-shaped sandstone blocks set in large amounts of mud mortar. At approximately AD 1140 the southern room block was enlarged through the construction of additional stories and ground-floor rooms. Construction of the northern room block also began at that time and continued through occasional addition of individual rooms.

Construction activity in the monument declined rapidly after AD 1284 and the canyons appear to have been almost completely abandoned by AD 1300 (de Harport 1959: 1583). Utilization of the monument from that date to the arrival of the Navajo appears to have been limited to intermittent agricultural activities by small groups of Hopi. The abandonment appears to be roughly contemporary with the abandonment of Mesa Verde and of the Tsegi Canyon area; many of the explanations for the abandonment of those areas have been proposed for the monument, as well, but none have been confirmed.

Thus it appears that research on the Pueblo III stage in Canyon de Chelly National Monument could focus on (1) a reexamination of the hypothesized migrations into the monument and (2) explanation of the abandonment of the monument in the thirteenth century. While a number of archeologists have hypothesized migrations into the monument to account for patterns observed in Pueblo III architecture and ceramics, their hypotheses are based on weak assumptions and ignore some relevant data. The weakest assumption is that which states that high proportions of ceramics with a style indigenous to a particular locality indicate a migration from that locality when found on an archeological site in some other region. This assumption ignores the possibilities of diffusion of a design style and of trade. The occurrence of diffusion versus migration might be tested by examining artifacts other than ceramics for stylistic similarities. Migration should result in identical styles in a larger number of artifact classes than would result from trade. The possibility of trade in ceramics could be further tested by determining whether non-local sources of paste and temper were utilized.
The assumption that architectural similarities are indicative of migration is perhaps more tenable. Imitation of architectural styles, however, should not be discounted. Furthermore, archeologists working in the monument have not utilized all the relevant data when discussing architectural evidence for migration. For example, while the lower unit of White House is composed of core-and-veneer masonry similar to that of Chaco Canyon pueblos, the ruin does not possess the ground plan typical of Chaco pueblos. The rooms were laid out in a solid rectangular block, rather than around the sides of a plaza. Thus "Chacoan" architecture in Canyon de Chelly is by no means identical to that of the Chaco pueblos and hypotheses of a Chaco migration into the monument based on architectural evidence should be tested with data on a wide range of items of material culture.

The search for an explanation of the abandonment of the monument could adopt the theme of research suggested for other stages of the monument's prehistory, incorporating data on settlement patterns, subsistence and environmental conditions. The Canyon del Muerto survey noted that eight of 13 Pueblo III sites on the plateau were occupied only prior to AD 1150, based on ceramic assemblages dominated by Sosi and Dogoszhi sherds and lacking later types. Three sites appear to have been occupied after AD 1150 and two were dated using criteria which precluded assignment of a date more specific than "Pueblo III." It appears that utilization of the plateau declined dramatically after AD 1150. Previously-cited interpretations of the Antelope House data indicated that the site underwent expansion at that time, suggesting that the expansion may have been due to the movement of plateau inhabitants into the site (Don P. Morris 1975: personal communication).

Reasons for the movement have been suggested by Antelope House environmental analyses (Ambrose 1975b), as discussed in detail under the "Past Environment" subheading of Chapter 1. On the basis of the vegetal and dendrochronological evidence, Ambrose concluded that the period from AD 1100 to 1140 was one of particularly favorable environmental conditions, with above-average rainfall producing an abundance of wild plant resources. This is in accord with Schoenwetter and Eddy's (1964) environmental reconstruction for the Navajo Reservoir District, which hypothesized increasing total precipitation after AD 1050. This period of above-average precipitation was hypothesized as a factor contributing to increased Anasazi exploitation of the plateau's wild food resources.

Ambrose concluded that the period from AD 1140 to 1200, however, was a time of unusual environmental stress, in the form of drought and a consequent reduction of vegetal resources. This drought is here hypothesized to have led to the abandonment of the Defiance Plateau and to aggregation in canyon bottom sites, where agriculture was possible. The period from AD 1250 to 1274 is also believed to have been a period of environmental stress, in which localized drought may have reduced the plant cover in the monument, while above-average rainfall in the surrounding region sent erosive floods through monument drainages. This was followed by the so-called "Great Drought" of AD 1276 to 1299.

Although the Great Drought has been proposed as a cause of the abandonment of the monument (de Harport 1959: 97-103; 1591), the above data suggest that this is not an adequate explanation. The drought of
AD 1140 to 1180 was of equal intensity and of greater duration, but it did not lead to the abandonment of the canyons. The environmental data from the monument suggests an alternative explanation: that the years from AD 1250 to 1274 combined a unique combination of local and regional climatic conditions, producing an episode of erosion, with disastrous consequences for agriculture (Ambrose 1975b: 21-22). The erosion hypothesized by Ambrose would tend to lower the water table and perhaps to wash away arable land at a time when drought was already rendering agriculture difficult and had reduced the availability of wild resources. This hypothesis implies abandonment of the monument sometime during the period from AD 1250 to 1276, which is consistent with data from Antelope House, where tree-ring and archeomagnetic dates indicate a decline in activity after AD 1250 (Don P. Morris 1975: personal communication). Morris feels that the site was abandoned by the start of the Great Drought in AD 1276. Tree-ring dates from the Tower Unit at Mummy Cave, however, cluster at AD 1284. The Tower Unit is architecturally distinctive within the site, probably representing a late and temporary migration into the monument.

Testing of the hypothesis should focus on three problems. (1) A larger sample of tree-ring and archeomagnetic dates from the monument is needed to estimate the time of abandonment. Archeomagnetic dates from Pueblo III hearths would be particularly useful, since they would represent the last use of the hearths, which would tend to be later than the latest tree-ring dates. Such samples will probably have to come from excavated Pueblo III sites. (2) Ambrose (1975b: 23-24) suggested that the initial response of canyon populations to erosion would be to move up-canyon as the erosion proceeded headward. This phenomenon should be detectable in archeological survey data. A survey in the middle and upper canyons may be suitable for testing the abandonment hypothesis. (3) the occurrence of an erosion episode during the Pueblo III stage must be confirmed and precisely dated. A study of the alluvial geology would be useful for that purpose. While the results of such research would be specific to the monument, they would have broader significance, as well, in that they could be compared to data from other localities and used to evaluate arguments that abandonments must be investigated in specific localities, rather than attributed to area-wide causes such as the Great Drought, if they are to be understood.

AD 1300-1600: The Pueblo IV Stage

The years following AD 1300 were marked by the concentration of Pueblo populations in the areas they now occupy. To the west of the monument, Puebloans settled in the area of the Hopi Mesas. To the east, population concentrated at Zuni, Acoma and the Rio Grande Valley. The number of Pueblo villages decreased, but the size of each increased. The Pueblo IV stage of the Anasazi sequence includes this period of population aggregation.

The material culture of Pueblo IV resembles that of the Pueblo III stage in most respects, but significant changes in social organization seem to have occurred. Historic Pueblo social organization, as described by Titiev (1944), Eggan (1950), Fox (1967) and others, is believed to have
developed during the Pueblo IV stage or late in Pueblo III (Eggan 1950: 129-130; Dean 1969: 191). The fundamental unit of the organizational structure is a matrilocal extended household. The households are semi-independent and move without reference to other units. Matrilineages and clans exist but are not localized within villages. Membership in societies cross-cutting clan and lineage lines serves to integrate village inhabitants.

The Anasazi occupants of the monument did not possess distinctive architecture, ceramics or other artifacts and their movements subsequent to the abandonment of the canyons cannot be traced archeologically. It is assumed that the canyon Anasazi moved to the southern edge of Black Mesa and the Jeddito Basin, where they became part of the Hopi population (de Harport 1959: 1583). Although some Hopi clans have migration legends which indicate that they once occupied the monument, such legends have proven to be unreliable evidence for migration routes (V. Mindeleff 1891: 16-38; Longacre 1970: 2-3).

Archeologists working in the monument have not been concerned primarily with the Pueblo IV stage, so that information about this stage is sketchy. Pueblo IV Hopi ceramics have been reported at 47 sites within the monument by de Harport (1959: 1584-1620) and at Tse ta'a by Steen (1966: 55-57). The majority of sites found by de Harport had hearths but no evidence of structures. Some of the sites had one or two contiguous rooms open at one end and outlined by sandstone slabs. Ten of the Pueblo IV sites were said to have had masonry that might be of Hopi origin, but de Harport (1959: 1596) admitted that the masonry resembled some of the better examples of Navajo masonry and recognized that his judgment was essentially intuitive. These sites ranged from one to four rooms in size. One site, BAC 7, contained sherds which indicated a continuous occupation from late in the Pueblo III stage to early in the Pueblo IV stage, suggesting that the abandonment of Canyon de Chelly at the end of Pueblo III was not complete. Steen found two Hopi burials and one possible Hopi structure (a corn crib), as well as a number of Hopi sherds, during his excavations at Tse ta'a.

De Harport found that Pueblo IV sites were clustered. Groups of two to 12 sites were located from Cottonwood Canyon to CDC 329. Four large clusters were observed between The Window and a point two miles up-canyon from Spider Rock. The sites overlook arable land, but de Harport (1959: 1610) stated that they were situated without regard to the best arable land, possibly due to previously established (Pueblo III) land ownership patterns; Hopi descendants of the Canyon de Chelly Anasazi were thought to be returning to the canyon to farm their ancestors' lands. Since the sites within clusters were located within view of each other and since sites were generally situated on higher elevations than in previous periods, de Harport suggested that defensive potential was also a factor in site location decisions.

De Harport believed that the Pueblo IV occupation of the monument was intermittent, with complete abandonment of the canyons during some intervals. He speculated that when the canyons were occupied most of the inhabitants were present only during the farming season and that they returned to the Hopi villages in the winter. Because a few masonry
pueblos were thought to have been occupied and because de Harport felt the transportation of harvests to the Hopi mesas would be tedious, he believed that some individuals may have been year-round residents of the canyons. De Harport (1959: 1615) utilized a variety of assumptions about the continuity of occupation of Canyon de Chelly, the length of occupation of individual sites and the number of sites occupied simultaneously to devise population estimates of 12 to 113 persons for the Pueblo IV occupation. He considered the estimated populations to be inadequate for maintaining a full Hopi ceremonial cycle and concluded that the Pueblo IV inhabitants of de Chelly returned to home villages in the Hopi area for ceremonials. De Harport attempted to determine when Hopi groups would have been most likely to have utilized Canyon de Chelly; he concluded (1959: 1611) that the occupations may have occurred during periods of severe drought (AD 1400-1410, AD 1500-1510 and AD 1573-1593) on the Hopi Mesas.

De Harport's and Steen's discussions of the Pueblo IV stage must be read with caution, as many of their inferences have few supporting data. For example, de Harport inferred that land ownership patterns established during the Pueblo III stage determined the location of Pueblo IV settlements. This conclusion was reached, in part, because Pueblo IV sites were not located near the "best" agricultural land. De Harport, however, did not explicitly state his criteria for rating the quality of agricultural land. As a result, it is impossible to assess the validity of his criteria and the accuracy of his conclusion. There is also a lack of data directly supporting land ownership patterns as a determinant of Pueblo IV settlement patterns. De Harport's conclusion is based on the apparent failure of alternative explanations: erosion, location near best agricultural land and the like. As such, the conclusion is the result of an argument from negative evidence, which is risky. The lack of data encountered by de Harport and Steen is primarily a result of a lack of interest in the Pueblo IV stage on the part of archeologists working in the monument.

A more serious problem may have been created by de Harport's and Steen's assumption that the presence of certain ceramic types on a site is unequivocal evidence for the occupation of that site by specific cultural groups. Hopi ceramics found on a site are assumed to represent former occupation of the site by Hopi. Yet of the 47 Pueblo IV sites recorded by de Harport, 25 also contained Navajo material; three sites had stone ring hogans. This suggests the possibility that the Hopi ceramics were collected or obtained in trade by the Navajo. Many statements about such topics as Pueblo IV population size and settlement pattern, therefore, may be based on Navajo data.

Many of the problems with currently available discussions of the Pueblo IV stage in the monument could be corrected by obtaining additional archeological survey data. Identification of the groups occupying sites would have to be based on a wide range of criteria, in addition to ceramics. Survey crew members should be as familiar with differences between Hopi and Navajo masonry, architectural features and non-ceramic artifacts as current archeological knowledge permits. They should also be familiar with ethnographic and archeological data on Hopi-Navajo trade. When it
becomes possible to distinguish Hopi and Navajo sites with confidence, some of de Harport's and Steen's conclusions about the Pueblo IV stage should be tested. For example, the location of Hopi sites with respect to soil characteristics, water supply and eroded areas could be studied to test de Harport's conclusion that Pueblo IV sites were not located with respect to the "best" arable land.

AD 1600-1976: The Pueblo V Stage

The entry of the Spanish into the Southwest and their contact with Pueblo groups define the onset of the Pueblo V stage of the Anasazi sequence. There is little change in material culture between the Pueblo IV and Pueblo V stages; metal tools were introduced by the Spanish and Spanish influences, such as stairways, ovens and chimneys appear in the architecture. Village layouts, however, remained the same as in the Pueblo IV stage until relatively recently, when Anglo-American single-family homes were built with increasing frequency. Some new domesticates, such as sheep, were added to the Pueblo subsistence base, but these do not appear to have greatly altered the Pueblo way of life.

De Harport (1959: 1584-1620) recorded 55 Pueblo V sites within Canyon de Chelly, the majority of which are sherd scatters. Seven masonry structures built during the Pueblo II and Pueblo III stages yielded historic Hopi ceramics and nine sites contained masonry which might be Hopi. The Pueblo V sites noted by de Harport were uniformly distributed throughout the middle and upper zones of Canyon de Chelly. They did not show the clustering characteristic of Pueblo IV Hopi sites. De Harport estimated the Pueblo V population of Canyon de Chelly to have been 240.

De Harport (1959: 1619-1620) attributed the presence of Pueblo V sites in Canyon de Chelly to a migration of the Asa and Badger clans from the Hopi Mesas, as recorded in clan legends (V. Mindeleff 1891: 30). Tree-ring dates were interpreted by Douglass (1935: 49) and de Harport (1959: 1612) as indicative of a severe drought between 1727 and 1737; de Harport felt that the migration occurred at that time. The Hopi had apparently left the monument by 1804, since reports by the Narbona expedition into Canyon del Muerto make no mention of Hopi living in the canyon.

De Harport's discussion of the Pueblo V stage in the monument is marred by essentially the same problems which detract from his discussion of the Pueblo IV stage. Data are limited, since archeologists have not been interested in studying the stage. The use of migration legends to explain Hopi movements into the canyon must be accepted with caution because of frequent inaccuracies in those legends. Finally, many of the Pueblo V sites recorded by de Harport also contain evidence of Navajo occupation. Recommendations similar to those offered for the Pueblo IV stage can be made for solving these problems.

? - 1976: The Navajo

Following the Pueblo III stage, Puebloan peoples played a lesser role in events within the monument than did the Navajo. The Pueblo V Hopi migrants into the canyons were said to have encountered Navajo, with whom
they occasionally intermarried (V. Mindeleff 1891: 40). Archeological data about the Navajo are limited, as their sites have not been given the attention that the spectacular Anasazi pueblos attract. Historical sources are difficult to work with because early documents do not use tribal names in a consistent manner. For example, Hester (1962: 21-23) refers to Spanish documents in which the term "Apache" may indicate groups related to the modern Apache tribe, groups related to the modern Navajo or groups including both. Much remains to be learned about the Navajo. Researchers agree that the Navajo are an Athabascan group and that they entered the Southwest relatively late in archaeological terms, but controversy surrounds the exact time and circumstances of their entry. Some researchers have suggested that characteristics of Pueblo III sites in the Largo and Gallina areas of New Mexico, such as the presence of pointed-bottom ceramics and fortified villages in defensive locations, indicate contact with hostile Navajo intruders (Mera 1938; Hibben 1938; E.T. Hall 1944). The observed features could also reflect contact with non-Navajo Plains groups (Willey 1966: 219). No distinctly Navajo material has been dated that early in the Southwest. The earliest dates from a Navajo site are three tree-ring dates from the Gobernador area, ranging from AD 1491 to 1521 (Smiley 1951: 43). However, a recent re-evaluation of dendro-chronological samples from the locality places the earliest sample at AD 1495 and suggests that it is unreliable (Robinson, Harrill and Warren 1974: 88-89). A number of sixteenth and seventeenth century dates were also obtained in the Gobernador area, but lack of provenience information on the samples made it impossible to determine whether they represented an occupation during those centuries. The earliest cutting dates from Navajo sites fall in the early eighteenth century. A date in the late fifteenth or early sixteenth centuries is generally given for the Navajo entry into the Southwest (Hester 1962: 62-63).

Archeological and historical data were employed by Hester (1962) to divide the Navajo occupation of the Southwest into four phases: Dinétah, Gobernador, Cabezon and Reservation. Hester believed that differences in culture between eastern and western Navajo warranted the creation of a separate phase system for the western Navajo, but limited archeological data allowed him to define only one such phase, the de Chelly.

**The Dinétah Phase.** During this phase, the earliest in Hester's sequence, the Navajo entered the upper San Juan River Valley. As they did so, they are believed to have come into contact with Pueblo Indians and to have adopted an agricultural economy and semi-sedentary settlement (Hester 1962: 62-63). Corn, beans and bottle gourds were the principal Dinétah phase crops. Prior to the adoption of agriculture, the Navajo economy probably resembled that of the Plains Apache, which was dependent on migratory bison hunting. After the adoption of domesticates, hunting and gathering remained important and produced seasonal movement of settlements. Habitation consisted of forked-stick hogan.

**The Gobernador Phase.** In 1680 the Pueblo Indians drove the Spanish from much of the Southwest. In spite of their initial success, many feared Spanish reprisal and fled to live with the Navajo. As a result, a number of Pueblo traits appeared in Navajo sites and these have been used to
define the Gobernador phase of Hester's Navajo sequence. Masonry architecture and fortified sites in defensive locations appeared in eastern areas, which experienced a heavy influx of Pueblo populations. Forked-stick hogans remained the predominant house form elsewhere. Pueblo ceramics and European trade goods appear in sites of this phase. Raiding and warfare became significant economic pursuits. The primary purpose of raiding seems to have been the acquisition of livestock (Hester 1962: 26) and the Navajo were well on the way to becoming a pastoral people by the end of the phase.

The Cabezon and de Chelly Phases. Increased emphasis on pastoralism and increased utilization of European material culture define the Cabezon phase (Hester 1962: 65). The beginning of the phase is dated at 1775, but it was determined by making arbitrary divisions on the continua of "increasing emphasis on pastoralism" and "increasing utilization of European material culture." Stone-wall hogans became more common among the eastern Navajo area during the Cabezon phase, but they are much less frequent in the west. The western and eastern Navajo had become somewhat distinct by the Cabezon phase, prompting Hester to define a separate phase, the de Chelly, for the western Navajo after 1775.

Navajo raiding for livestock, intensified by Spanish, Mexican and American encroachment upon Navajo lands, continued during the Cabezon and de Chelly phases (Hester 1962: 22-23). Hill (1936) presents a description of raiding practices. Raiding parties usually consisted of four to 10 individuals. Plunder was the principal objective and settlements were seldom burned. Some raids were conducted as reprisals, rather than for plunder; these raiding parties were usually larger, involving 30 to 200 Navajo, and the raids were more destructive.

The raids provoked a series of punitive expeditions by Spaniards, Mexicans and Americans, which culminated in Col. Kit Carson's expedition against the Navajo in 1863. Carson's tactics convinced a sizeable portion of the Navajo population to surrender. Those who did so, numbering as many as 9,000, were interned at Fort Sumner, New Mexico. An attempt to re-emphasize agriculture in the Navajo economy failed, due in part to the Fort Sumner area's unsuitability for an agricultural population of that size.

The Reservation Phase. In 1868 the Navajo were released and reservation life began. Kluckhohn and Leighton (1947) present an excellent summary of this period. Pastoralism regained its economic importance and income from weaving and wage work began to contribute significantly to the economy.

Much less archeological research has been devoted to the Navajo within the monument than to the Anasazi. Much of the work has been incidental to research on the Anasazi (C. Mindeleff 1897; de Harport 1959) or has consisted of limited survey and excavation (Hurt 1942; Stacy and D.P. Morris 1972). Major research on the Navajo recently has been undertaken by the Museum of Northern Arizona (James and Lindsay 1973; James 1974f) and by the Canyon del Muerto Survey (Magers 1976).
The date of the Navajo entry into the monument is unknown, as is the date of their arrival in the Southwest. The earliest archeological date resulted from Hurt's (1942) examination of two groups of hogans along the former Spider Rock Overlook Road alignment. Tree-ring specimens from one hogan were dated to 1758. Other hogans produced dates ranging through 1770. These dates, however, have been revised (Bannister, Dean and Gell 1966: 33; Brugge 1967); the earliest revised date is 1794, the latest 1864. Dates from a fire pit at CDC 206 and from a granary complex at the base of Spider Rock (CDC 232) suggest Navajo occupation of Canyon de Chelly during the last quarter of the eighteenth century. Documentary evidence suggests that the Navajo may have settled in the de Chelly area as early as 1706 (Reed 1941: 487). References to the movement of Pueblo refugees into the area, first from Jemez and later from Awatovi, are said to support that interpretation (James and Lindsay 1973: 364). De Chelly is depicted on a map drawn in 1778 by Don Bernardo de Miera y Pacheco (Brandon 1961: 130-131); it is thought that he obtained his information about the settlement from members of Spanish military expeditions against the Navajo in 1774-1775 (Brugge and Wilson 1976: 1). The name Chelli, a variant spelling of Chelly, appears on a list of "divisions" of the Navajo in 1786 and is also included in a 1796 list of 10 Navajo settlements (Brugge and Wilson 1976: 1). Documentary sources, therefore, tend to confirm the archeological evidence that the Navajo had moved into the monument by the end of the eighteenth century, at the latest.

Archeological and ethnological research on the monument Navajo have suggested that they differ from the Navajo in surrounding areas (James and Lindsay 1973: 362). The rich, but spatially restricted, environmental conditions in the monument produced a more limited seasonal movement there than in many other areas. The agricultural practices of the monument Navajo more closely resembled those of Pueblo groups (Hill 1938: 51), with a heavier reliance on agriculture, at the expense of sheep herding, than in most Navajo areas. This has sometimes resulted in de Chelly Navajo being considered poor by other Navajo (C. Mindeleff 1898: 483).

Recent archeological work on the north rim of Canyon del Muerto has defined several phases for the Navajo occupation of the monument (C.D. James 1974f).

The Del Muerto Phase. The earliest is the Del Muerto phase. It is contemporary with Hester's Gobernador phase and includes the time from the arrival of the Navajo in the monument area until about 1800. Settlement seems to have occurred first near Canyon de Chelly (Hill 1938: 48-49; de Harport 1959: 1600). Settlement of the north rim of Canyon del Muerto occurred later, perhaps as a result of population growth in the original community (Hill 1938: 48-49). Subsistence practices included the cultivation of corn, beans, squash and melons, sheep herding and some hunting and gathering.

The north rim settlements, studied by James, initially were built in the open and had up to 10 hogans per site. Forked-stick, corbelled-log and stone hogans were constructed. The stone hogans tend to be slightly later and are generally found closer to the canyon rim. The
stone hogan sites tend to be smaller, to be more dispersed and to blend more with the topography than do the other sites, suggesting a need for camouflage and defense. The earliest north rim sites were found on the plateau in the vicinity of Antelope House. Toward the end of the Del Muerto phase the rim area near Massacre Cave (CDM 176) was settled. Denser stands of pinyon and juniper in that area make travel more difficult and further aid camouflage, suggesting an increased concern with defense as the phase drew to a close. Stone hogans were the most common type in the Massacre Cave locality, with one to three hogans present on each site.

The De Chelly Phase. Changes in the Navajo settlement pattern, reflecting even greater concern with defense, are central to James' definition of the second phase of the Navajo sequence. James' beginning date for the De Chelly phase, 1800, is somewhat later than Hester's, but is based on additional data gained through excavation and ethnographic research. De Chelly phase sites are more camouflaged than are Del Muerto phase sites and do not occur in open areas. Preferred areas of settlement were near ledges, along canyon rims and in small side valleys near the canyon rim. Settlements in these areas are more inconspicuous, and often less accessible, than are those on the plateau.

Defense was probably a major factor in site location decisions because of a series of military expeditions against the Navajo by Spaniards and Americans, resulting from the increasing frequency of Navajo raids to acquire livestock and to prevent encroachment by Spaniards, Mexicans and Americans on Navajo land. The first documented Spanish military contact with the de Chelly area Navajo is the account of a military expedition led by Antonio Narbona during the winter of 1804-1805. On January 17, 1805, Narbona attacked Navajo who had taken refuge in Massacre Cave, killing 115 and taking 33 captive (de Harport 1959: 124-125; McNitt 1972: 431-433). This attack gave the cave its name. Navajo accounts of the battle were recorded by van Valkenburgh (1940). The canyons were entered again in 1847 by an American military expedition led by Maj. W.J.H. Walker, who proceeded 10 km up Canyon de Chelly without making contact with the Navajo (McNitt 1972: 126). Another American military expedition, led by Lt. Col. J.M. Washington, entered the monument area in 1849. Lt. James H. Simpson, a member of the expedition, took three assistants and 60 troops into Canyon de Chelly in search of a Navajo fortress reputed to be located on a high isolated plateau near the mouth of the canyon. His journal suggests that he was looking for a large masonry or earthwork structure, which he did not find (McNitt 1964: 95). He concluded that the fortification was a myth, but Navajo sites on isolated buttes are found in the monument and appear to be refuge sites. CDM 19 is an example of such a site (Don P. Morris 1975: personal communication). These sites contain small defensive walls, but no structure that Simpson would have called a fort. Simpson's journal also contains the first recorded observations on the Anasazi ruins in the monument. Additional American expeditions entered Canyon de Chelly in 1851, 1858 and 1859 (McNitt 1972: 196-198, 236, 348-349, 367-368). These expeditions had limited contacts with the Navajo, since the Navajo generally avoided the large scale confrontations which the expeditions attempted to provoke. The expeditions were unable to halt Navajo raiding.
It became apparent to American military planners that new tactics would have to be adopted to end the Navajo raids. These would involve the destruction of Navajo crops, harassment of the Navajo during the fall and a direct strike during the winter, when Navajo food reserves would be low. The utilization of small units would increase the possibility of surprise (Bailey 1964: 145-171). Carson began employing these tactics in 1863 and in January of 1964 he attacked Canyon de Chelly. During the course of the operation the north rim and bottom of Canyon del Muerto and the south rim and bottom of Canyon de Chelly were explored. Hogans and food supplies were destroyed. With their food supplies running low, many Navajo decided to surrender to Carson and were sent to Fort Sumner (de Harport 1959: 135).

The Fort Sumner Hiatus. The Carson expedition left the monument area almost deserted. James (1974f) has referred to this period as the Fort Sumner Hiatus, as no sites dating to the time of the Navajo internment at Fort Sumner have been found in the monument. James expects that any sites built during this period would be difficult of access and would be expected to resemble sites built just before and after the hiatus. Ethnographic data or reliable tree-ring dates will probably be required to distinguish such sites. James states that the internment at Fort Sumner is important in the archeological record because contact between eastern and western Navajo at Fort Sumner reduced some of the differences between them.

The Tsaile Phase. The monument area was resettled following the release of the Navajo from Fort Sumner in 1868, which marks the beginning of the Tsaile phase. Resettlement appears to have occurred first in dense pinyon-juniper woodland in higher elevations of the monument. The Massacre Cave area was settled before the del Muerto area. Occupation of the pinyon-juniper woodland may have reflected a continued concern with site camouflage or with the nearness of the settled areas to the Fort Defiance ration center. Sites of the Tsaile phase consist of one to three hogans, which may be of forked-stick, polygonal cribbed-log or vertical wall construction.

The Wheatfields Phase. James dates the onset of the Wheatfields phase at 1900. The phase is marked by the increasing influence of trading posts, wage labor and schools on subsistence and settlement patterns. The increasing volume of Anglo-American items in trash dumps indicates increasing reliance on trading posts for supplies. The proximity of the Del Muerto community to sources of wage labor and to schools in Chinle seems to have resulted in a much higher population density in the Del Muerto area than in the Massacre Cave area, probably accentuated by a population movement into the Del Muerto community from the Wheatfields area above de Chelly (James and Lindsay 1973: 368-369; James 1974f).

The Chinle Phase. After 1945 Navajo material culture is composed mainly of Anglo-American items. The automobile was introduced and a day school was opened in the Del Muerto community, events which seem to have resulted in an increased tendency to occupy camps year-round. These changes serve
as the basis for James' definition of the Chinle phase. Forked-stick hogans had become rare by this time and frame houses became increasingly common.

The Window Rock Phase. The last phase in James' sequence, the Window Rock phase, begins in 1965 and is marked by the presence of items such as plastic containers and aluminum.

James' research constitutes the first detailed archeological study of the Navajo occupation of the monument. The conclusions appear to be valid (Magers 1976), but it must be remembered that James' archeological sample was rather limited, since it was essentially confined to sites on and near the North Rim Drive overlook road alignments. Archeological samples gathered from such right-of-way projects do not conform to the requirements of sampling theory and there is some risk that the sample is not representative of the region from which it is drawn. While it is possible to obtain valid results from a right-of-way survey (Mueller 1974: 49), the conclusions should be tested further, if possible. The Canyon del Muerto Survey is attempting to test James' conclusions (Magers 1976; McDonald, Thornton and Morris 1976). Even when this work is completed, however, little will be known about the Navajo occupation of Canyon de Chelly, since no survey and little excavation of Navajo sites has been done in that canyon. It is recommended that Navajo, as well as Anasazi, sites be recorded if additional archeological surveys are undertaken in Canyon de Chelly.

Summary

While the culture history of Canyon de Chelly National Monument can currently be outlined as far back as AD 300, discoveries of Archaic materials in surrounding areas suggest that the monument may have been occupied at a much earlier date. Determining the date of the initial occupation of the monument is a culture-historical problem and could be solved by future archeological research.

Future research, however, need not be limited to that problem. Much remains to be learned, such as explanations for events in the culture history. It has been suggested that future archeological research in the monument focus on the investigation of relationships between environmental conditions, settlement pattern and subsistence. Such investigations have shown promise for explaining events in southwestern culture history. For example, the "Great Drought hypothesis" links knowledge of environmental conditions and subsistence practices in an explanation of a major alteration in Anasazi settlement patterns. Canyon de Chelly National Monument offers considerable potential for the study of such problems because of the preservation conditions in its numerous rock shelters. The Antelope House Project, for example, has shown that environmental studies can benefit from the analysis of large quantities of preserved vegetal materials and that detailed information on the diet of the monument's inhabitants can be obtained from studies of preserved coprolites.

Several hypotheses have been suggested for testing in the monument. It was hypothesized that the adoption of agriculture in the Southwest was a gradual process, beginning during the Archaic period and continuing
through the Pueblo I stage. The degree of reliance on agriculture has been hypothesized to have been dependent on population size and environmental conditions in specific localities. This hypothesis has been offered to account for difficulties encountered when one assumes that agriculture was unequivocally superior to hunting and gathering and was, therefore, adopted at a rapid rate. The final impetus toward primary reliance on agriculture for subsistence has been hypothesized to have been a deterioration in climatic conditions during the eighth century AD, although monument inhabitants were familiar with agriculture at a much earlier date. Following the eighth century, Anasazi in the monument have been hypothesized to have increased their utilization of wild food resources whenever climatic conditions permitted. Finally, it has been hypothesized that drought and erosion during the twelfth and thirteenth centuries AD so complicated the task of subsistence that the monument was abandoned.

A similar approach could be adopted for the archeological study of the Navajo within the monument. However, ethnohistorical research suggests that in the case of the Navajo the concept of "environment" could profitably be modified. For the Anasazi, recommended research and suggested hypotheses focus on characteristics of the physical environment. For the Navajo, the cultural environment, in the form of the presence and actions of Spanish, Mexican and American Groups, seems to have been at least as significant. Hypotheses relating the state of the cultural environment to Navajo settlement pattern behavior have been suggested by James' research and could be tested with a larger sample of sites within the monument.

The research focus discussed here has not been suggested because it is the only form of investigation likely to produce worthwhile results. A number of other topics could be investigated. Much more could be learned about the social organization of the monument's inhabitants and its development throughout their history. The research orientation discussed above, however, has three characteristics which recommend it: (1) the research orientation can utilize the unusual preservation conditions in the monument, (2) both survey and excavation can provide data relevant to the solution of questions if the suggested orientation is adopted and (3) the orientation leads to questions that can be asked about all stages of the monument's history. The latter two characteristics can be particularly valuable, in that the recommended research orientation can serve as a guide to formulating research designs for investigating sites threatened with destruction by erosion or for mitigating the adverse impact of a development project. Archeologists frequently encounter difficulties in deciding upon a research program in such instances and it is hoped that the research orientation discussed above can serve as a useful guide.
Discussion of the culture history of Canyon de Chelly National Monument has resulted in the formulation of a series of ecological hypotheses, which attempt to explain significant events in the culture history and which have ramifications for southwestern archeology as a whole. These hypotheses cannot currently be tested, since past research in the monument has not produced the relevant data. This chapter will review the data requirements, will show why they cannot be met with available data and will recommend research procedures for recovering the necessary information.

Hypotheses and Data Requirements

The series of proposed ecological hypotheses begins with the statement that the rate of adoption of agriculture in the Southwest was a function of local population size and environmental conditions. Following the introduction of domesticates during the Archaic, reliance on agriculture increased in proportion to local population growth, with a final impetus toward dependency on agriculture provided by a deterioration in climatic conditions during the eighth century AD. Testing of this hypothesis requires (1) that population trends from the Archaic stage through the end of Basketmaker III stage be established, (2) that changes in climatic conditions during these stages be known, particularly during the seventh, eighth and ninth centuries AD, and (3) that changes in subsistence practices from the Archaic through the Basketmaker III stage be specified. These requirements cannot now be met because (1) no Archaic sites are known within the monument and Basketmaker II and III sites may be seriously underrepresented in existing survey samples, which makes the establishment of population trends impossible; (2) no environmental information specific to the monument is available for periods prior to approximately AD 1000, and (3) no dietary information specific to the monument is available for stages prior to Pueblo II. The lack of recorded Archaic sites and the probable underrepresentation of Basketmaker sites also render it impossible to make reliable statements about site distributions, with respect to subsistence resources (such as specific wild foods or arable land), which precludes inferences about subsistence strategies. This situation has arisen because archeological surveys in the monument have used ceramics to assign the occupation of sites to specific culture-historical stages; ceramics are not likely to be found in Archaic or Basketmaker II sites. Surveys have also tended to overlook the Defiance Plateau and there is evidence to suggest that Archaic and Basketmaker sites are present there. These factors would result in an underrepresentation of Archaic and Basketmaker sites in survey records and would distort site distribution statements based on those records. The situation discussed above has also arisen because excavations of Basketmaker sites within the monument have focused on the recovery and description of artifacts for purposes of compiling culture-historical trait lists, rather than on the recovery of evidence (such as coprolites) for the nature of Basketmaker diets.
It was hypothesized that during the Pueblo I, II and III stages Anasazi subsistence was based primarily on agriculture. The subsistence base remained relatively stable throughout the Pueblo I and early Pueblo II stages, producing stability in settlement pattern, architecture and social organization. However, climatic conditions are believed to have improved during the latter part of the Pueblo II stage, leading to greater exploitation of wild resources, particularly stands of pinyon on the Defiance Plateau. A severe drought from AD 1140 to 1180 has been hypothesized to have led to a decline in exploitation of the plateau and to an aggregation of population within agricultural communities in the well-watered canyon bottoms.

These hypotheses imply that Pueblo I and early Pueblo II sites will be located in the same environmental zones and that the proportion of sites in each zone will show no statistically significant differences. The proportion of sites in the Pinyon-Juniper Continuum will increase significantly during late Pueblo II and decline again following AD 1140. The hypotheses also imply (1) that an increase in construction activity will be noted in sites in agricultural locations within the canyons shortly after AD 1140, (2) that means of integrating the aggregated populations will appear in such sites, (3) that dietary analyses will show increasing utilization of wild foods during late Pueblo II and early Pueblo III, followed by a decline in the occurrence of such foods following AD 1140, and (4) that improvement in environmental conditions can be shown to have occurred during late Pueblo II and to have ended during early Pueblo III. These hypotheses and all implications were derived from Antelope House Project and Canyon del Muerto Survey data. The use of such inductive methods to derive hypotheses is assumed here to be legitimate, but confirmation of the hypotheses must rest on independent data, rather than on existing Antelope House and del Muerto Survey data, to avoid circular arguments.

Testing might consist (1) of expanding the sample of surveyed areas and excavated sites to verify its reliability or (2) of applying different analytical procedures to the existing data. For example, tool types and frequencies were not analyzed in the process of deriving subsistence hypotheses. Yet they are capable of providing information about subsistence and their analysis could provide independent tests of the hypotheses. Data from previous research in the monument are not likely to prove useful, since previous surveys have not examined the plateau and previous excavations were not directed toward the recovery and analysis of dietary information.

It is not possible to test the implication about means of population integration with the available information because archeologists have interpreted Pueblo II and III social organizations through analogies to modern Pueblo social organization, a method which would tend to obscure any changes during those stages. De Harport noted an apparent decline in the use of "great kiva-like" sites during the Pueblo II and III stages and interpreted it to be the result of a decline in community ceremonial activities. Such a decline would tend to run counter to this implication, since it supposes a necessity to integrate populations, which may not have been linked by kinship or similar ties, as population aggregation occurred.
The structures noted by de Harport may not have been great kivas, however, and ceremonial activities requiring great kivas are certainly not the only means for integrating large aggregated populations.

A third set of ecological hypotheses presents alternative explanations for the abandonment of the monument by the Anasazi during the thirteenth century. It has been hypothesized that abandonment occurred during an episode of localized drought and above-average rainfall in the surrounding region, which occurred during the third quarter of the thirteenth century and which led to erosion of farmland within the monument. It was also hypothesized that abandonment occurred as a result of the Great Drought of AD 1276-1299. The first hypothesis implies (1) that if erosion led to the abandonment of the monument it can be shown to have occurred at the appropriate time and, (2) since erosion does not generally occur uniformly throughout a drainage, the initial response to erosion may have been to move into uneroded portions of the monument drainage. The hypothesis also implies (3) that there will be little evidence of Anasazi activity within the monument following the third quarter of the thirteenth century. The second hypothesis implies (4) that there will be evidence of Anasazi activity in the monument as the fourth quarter of the century begins, but that this will decline to almost nothing by AD 1300. Evidence for a decline in activity might consist of an absence of dendrochronological or archeomagnetic specimens younger than dates suggested by the test implications; absence of the former would indicate cessation of woodcutting, while absence of the latter would suggest cessation of cooking and heating. Since implications 3 and 4 and the hypotheses themselves were suggested by the data from Antelope House and Mummy Cave, those data should not be used to demonstrate the validity of the hypotheses, especially since they appear to conflict. Additional information from other Pueblo III sites will be necessary to determine whether Antelope House or Mummy Cave is more representative of the monument as a whole. It is even possible that both hypotheses will be found to be valid; some sites may have been abandoned as a result of erosion during the third quarter of the thirteenth century, others as a result of the drought from AD 1276 to 1299. This points out that data pertaining to implications 1 and 2 are lacking, since it is not presently possible to state which sections of the monument, if any, were eroded during the thirteenth century, precisely when they were eroded or how erosion correlates with abandonment. No alluvial studies which could answer such questions have been undertaken and current archeological survey data are not adequate to evaluate the possibility of movement within the monument to escape the effects of erosion. Such an evaluation would require information about the dates of site occupations and abandonments, which is difficult to obtain with the procedures employed in the past. Ceramics have been heavily relied on to date site occupations during surveys and ceramic assemblages frequently do not contain the precise chronological information required to test the hypotheses under discussion.

Finally, it was hypothesized that following the Pueblo III stage Anasazi and Hopi use of the monument was seasonal or temporary. The Navajo assumed the dominant role in the history of the monument. Based on James' research, it has been hypothesized that following their initial
occupation of the monument the Navajo became increasingly concerned with the defensibility of their sites. This concern persisted until the Navajo were forcibly removed from the monument by Carson in 1864 and sent to Fort Sumner. Some Navajo returned to the monument area after their release from Fort Sumner in 1868 and proximity to Anglo-American goods and services, such as trading posts and schools, is hypothesized to have become increasingly important in site location decisions after that year. These hypotheses imply (1) that Hopi sites in the monument will be few and small and (2) that such sites may not contain evidence of the full range of activities or facilities (such as storage rooms or kivas) found in villages on the Hopi Mesas. The mesa villages are known to have been occupied year-round and for considerable periods of time. These hypotheses also imply (3) that Navajo sites will show a trend toward camouflage and difficulty of access until 1868 and (4) that after that date the Navajo population will show an increasing tendency to concentrate near trading posts and government facilities, such as schools. These hypotheses cannot presently be tested; although it seems probable that there are few Hopi sites, available data cannot be used to say when and for what purposes the Hopi occupied the monument. Many of the recorded "Hopi" sites may, in fact, be Navajo, which raises the possibility that current interpretations of the nature of the Hopi occupation of the monument are inaccurate. The Hopi sites have not generally been accurately dated, nor have they been studied in detail from a functional viewpoint. The Navajo hypotheses cannot be tested with existing data because they have been derived from those data. While they appear plausible, they should be tested further because they are based on a restricted and possibly biased sample of Navajo sites in the monument.

Research Recommendations

A consistent theme in the preceding discussion of research hypotheses is our inadequate knowledge of site distributions, due to the restricted and, therefore, possibly biased nature of past archeological surveys. This suggests a need for additional archeological survey, which is reinforced by Executive Order 11593, NEPA and 36 CFR 800; these require that cultural properties on federal lands be inventoried and no such inventory has been done in the monument. Thus it is recommended that highest research priority be given to archeological survey.

An inventory of cultural properties within the monument would necessitate an intensive survey of 100% of its area, which should be the ultimate objective of the recommended archeological survey. However, previous research suggests that the number of sites found during such an inventory would be large and that it would require considerable time to record them. The topography and nature of the road system in the monument create access problems in certain areas, notably the peninsula between Canyons de Chelly and del Muerto, which further increases the time required for a 100% inventory. A 100% inventory may, in fact, require more time and funding than is currently feasible for a single project. A scientifically-designed sampling survey of the monument which would be adequate to meet research and interpretation requirements and which would
be useful to planners as a tool for assessing the types and numbers of sites likely to be found in given vegetation or topographic zones, is therefore recommended.

A number of survey sampling strategies have been archeologically tested and found to be effective research tools (Mueller 1974; Judge, Ebert and Hitchcock 1975). The choice of a sampling strategy should be left to the individual planning the survey, since the specific research hypotheses employed will influence its suitability. Two strategies deserve comment, however.

The first is simple random sampling, in which the area to be sampled is divided into units, usually a grid in archeology; the units are then numbered and some are selected for study by use of a random numbers table or a similar device, which assures that the numbers selected will be statistically random. There seems to be some agreement among archeologists that this is a relatively inefficient strategy unless the area to be studied is relatively homogenous and access to sampling units is relatively easy (Mueller 1974: 64; Judge, Ebert and Hitchcock 1975: 120-121). This is not the case in the monument, where there is diversity in vegetation, topography, water supply and site types and where topography creates access problems in many localities. Simple random sampling, therefore, is not recommended for the monument as a whole. It may be useful within specific ecological zones, however, since these are usually homogenous.

The second sampling strategy is the transect, a procedure in which the sampling unit is a straight path. Tests of this procedure with data from Chaco Canyon (Judge, Ebert and Hitchcock 1975: 106-118) have shown it to be an effective device for estimating the number of sites within ecological zones. Judge, Ebert and Hitchcock also felt that it minimized problems of locating and defining sample units in the field. For the latter reason, and because many of the research hypotheses suggested in this overview contain implications regarding the number or proportions of sites in specified ecological zones, transects may be particularly appropriate in the monument. Transects, however, did not appear to be the best procedure for sampling site attributes or for determining relationships between sites and some of the research hypotheses suggested above require information on site attributes.

Thus a two-stage survey may be preferable to a single-stage survey using only one sampling procedure. The first stage would utilize available archeological knowledge to divide the monument into sampling strata, such as vegetation zones. It would then test the utility of the strata as predictors of site type and location through a transect survey designed to detect differential occupation of the strata. The second stage would modify the sampling strata, if necessary, and test for differences in site attributes or site relationships, using a quadrat sampling strategy.

The question of sample fraction also deserves some comment. Samples of as little as 1% of the surface area of a region can reveal significant patterns in the archeological data (Read 1975: 51), although samples of up to 40% may be needed to produce reliable results in many instances. In order to determine what constitutes an adequate sample fraction in a
specific case, it is necessary to state the degree of precision desired, the sampling technique used, the characteristics of the population to be sampled and the cost of obtaining a sample (Read 1975: 51-59). While it seems best to allow the individual planning the survey to determine sample fraction, it appears that the research objectives proposed in this overview could be met with less than the 100% coverage required by resource management policy. This may be an advantage, given limited survey funds; research objectives can be met without the cost of a 100% survey and, since research objectives include the gathering of settlement pattern data, planners may still be able to anticipate what types of archeological materials will be present in an area programed for development. Those areas of the monument which have been inventoried by de Harport and Mount, but which lack data adequate for testing the proposed hypotheses, can be sampled rather than re-surveyed at 100% intensity. It is suggested that the first stage of the recommended survey and the initial phases of the second stage could be devoted to obtaining survey data from an adequate sample fraction of the entire monument, including areas already surveyed. Final phases of the second stage could be devoted exclusively to survey of uninventoryed areas until 100% inventory coverage of the monument is achieved. This procedure would create some problems of sample bias, since the probable result would be a disproportionate representation of areas not presently inventoried. This could probably be overcome, however, by using the initial survey sample to test hypotheses pertaining to the monument as a whole and by using data from the final phases of the survey to test hypotheses pertaining specifically to areas not presently inventoried.

The primary objective of a scientifically designed sampling survey is to avoid bias in the resulting sample due to neglect of some areas or ecological zones, which has occurred in the past. However, if the survey results are to be useful, particularly in testing the hypotheses suggested above, matters other than sampling must be considered when planning the survey. For example, some of the suggested hypotheses require information on past population trends. Plog (1975) has commented on procedures for estimating population trends and has offered suggestions which may prove useful for research in the monument. After evaluating commonly used archeological indicators of population size, Plog concluded that the amount of utilized space is one of the most effective, although a number of difficulties in defining utilized space were noted. Measures of utilized space have been based on absolute number of sites, aggregate site area, number of rooms or number of dwelling units. Plog concluded that the number of dwelling units is the most satisfactory index of population size. The other measures cited do not adequately account for the possibility that not all sites or areas within sites serve as habitation areas; increases in numbers of special-activity sites may lead to inaccurate conclusions about population size. Plog recognized that population estimates based on the number of dwelling units would be difficult to make on the basis of survey data. During his own population study of the Hay Hollow Valley, which was based on survey information, he was faced with a problem of estimating the number of dwelling units on sites with little or no standing architecture. In order to circumvent that difficulty Plog examined excavation reports from the
surrounding Little Colorado River region to compare site area prior to excavation with the number of rooms uncovered. Regression equations for estimating number of dwelling units on the basis of site area were generated from the resulting data. Similar equations might be constructed for the Four Corners area and applied to the records of the proposed survey of the monument. Plog also noted that population estimates have often compared phases (such as the stages discussed in this overview) by assuming that a site's population was constant throughout its occupation and that the site was occupied for the whole phase. The effect of these assumptions is to smooth out population curves. Plog (1975) recommended:

... breaking the time span during which the site was inferred to have been occupied into 50-year blocks and proceeding as follows: (a) maximum occupation of the site is assumed to have occurred at the midpoint of the occupation span; (b) maximum occupancy of the site is estimated, based on Southwestern ethnographic data at .78 of the dwelling units on the site; (c) in each period moving away from the midpoint in either direction, the number of rooms is half that of the preceding period. Thus, a site with 100 dwelling units occupied for 250 years was recorded as follows: 20/39/78/39/20.

These procedures are rather arbitrary. Within the monument, better results might be obtained by using a site growth curve developed from Antelope House data and refined with data from other sites as they become available. Architectural evidence, tree-ring specimens and archeomagnetic samples at Antelope House permit the establishment of a construction sequence and allow length of occupation of some rooms to be estimated (Don P. Morris 1975: personal communication). Those estimates will be extrapolated to other rooms and utilized in the construction of an approximate site growth curve in the final report.

Other implications of the hypotheses suggested for testing require the recommended survey to record site location with respect to vegetation and topography. For example, it was stated that Archaic and Basketmaker sites will show a significantly greater association with the Pinyon-Juniper Continuum than will later sites. It also was hypothesized that Navajo sites prior to 1868 will be more difficult of access than will sites built after the return from Fort Sumner. Evaluation of significance of association should be based on accepted statistical techniques, such as Chi-square, to avoid subjective bias.

The hypotheses contain implications about the artifacts which will be found on sites recorded during the survey. For example, Archaic and Basketmaker sites in the Pinyon-Juniper Continuum have been hypothesized to be base camps. This implies that a wider range of activities occurred at those sites than at special activity sites, such as quarries, which should be reflected by the presence of a wider range of artifact types. In order to make quantitative and qualitative statements about the artifacts, it is recommended that controlled surface collections be made according to probabilistic sampling strategies. Redman (1975: 152-153) has discussed ways in which such collections can be made. Small sites can be divided into four quadrants (to provide provenience information
for the collections) and all artifacts can then be collected. Larger sites may be stratified on the basis of such features as room blocks and trash mounds and may be sampled by both quantitative and qualitative techniques: complete surface collections from limited areas (such as circles with a 2m radius) can be supplemented by collections from larger areas of diagnostic items important for nonquantitative stylistic or chronological analyses. If the full potential of these collections is to be realized, it is clear that the survey will have to depart from past practices in the monument and allow for lithic, as well as ceramic, analyses. In addition to indicating the range and types of activities carried on at a site, lithic analyses may lead to the identification of more pre-ceramic sites. Survey collections should also include archeomagnetic and dendro-chronological samples whenever possible, as these will be necessary to the chronological implications of some hypotheses, particularly those regarding the Anasazi abandonment of the monument in the late thirteenth century.

These procedures are currently being implemented by the Canyon del Muerto Survey (McDonald, Thornton and Morris 1976), which could serve as the starting point for the recommended survey of the entire monument. The transect system established for the Canyon del Muerto Survey could be expanded to include the entire monument and, if the objectives of the del Muerto Survey are compatible with those of the monument survey, the del Muerto data may be usable as part of the sample for the monument as a whole.

Archeological survey will not provide all the data necessary to test the proposed hypotheses, however, as they contain implications regarding environmental conditions and diet which require testing by other means. For example, hypotheses explaining the apparent absence of Archaic sites in the canyons and those concerning the Anasazi abandonment of the monument contain implications regarding erosion of the stream channels, which require data from a study of canyon alluvium. Such a study might be conducted concurrently with the archeological survey, but the investigator should be a professional geomorphologist, since the requisite knowledge is not commonly provided as part of an archeological education. Because information about an Archaic occupation of the monument and about its abandonment in the thirteenth century is linked to research problems of interest to southwestern archeologists in other areas and because alluvial studies may also provide information on environmental conditions throughout the history of the monument, it is recommended that an alluvial study of the canyons be given second research priority. It has not been given first priority because it lacks the legislative and policy mandate of the archeological survey.

Other environmental data not likely to be recovered through survey include palynological samples, since survey collections would be limited to surface materials and pollen on the surface of a site would be modern. Neither would macrovegetal samples, such as those used by Ambrose (1975b), be recoverable during survey, as one would not expect such a mass of materials to be available on the surface; in any event, the samples must be assignable to specific time periods, which is likely to require their recovery from stratigraphic context. Finally, while site location patterns do reflect subsistence practices, much more direct and easily quantifiable
evidence would be provided by analysis of fecal specimens recovered through excavations. Excavation, however, irreparably disturbs the areas involved and is not a procedure to be recommended automatically, especially when it is oriented toward the recovery of only one or two classes of data required for the test of a specific hypothesis. Thus excavation to recover environmental data relevant to the testing of the proposed hypotheses is recommended for third priority and should be undertaken only in conjunction with research on hypotheses that promise to make maximum use of the data from affected areas. Should excavation be found necessary to mitigate the effects of erosion, stabilization or similar activities and should sufficient time not be available to develop a broad range of research hypotheses, it is recommended that highest priority be given to the recovery of pollen samples, vegetal remains and coprolites, in order to test the hypotheses suggested in this overview. Such an approach would assure recovery of data not generally available in areas with poorer preservation conditions. Samples resulting from stabilization or development activities would tend to be less reliable than samples selected according to strict statistical procedures. Data from the survey and geomorphological study would provide some checks on the validity of the results.

Research Outside the Monument

The hypotheses discussed in this overview require data from within the monument. For example, questions about population growth in the monument during the Archaic and Basketmaker stages should not be answered on the basis of information from other localities, which may differ with respect to such factors as the extent to which population emigration or "budding off" into unoccupied territory was possible. Those factors would tend to produce quite different patterns of population growth. Questions about climatic variation and its implications for human behavior must also be discussed on a local basis, due to the differences in vegetation, topography, hydrology, subsistence techniques and social organization which occur throughout the Southwest (Dean 1969: 194).

In order to avoid triviality, however, the research was linked to broader concerns, such as elucidating the conditions under which agriculture was adopted in the Southwest or the thirteenth century Anasazi abandonment of much of the Four Corners area, providing the potential for research in other localities to contribute to the interpretation of monument archeology. For example, hypotheses relating to the adoption of agriculture state that hunting-and-gathering is more efficient than agriculture in terms of energy yield per unit of input, but that it is less efficient as population grows. The implications of this hypothesis could be tested in many localities, allowing us to use the hypothesis for interpretation of events within the monument with greater confidence. If climatic changes are invoked as causal factors, research elsewhere in the Southwest may be used to show that the changes occurred, that they were regional in scope and that they are likely to have affected Canyon de Chelly, but the effects of these changes must be established locally. In short, research in other areas may provide insight into the forces influencing the behavior of the monument's inhabitants, but it is not sufficient for explaining that behavior.
At least one research problem of major significance will require information from outside the monument. This concerns the Pueblo III phenomena labeled as "migrations," evidence for which includes construction in non-local architectural styles, such as the Chacoan masonry at White House, or by the appearance of new ceramic styles. Classifying all examples of these phenomena as the result of migrations overlooks at least one equally plausible alternative: trade. White House, for example, seems to have been constructed during the fourth quarter of the eleventh century, a period which also included considerable construction activity within Chaco Canyon. This activity, some of which suggests an actual reorganization of the Chaco population, has been attributed to the influence of Mexican traders (Di Peso 1975: 301), who may have been attempting to increase the volume and reliability of Chaco agricultural production to provide a food supply for turquoise miners in agriculturally marginal areas or who were organizing a trade system to guarantee the presence of desired commodities when they arrived on periodic expeditions from the south. In the latter case, White House may have served as an outpost in the trade network. The presence of Mexican items, such as macaws, at some sites in the monument could be offered in support of that hypothesis, but it is not at all clear what role the monument might have played in the proposed trade network. Since such a network is generally thought to have been oriented toward the procurement of turquoise or other luxury items not present in the monument, it might be preferable to view White House and similar sites as components of a trading system developed indigenously in the Four Corners area. In that case, the organization of Chaco societies could be viewed as a result of water control efforts (Vivian 1974: 109), which had the side effect of improving their organization for trade. One item which may have been traded is cotton. Judd (1954: 71) pointed out that no seeds, bolls or stem fragments of cotton were found at Pueblo Bonito, but that cotton cloth was found, suggesting that cotton was not grown in Chaco Canyon but was obtained in trade. Cotton seeds, bolls and stem fragments have been found in Canyon de Chelly National Monument (Magers 1975), suggesting that the monument could have been a source of cotton. Finally, it would also have been possible for Chaco populations to engage in both a luxury items trade with Mexican groups and in a non-luxury items trade with other Anasazi populations.

Additional research appears to be necessary in the monument, in Chaco Canyon and, perhaps, in Mexican sites to determine what, if anything, was traded, when it was traded and with whom. Even if the phenomena attributed to migrations into the monument are, in fact, the result of migrations, it still is necessary to establish where the migrant groups originated, why and when they left their original homes and what might have drawn them to the monument. Since archeologists also have argued for the presence of Mesa Verde groups within the monument, some work will probably have to be done with Mesa Verde data, as well. Such coordinated research in several areas will require substantial funding. In an ideal world, where funds were unlimited, such a project would be recommended for second priority, since it involves a topic of continuing interest to archeologists working within the monument and is relevant to southwestern archeology as a whole. Assuming limited availability of funds, however, this research is recommended for fourth priority.
Summary

A sampling survey providing coverage of the entire monument should receive highest priority as funding becomes available for future archeological work. This will permit partial satisfaction of management objectives and will provide data applicable to a wide range of significant research questions. As additional funds become available the size of the sample should be increased until 100% coverage of the monument is achieved and policy requirements for an archeological inventory are met. Since some of the hypotheses suggested for testing require environmental data, particularly about erosion of the canyon bottom streams, a study of the alluvial geology of the monument is recommended for second priority. Some additional environmental and dietary data will be needed to supplement information provided by the survey and alluvial study; excavation to recover such data has been suggested for third priority. Coordinated research in the monument and in several other areas to test trade and migration hypotheses has been recommended for fourth priority.
APPENDIX

RESEARCH SUMMARY

Principal Investigator: Lt. George M. Wheeler.

Sponsoring Institution: Corps of Engineers, U.S. Army.

Project Title: U.S. Geographical Surveys West of the One Hundredth Meridian.

Location: The survey report (Putnam 1879) does not specify the areas investigated. The text and T.H. O'Sullivan's photographs suggest that the survey party explored Canyon de Chelly to a point above Spider Rock, but that it did not investigate Monument Canyon or Canyon del Muerto. The latter inference is supported by the report of the 1882 Stevenson expedition. One of Stevenson's Navajo guides informed the party that they were the first white men to explore del Muerto (Stevenson 1886: 332). While the statement ignores pre-Fort Sumner military expeditions, the guide may not have been old enough to remember those expeditions. The guide should have known about the route of the Wheeler survey, however.

Purpose of Survey: The primary purposes of the Wheeler survey were to secure topographic information in Arizona, Nevada, New Mexico and Utah and to prepare accurate maps of the areas. Information on mineral resources, climate, vegetation and other features of interest to potential miners, ranchers or farmers was to be obtained, including data on the number and behavior of Indians living in the region. In accordance with the latter objectives, a portion of the survey party entered Canyon de Chelly.

Techniques: No discussion of the field investigation techniques employed in Canyon de Chelly is available. It seems that photography was an important part of the data collection process. The survey can, at best, be classified as a reconnaissance, aimed at ascertaining the presence of archeological remains in the canyon.

Summary of Results: The survey report consists primarily of a description of White House drawn from the journal kept by Lt. James H. Simpson during the 1847 American military expedition to Canyon de Chelly, with some additional observations made by the author of the report. A number of excellent photographs were made by O'Sullivan. No map of observed archeological sites was produced. If collections were made they are not discussed.

Evaluation: The survey report is of limited utility, since it contains neither a map nor a comprehensive discussion of the sites observed and since more detailed descriptive data on White House are now available. The O'Sullivan photographs are of high quality, however, and show changes in site condition, vegetation and stream entrenchment over the last 100 years. They may be helpful in assessing stabilization needs.
Records: Putnam (1879) presents the only report on the survey's archaeological activities in Canyon de Chelly. Some of O'Sullivan's photographs are reproduced in Horan (1966).
Principal Investigator: Col. James Stevenson.


Project Title: None.

Date: 1879, 1880 or 1881.

Location: The location of Stevenson's collecting activities is reported (Powell 1883; Stevenson 1883) only as Canyon de Chelly.

Purpose: The sole purpose of Stevenson's fieldwork seems to have been the collection of artifacts for the National Museum.

Techniques: No information on collection techniques was provided. It is not known if the items discussed were excavated, surface-collected or obtained from another collector.

Summary of Results: An illustrated catalog of the items collected was published, including a discussion of their technological characteristics.

Evaluation: The technological discussion included in the catalog (Stevenson 1883) is primarily of historical value as an early example of such discussions. The catalog of items from de Chelly is of limited value, since the artifacts lack information on how or where they were collected.

Records: Powell (1883) provides a summary of the fieldwork. Stevenson (1883) provides the illustrated catalog and discussion of technology. The collections are at the Smithsonian Institution.


Project Title: None.

Dates: October 1882; November and December 1883, 1884; August and September 1885, 1893.

Location: Stevenson and his colleagues explored Canyon de Chelly and all its branch canyons at least as far as Monument Canyon. Canyon del Muerto was explored at least to Middle Trail Canyon. Excavations were undertaken at Mummy Cave and Big Cave.

Site Descriptions: Mummy Cave consists of two large alcoves connected by a ledge, containing approximately 80 Pueblo rooms. Basketmaker trash, cists and possible pithouses also are present. The site has yielded tree-ring dates ranging from AD 306 to 1284. Big Cave contains a small Pueblo room block and extensive Basketmaker deposits. Both sites are sheltered and contain a considerable quantity of perishable material.

Purpose: The immediate goal of the surveys was detailed description of the architecture and artifacts of the area. Ultimately, inductive classification and ordering procedures were to be applied to the data and to similar data from other areas in order to determine the relationships between prehistoric and modern pueblos.

Techniques: Reports on the surveys do not discuss techniques. The 1882 survey party totaled 19, including two photographers, three ethnologists, two guides, four soldiers, two teamsters, three tourists, a disbursing agent, Stevenson and his wife. The surveys are best described as reconnaissances by modern standards. The focus of interest was on sites with standing architecture, since these seemed most closely related to the modern pueblos whose history the archeologists and ethnologists wished to describe. This resulted in the use of field procedures not sufficiently intensive to locate numerous sherd scatters, lithic scatters and similar sites. Information on where the Big Cave and Mummy Cave excavations were made is vague. The choice of areas to excavate was made on the basis of their surface potential for yielding well preserved museum specimens or interesting architectural details. Cists in the Mummy Cave talus and kivas in that site were excavated, including Kiva B (according to Richert's 1961 labeling system).

Summary of Results: One hundred thirty-four sites in Canyon de Chelly, Canyon del Muerto and their major tributaries were located and plotted on a sketch map of the canyons. A second map, showing the relationship of major villages to arable land was also provided. Cosmos Mindeleff (1897) concluded that arable land was an important factor influencing site locations. Cosmos Mindeleff also classified sites on the basis of their
defensive characteristics, concluding that defense was not important to the inhabitants of the canyons, as few sites showed architectural features which could be interpreted as defensive. The bulk of Mindeleff's report consists of descriptions of individual sites and architectural features, accompanied by sketches, ground plans and photographs selected from among those made during the fieldwork. Artifacts, including sandals and cordage, and two mummies were excavated but were not discussed in detail.

Evaluation: The work suffers from a number of flaws. A representative sample of the monument area was not investigated, since the plateau was ignored. By concentrating on sites with standing architecture, numerous special activity sites and early sites were overlooked. Navajo material was generally ignored. However, these criticisms apply standards that are more appropriate to a modern inventory survey. Stevenson and his associates were interested in delineating the relationships between existing and extinct pueblo villages. In that respect, their focus on sites with standing architecture seems justifiable and Cosmos Mindeleff (1897) was correct in his conclusion that both were inhabited by related people, not by different "races." Mindeleff might have been aided considerably in establishing a developmental sequence if modern dating methods, such as dendrochronology, had been available. Cosmos Mindeleff also seems to have been correct in concluding that defense was not a significant criterion in the selection of village sites, but that availability of arable land was. The ground plans and descriptions of sites provided by Mindeleff (1897) are the best available for a number of sites and make his report invaluable to archeologists working in the monument. In this respect, perhaps one of the most significant criticisms which can be made of the surveys is the occasional difficulty experienced when attempting to relate a passage in Cosmos Mindeleff's report to a specific site or illustration. This criticism is based on failure to meet an objective which Mindeleff himself seemed to strive for: the detailed description of sites in the canyons. This problem is created by Mindeleff's failure to label each site with its name or number on his maps and by his failure to use such site designations each time he discusses a site. In the context of the period within which Stevenson and the Mindeleffs worked, however, their surveys were a significant contribution to the archeology of the monument and of the Southwest; the maps and architectural descriptions which resulted remain useful.

Records: Brief reports on the surveys were written by Powell (1886, 1887, 1880, 1891). A slightly more detailed report on the 1882 survey was written by Stevenson (1886). A popular article based on the research was written by Bickford (1890). The most comprehensive report, containing photographs, sketches and numerous ground plans as well as much architectural description, was published by Cosmos Mindeleff (1897), who also wrote a shorter article (1895). Photographs taken by Benjamin Wittick and J.K. Hillers during the 1882 survey and later visits may be found in the Wittick collections at the Laboratory of Anthropology, Santa Fe; the Centennial Museum, El Paso, and the Hillers collection at the U.S. Geological Survey Photographic Library, Denver. Collected artifacts were sent to the Smithsonian Institution.
Principal Investigators: Charles and Sam Day.

Sponsoring Institution: None.

Date: Circa 1900.

Location: Various sites in Canyons de Chelly and del Muerto.

Purpose: Collection of artifacts for sale.

Techniques: No description of techniques is available. Provenience information was not recorded.

Summary of Results: A sizeable collection of Hopi and Anasazi artifacts was assembled. No attempt at interpretation was made.

Evaluation: The Days are regarded as pothunters. Reports (Anonymous 1907; Lummis 1907) about the Day's activities discouraged archeological work in the canyon from 1906 to 1923. The collections lack information on recovery techniques and provenience and would seem to be useful primarily in museum exhibits.

Records: The Days kept no records of their activities. Items from the collection are referred to in Baum (1903), Fewkes (1906), Crawford (1924), Weltfish (1932) and Earl Morris (1938). The collection was sold to the Brooklyn Museum; the artifacts are listed in Schroeder (1961).
Principal Investigator: F.M. Palmer.

Sponsoring Institution: Southwest Society, Archeological Institute of America.

Project Title: None.

Date: May 31 - June 16, 1906.

Location: Antelope House.

Site Description: Antelope House is an 85-room Anasazi pueblo, located on the bottom of Canyon del Muerto about 5.6 km above its junction with de Chelly. The pueblo is sheltered by a high overhang, resulting in excellent preservation of perishable materials. The location was occupied from at least AD 696 through the late thirteenth century. Architectural units include two plazas and three room blocks.

Purpose: Recovery of specimens for museum exhibit.

Procedures: Reports on the excavation do not discuss the field strategy or procedures. Reasons for selecting Antelope House for excavation are not provided, nor are reasons for excavating particular areas within the site. A letter from Palmer to Maj. E.W. Jones of the Southwest Society states that several rooms, a kiva and a cemetery were excavated, but it does not state where these excavations were located within the site. Photographs taken during the work indicate that Kiva A and the south plaza, which contained the cemetery, were excavated. Don P. Morris (1975: personal communication) found signs of previous excavation in Rooms 29 and 30 during the course of his work at Antelope House and believes they may have been excavated by Palmer. Excavation techniques are not discussed, but they probably did not involve use of stratigraphy, since Palmer's work preceded the first known use of stratigraphic techniques in the Southwest.

Results: Several rooms, Kiva A and the southern plaza were excavated. Numerous artifacts and several burials were recovered. No scientific interpretation of the material was attempted.

Evaluation: The principal objective of Palmer's work appears to have been collection of artifacts, rather than interpretation. No detailed description of Palmer's collections is available and any attempt to use the material in scientific discussions will have to rely on a new study of the collections. This will be difficult, since the collections lack provenience data.

Records: The work of the expedition is reported in an anonymous (1907) article and in an article by Charles F. Lummis (1907). A letter from Palmer to the chairman of the Southwest Society, dated July 12, 1906, lists the artifacts collected. These were sent to the Southwest Museum, Los Angeles. An album of photographs taken during the expedition was donated to Hubbell Trading Post in 1970.
Principal Investigators: Charles L. Bernheimer and Earl H. Morris.

Sponsoring Institution: American Museum of Natural History.

Project Title: Third Bernheimer Expedition.

Date: June 1-5, 1923.

Location: Canyon del Muerto was entered via Twin Trail and explored on horseback. The party explored upstream beyond Mummy Cave and downstream to Antelope House. Excavations were undertaken at Mummy Cave and Big Cave. Pictographs at Antelope House were photographed.

Purpose: The expedition attempted to determine whether Basketmaker groups had occupied Canyon del Muerto and if so, to what extent. Its members also were interested in securing photographs of the pictographs known to be in the canyons.

Procedures: Following a horseback reconnaissance, Mummy Cave and Big Cave were selected for excavation because the size and preservation of their deposits suggested that Basketmaker materials would be present. Selection of areas for excavation appears to have been made on a "judgment sample" basis: surface materials were used to evaluate the potential yield of subsurface deposits and some of the more promising areas were excavated. For example, Morris' field notes for the second 1923 visit state: "In June there were bones showing at the south end of bottom of refuse slope. We dug up a minimum of six skeletons decomposed so that the head form could not be determined." That area, the "southeast end of high part" of Big Cave, Room 50 at Antelope House and possibly other areas were excavated on this basis. There is no information in Bernheimer's or Morris' field notes or publications on recovery techniques or provenience controls.

Results: Several burials, more than 20 sandals, a cradle, matting, fragments of cloth, buckskin, a flute, pipes and numerous other objects were recovered with a minimum of effort. It was concluded that there had been a heavy Basketmaker occupation of Canyon del Muerto, that sites in the canyon had the potential for defining chronological subdivisions within the Basketmaker stage through stratigraphy and that preservation conditions in the sites promised to add a number of perishable items to Basketmaker trait lists based on work in open sites. The primary result of the Bernheimer expedition itself, however, was not to add new data about the Basketmakers, but to indicate the potential reward of additional, intensive work in Canyon del Muerto.

Evaluation: The Bernheimer expedition contributed no new descriptive or interpretive information on the Basketmakers, as the amount of time spent in Canyon del Muerto limited the number of observations which could be made and the quantity of materials which could be collected. Its utility, judged either by the archeological standards of the time or by current standards, was limited. The researchers were correct, however, in their
estimation of the archeological potential of Canyon del Muerto and their survey reports stimulated research.

Records: The expedition's collections were sent to the American Museum of Natural History in New York. The American Museum and the University of Colorado Museum have sets of Earl Morris' field notes pertaining to this expedition and to later research in the monument. A non-technical account of the expedition is presented in Bernheimer (1924) and a copy of portions of Bernheimer's field notes dealing with Canyon del Muerto are on file at Canyon de Chelly National Monument.
Principal Investigator: J.H. Jeancon.

Sponsoring Institution: National Geographic Society.

Project Title: First Beam Expedition.

Date: June 1923.

Location: Dendrochronological specimens were obtained from Antelope House, Mummy Cave, Junction Ruin (CDM 127), White House and Sliding Ruin (CDM 107).

Site Descriptions: Junction Ruin is a small pueblo of about 10 rooms and a kiva, located in a rock shelter about 25 m above the canyon floor at the junction of Canyons de Chelly and del Muerto. White House is a pueblo of 45 to 50 rooms on bottom land in Canyon de Chelly and about 20 rooms in a cave about 10 m above the canyon floor. The masonry in White House is a core-and-veneer type resembling that of Chaco pueblos. Sliding Ruin, a pueblo of 30 to 50 rooms, is located in a rock shelter about 40 m above the floor of Canyon de Chelly. The bottom of the shelter slopes steeply and massive retaining walls were built to create living space. Portions of the walls have since collapsed, causing trash and some structures to slide to the canyon floor. Basketmaker materials are also present.

Purpose: The expedition was designed to secure dendrochronological specimens to expand the tree-ring chronology being developed at the time and to close critical gaps.

Procedures: Areas and sites known to have exposed beams were inspected and promising beams were sampled by sawing off the ends or by cutting wedge-shaped specimens. The sampling procedure was essentially opportunistic.

Results: Eighteen specimens were gathered from prehistoric sites in the monument. Three from Mummy Cave, one from Junction Ruin, two from Sliding Ruin and one from White House were dated. Dates ranged from AD 944 (for a Sliding Ruin beam) to 1268 (for a Mummy Cave beam).

Evaluation: The Beam Expedition provided some insight into the dating of the pueblos. Few dates were obtained, however, as the expedition limited its samples to surface materials, which were not common due to previous wood scavenging. Additional dates would have to be obtained from buried wood, hearth charcoal and archeomagnetic samples before construction sequences or similar interpretations requiring detailed dating could be worked out.

Records: Specimens gathered by the Beam Expedition and some of Jeancon's correspondence are housed in the Laboratory of Tree-Ring Research at the University of Arizona. Dates for specimens collected by the expedition are published in Peterson (1935) and in Bannister, Dean and Gell (1966).
Principal Investigator: Earl H. Morris.

Sponsoring Institution: American Museum of Natural History.

Project Title: None.

Dates: September 24-November 18, 1923.

Location: Mummy Cave, Big Cave, CDM 169 and an unnumbered site in Tseh-ya-kin Canyon.

Site Descriptions: CDM 169 is a Basketmaker and Pueblo site in an overhang near the canyon floor south of Mummy Cave. It contained two slab-lined pithouses, a kiva, cists and Basketmaker burials. It has yielded some of the few reliable Pueblo I tree-ring dates from the monument. The Tseh-ya-kin Canyon site was a burial in a rock shelter high in the cliff on the north side of Tseh-ya-kin Canyon.

Purpose: Morris was seeking material which could be used to refine definitions of the Basketmaker stage. These definitions were trait-lists and Morris was attempting to add traits to the list.

Procedures: Areas with deep trash deposits and a minimum of overlying Pueblo architecture were selected for excavation. It was hoped that this procedure would yield stratified Basketmaker trash and minimize problems created by having to cope with overlying Pueblo architecture. At Mummy Cave a trench was cut from the south center of the foot of the refuse talus to the Pueblo rooms near the back of the cave in order to obtain a stratigraphic section. The decorated kiva originally excavated by Mindeleff was re-excavated and recorded. More than half of CDM 169 was excavated. In Tseh-ya-kin Canyon a burial and a cache, evidently comprising the entire site, were dug in one day. A recess in the cliff at the western end of Big Cave was excavated. There is no explicit discussion of recovery techniques or of provenience controls, but Morris kept records regarding artifacts associated in features such as cists and burials. The procedure was crucial to Morris' attempt to refine Basketmaker trait lists, as such refinements would be based on the association of undated with dated material in single features. The work party consisted of Earl and Ann Morris, a cook and a laborer.

Results: The collection of material from Canyon del Muerto was extensive, with burials, associated grave goods and cist contents figuring prominently in published references to the work. The publications are popular articles and focus on description of outstanding specimens. Analysis of the material was hampered by prehistoric disturbance of the trash deposits, resulting in considerable mixing. It was difficult for Morris to determine which items in a particular deposit belonged to which cultural stage. These difficulties may have contributed to Morris' failure to publish technical reports on his work.
Evaluation: Earl Morris' research will be evaluated in the summary of his final field season in the monument in 1932.

Records: The collections and copies of Morris' field notes are located in the American Museum of Natural History in New York. Popular publications referring to the 1923 research were written by Earl Morris (1925, 1938) and by Ann Morris (1933).
Principal Investigator: Earl H. Morris.

Sponsoring Institutions: American Museum of Natural History; University of Colorado; Bureau of American Ethnology.

Project Title: None.

Date: October and November 1924.

Location: Mummy Cave, Big Cave, CDM 151, CDM 152, Pictograph Cave (TWT 1), Cave 3 (unnumbered in the Canyon de Chelly system), Cave 4 (also unnumbered), an unnamed site in Twin Trail Canyon and two unnamed sites in Canyon del Muerto.

Site Descriptions: CDM 151 is a two-story Pueblo site of more than 30 rooms. Basketmaker and Navajo materials are also present. It is located in a rock shelter in the north wall of the western segment of Twin Trail Canyon. CDM 152 contains a Pueblo site of approximately 15 rooms; E. Morris also found Basketmaker burials during excavation. It is located in a rock shelter a few hundred meters west of CDM 151. Pictograph Cave contains approximately 50 pueblo rooms in a rock shelter about 125 m above the floor of the eastern half of Twin Trail Canyon. Numerous pictographs and Basketmaker cists are also present. Cave 3 contains a sequence of material from Basketmaker II through Pueblo III in a rock shelter about 70 m long, 25 m deep and 40 m high. The shelter is located in the north side of the eastern half of Twin Trail Canyon, near the canyon floor. Cave 4 contains three slab-lined rooms and pictographs. The unnamed site in Twin Trail Canyon is a small, deep shelter, the slope in from which was strewn with chipped and fire-cracked stone and a few sherds. There was evidence of extensive burning in the site. Its cultural affiliation was not discussed. One of the unnamed del Muerto sites, described as being 1.6 km below Antelope House, consists of an unusual depth of cultural material in a bank beneath an overhang on the western side of the stream. This is probably the Ute Raid Site (CDM 6). The other del Muerto site, located on the western side of the canyon about .4 km below the mouth of Twin Trail Canyon, was described as a small, low cave with numerous pictographs, containing slab cists, Pueblo refuse, a Pueblo burial and a Navajo cache.

Purpose: Morris' objectives were those of his 1923 field season, plus stabilization of the Mummy Cave tower unit.

Procedures: Procedures were evidently similar to those employed in 1923, but only stabilization procedures were discussed explicitly. Buttresses were built under the eastern end of the tower unit at Mummy Cave, in an area which had been undermined by collapse of fill material. A retaining wall was built westward from the southeast corner of the tower, across the front of the unit. A breach in the western portion of a prehistoric retaining wall was filled and a foundation was built beneath the front wall of a room near the western end of the east alcove. Three Anglos and six Navajos were employed in the stabilization project for three days and a
seventh Navajo was added to the crew on the fourth and final day. The size of Morris' excavation crew is not known. The southeast side of the 1923 Mummy Cave stratigraphic test was "dug over" and further work in the vicinity of the recess at the western end of Big Cave was performed. The area between the Pueblo room block in Big Cave and the eastern end of the shelter was also excavated. Trash deposits in the eastern and central portions of CDM 151 were tested in 1924, but the excavation of Pueblo rooms was generally avoided, as Morris' primary interest still lay in the Basketmaker stage. Excavations were also undertaken through CDM 152, although the Pueblo rooms were again avoided. Available copies of Morris' field notes dealing with the work in Cave 3 do not allow precise description of the areas dug. The field notes suggest that most of Cave 4 was excavated. One day's work was done in the unnamed Twin Trail Canyon site. Excavations were halted because fire had destroyed much of the perishable material and seepage had damaged most of the remainder. At the unnamed del Muerto site, tentatively identified here as CDM 6 a 5.5 m stratigraphic test was made along an eroded bank in front of the site. Morris' field notes imply that most of the second unnamed del Muerto site was excavated. Morris' party spent 40 days in Canyon del Muerto.

Results: The results of the 1924 work were similar to those of 1923. A large collection of artifacts and burials was made, but Morris did not achieve his goals because the Basketmaker deposits had been disturbed prehistorically.

Records: A report on the stabilization of the Mummy Cave tower unit was submitted to the Bureau of American Ethnology, with photographs. Field notes and collections were sent to the American Museum of Natural History and the University of Colorado. Popular publications were written by Earl Morris (1925, 1938) and by Ann Morris (1933).
Principal Investigators: A.V. Kidder and Earl H. Morris.

Sponsoring Institution: American Museum of Natural History.

Project Title: None.

Date: September 24 - October 13, 1925.

Location: Excavations were conducted in Mummy Cave, Big Cave, White House, Sliding Ruin (CDC 107) and several smaller sites, including CDC 110. Collections were made in Massacre Cave and a reconnaissance survey of Canyon de Chelly, at least as far as Spider Rock, was performed.

Site Descriptions: Massacre Cave, so called because a large number of Navajos were killed there by the Narbona expedition in 1804, is a shallow rock shelter at the top of a talus slope in Canyon del Muerto. Skeletons are visible on the surface in the shelter.

Purpose: Additional stabilization of the Mummy Cave tower was to be attempted, the survey of Canyon de Chelly was to serve as the basis for planning future research in the canyons and Earl Morris was still hoping to find undisturbed Basketmaker strata.

Procedures: The 1925 crew included A.V. Kidder, Earl and Ann Morris, seven other Anglos and several Navajos. At Mummy Cave a bulge in the south wall of the tower was corrected by placing S-irons on the face of the wall and drilling through the wall to connect them to turnbuckles; these in turn, were connected to iron rods anchored to the cliff. The turnbuckles were tightened until the bulge was removed. New trenches were opened in the trash slope in the east alcove and in a small plaza in the rear of the alcove. A trench was also dug in trash in front of the west alcove. The crew remained at Mummy Cave from September 26 to September 30. While they were camped there, Tseh-ya-kin Canyon was explored and three sites in high rock shelters were tested. Work on these sites required about one afternoon each, with crews of one to three persons. Other sites were also visited and, perhaps, excavated. Further work was done in the area of Morris' 1923 and 1924 trenches at the western end of Big Cave. The central and eastern portions were also explored, but available copies of 1925 field notes do not contain maps showing the location of the work and the verbal descriptions are vague. Work at Big Cave lasted from October 1 to October 4. One day was spent excavating a site about .8 km above White House. A Navajo burial and a few slab cists were excavated. This site may be CDC 91. At least one day was spent by Earl Morris, Kidder and several laborers in the excavation of six burials at Sliding Ruin. These were in the eastern portion of the western half of the cave. One day was spent at CDC 110, excavating slab cists, Navajo burials and Basketmaker trash. Four days were spent at White House. Some clearing was done in the upper unit to facilitate note taking, but the bulk of the work consisted of excavation of kivas to the east of the site, probably Kivas 1 and 2 on Steen's (1942) maps. At least five people participated
in this work. A number of other projects were undertaken. Mummy Cave was mapped and a map-making traverse was made from Antelope House to White House along the canyon bottom. A skull, some cloth and some sherds were collected from Massacre Cave. Pictographs at Antelope House were photographed. A reconnaissance survey of Canyon de Chelly, to a point about 2.4 km above Spider Rock, was made.

Results: The results of the 1925 season were similar to those of previous years. Morris did not find the undisturbed Basketmaker deposits he was searching for. The activity of later occupants of the excavated sites had resulted in the mixture of early and late Basketmaker materials in single strata and had frequently introduced Pueblo material, as well. The survey results were not discussed.

Records: The 1925 collections and field notes were sent to the American Museum of Natural History. There are no technical articles on the 1925 fieldwork. Popular publications referring to the work include Kidder (1927), Earl Morris (1938) and Ann Morris (1933).
Principal Investigator: Earl H. Morris.

Sponsoring Institution: American Museum of Natural History.

Project Title: None.

Date: October 1 - November 16, 1926.

Location: White House and possibly CDC 101.

Purpose: Stabilization and excavation of lower White House. It is not clear why White House was selected for excavation, since Morris never explicitly stated his objectives. He does not seem to have been interested in obtaining additional Basketmaker data, since he concentrated on the Pueblo rooms, a strategy at variance with that of previous years. Morris or his superiors at the American Museum may have been interested in increasing the museum's collection of Pueblo artifacts.

Procedures: The greatest danger to the stability of White House was believed to be erosion. Consequently, two retaining walls were constructed in front of the site to deflect the stream flow. The walls were built of sandstone, held by woven wire fencing fastened to cedar posts. They are 100 m long, 1.5 m wide and 1 m high. Lower White House was completely excavated as deep as wall conditions permitted. Upper White House was mapped. It also seems that CDC 101 was excavated, since a catalog of archeological specimens obtained in 1927 refers to excavation of Basketmaker skeletons at that site in 1926.

Results: Eleven rooms, two kivas and 30 burials were excavated at White House. An excavation report was not written, although a summary of the work is contained in a report prepared in compliance with the terms of the American Museum's excavation permit. The author of the report remarked that White House must have been a "shrine or mart," based on the variety of ceramic types present and the diversity of sources they were presumed to represent. The report does not refer to work at CDC 101.

Records: Collections and field notes were sent to the American Museum of Natural History. A brief report was written in compliance with the terms of the permit under which the work was done (American Museum 1926).
Principal Investigator: Earl H. Morris.

Sponsoring Institution: American Museum of Natural History.

Project Title: None.

Date: October 30 - November 5, 1927.

Location: White House, Sliding Ruin, CDM 151, Mummy Cave and possibly CDC 101.

Site Description: CDC 101 is a 30-40 room pueblo on bottom land at the mouth of Wild Cherry Canyon. Masonry at this site resembles that in Chaco pueblos.

Purpose: The primary objective of the 1927 fieldwork was to secure tree-ring specimens that would provide a chronological framework for Morris' work in the monument.

Procedures: Information on field procedures and techniques is limited, but sections apparently were cut from all visible timbers in the sampled sites. Excavations were undertaken at CDC 101 in an area which had been pothunted between the 1926 and 1927 field seasons. Some collections were made in the process of cleaning off timbers in Sliding Ruin and test excavations were made in a talus slope at CDM 151.

Results: Several Basketmaker burials and associated grave goods were recovered. The number of tree-ring specimens secured from most sites was limited due to prior scavenging of wood from the sites. At White House and Mummy Cave, however, large samples were collected and provide some insight into periods of construction activity at the sites.

Records: Field notes and collections made in 1927 were sent to the American Museum of Natural History. The tree-ring specimens are now housed in the University of Arizona's Laboratory of Tree-Ring Research.
Principal Investigator: Earl H. Morris.

Sponsoring Institution: The American Museum of Natural History and the Carnegie Institution.

Project Title: None.

Dates: July 10 - August 16, 1929.

Location: Excavations were undertaken at Antelope House, Battle Cove (CDM 7), Ledge Ruin (CDM 2) and possibly at CDM 28 and BCH 4. Additional stratigraphic sections were made at the Ute Raid Site.

Site Descriptions: Battle Cove contains Basketmaker II cists and an eight-room Pueblo structure in a shelter on the south side of Canyon del Muerto. Ledge Ruin is a 30-room pueblo in a shelter about 35 m above the floor of Canyon del Muerto. It is quite close to the Ute Raid site. CDM 28 is a Basketmaker site in a high shelter in Canyon del Muerto. Cists and retaining walls are present. A site on a knoll east of the present Thunderbird Lodge at the mouth of the canyon was also excavated. Cists and burials were found. This site may be BCH 4.

Purpose: Earl Morris was once again searching for unmixed early Basketmaker strata to develop an artifactual trait list for the stage.

Procedures: Morris concentrated on the excavation of Basketmaker cists in Battle Cove. The eastern end of the shelter seems to have been almost entirely excavated and the western end was extensively tested. Portions of the South Plaza at Antelope House which did not appear to have been excavated by Palmer in 1906 were dug. Ledge Ruin and CDM 28 were visited and limited testing was done in each. At BCH 4 an east-west trench, 7.6 m long by about 3.6 m wide, was dug in the southern portion of the site and an area measuring 9.1 m by 6.1 m was excavated at the northern end. New stratigraphic cuts were made in the face of the eroded bank at the Ute Raid Site. In addition to the excavations, color drawings of pictographs at Antelope House, Standing Cow Ruin and Pictograph Cave were made by Ann Morris. A map of Canyon del Muerto from Big Cave to its mouth and from there to the mouth of de Chelly was drawn by Edward Weyer. A number of Navajo artifacts, particularly pots, were brought into the field camp by canyon Navajo and were collected by the work party.

Results: Two hundred twenty-five items were catalogued. As in previous years, burials, grave goods and cist contents were heavily represented in the collections, presumably because they indicated items in contemporaneous use, which would have been valuable to Morris in the development of his Basketmaker trait list. Among the most spectacular discoveries was a Pueblo III burial, the Tomb of the Weaver, containing a very well-preserved body and numerous artifacts. Unmixed early Basketmaker burials were found in cists in Battle Cove. Morris felt that they would allow him
finally to compile a list of early Basketmaker artifactual traits. However, he did not get around to writing a report on the work.

Records: Collections and field notes were sent to the American Museum of Natural History. Copies are on file at the University of Colorado Museum. The 1929 excavations were discussed in popular publications by Earl Morris (1948) and Ann Morris (1933). Ann Morris' (1930) pictograph drawings were printed in a pamphlet published by the American Museum.
Principal Investigator: Earl H. Morris.

Sponsoring Institutions: The Carnegie Institution and the National Park Service.

Project Title: None.

Dates: September 11 to about October 10, 1932.

Location: Mummy Cave and a site near the mouth of Pine Tree Canyon.

Purpose: Completion of the stabilization of the Mummy Cave tower.

Procedures: The bulk of the project involved filling cracks in the Mummy Cave tower, which had developed as the tower pulled away from the side walls. Some roof beams in the tower were also replaced. The interior of the tower was cleared prior to the start of stabilization. Some exploration of Canyon del Muerto in the Mummy Cave area was undertaken and a site discovered below the mouth of Pine Tree Canyon during this exploration was tested. The site was at the foot of a cliff on the north side of the canyon. It has not been relocated and numbered in the monument numbering system. Four Anglos assisted Morris in 1932 and the names of 13 Navajo laborers also appear in his work records. It is not known if the full Navajo crew worked every day.

Results: Fragmentary human remains were found in the fill of the tower unit rooms. Morris interpreted the condition of the remains as resulting from violent death. Eight burials were recovered from the site near Pine Tree Canyon. Morris found a number of prayer sticks embedded in the masonry of the Mummy Cave tower. These resembled artifacts found at Mesa Verde and reinforced Morris' conclusions, based on architectural style and ceramics, that the tower unit was built by Mesa Verde immigrants.

Evaluation: Excavations in the monument did not live up to Morris' high expectations for the work. The Basketmaker cists and graves he had hoped would enable him to refine trait lists contained disturbed and redeposited material to which the Law of Association could not be applied; that is, artifacts found in them could not be assumed to have been in contemporaneous use. Morris' work has been of limited utility to other archeologists because of the lack of technical publications. Considerable work with Morris' field notes, catalog and collections would be required if analysis were to be attempted; since provenience information is often vague, the results might well prove unsatisfactory for many purposes. This problem is compounded because Morris' selection for trash deposits and cemeteries in rock shelter sites did not representatively sample Basketmaker sites and artifacts and is not suitable for research problems requiring such a sample. Nevertheless, Morris' work in the monument provided him with a valuable comparative base for discussing the Basketmaker stage in other areas, such as the La Plata district (E. Morris 1939), and made some direct contributions to the archeology of the monument. For example, the series of tree-ring dates obtained from White House strongly suggests that
the construction of the lower unit, with its Chacoan masonry, was contemporaneous with a major construction episode in Chaco Canyon in the mid-eleventh century AD, pointing out the need for further study of the relationships between the Anasazi in Canyon de Chelly and in Chaco Canyon. Finally, Morris' stabilization efforts at White House and Mummy Cave were quite successful.

Records: The location of the 1932 collections is not known. Copies of the 1932 field notes are available at the University of Colorado Museum. Morris (1941) published an article on the prayer sticks found in the tower unit and a popular article in Natural History (1938) summarizing his work at Mummy Cave. Morris also referred to collections made in the monument during his many field seasons in several publications (1927b, 1936, 1939 and 1951). Morris and Burgh (1941) refer to basketry specimens from the monument.
Principal Investigators: H.S. Gladwin, Deric O'Bryan and Emil W. Haury.

Sponsoring Institution: Gila Pueblo.

Project Title: None.

Dates: 1931, 1938, 1939 and 1940.

Location: Mummy Cave, CDM 169, Big Cave, Antelope House, Junction Ruin, White House, Sliding Ruin and CDM 151.

Purpose: To collect additional specimens from major sites in the monument, in order to verify and improve dating, and to record sites for the Gila Pueblo files.

Procedures: No information is available on sampling or collection procedures.

Results: The dendrochronological collections significantly increased the number of dates for Mummy Cave and CDM 169. Dates became available for Big Cave, Antelope House and CDM 151 for the first time. Few additional dates were obtained for the other sites.

Evaluation: In the most recent summary of tree-ring dates from the monument (Bannister, Dean and Gell 1966), the proveniences of many of the specimens from Mummy Cave, CDM 169, Big Cave, Antelope House and CDM 151 are listed as "general," limiting the usefulness of the dates to discussions of the overall dating of sites.

Records: The Gila Pueblo dendrochronological records and collections are now housed in the University of Arizona's Laboratory of Tree-Ring Research. No report on collection activities was published.
Principal Investigator: James Spuhler.

Sponsoring Institution: None; had the project been carried out, however, the material would have been sent to Harvard University.

Project Title: None.

Date: 1940.

Location: Massacre Cave.

Purpose: Collection of Navajo skeletal material from the cave floor for physical anthropological research, apparently involving measurement of the bones and determination of sex.

Procedures: The bones were collected from the surface. It is not known whether any provenience controls were maintained.

Results: Because of its potentially negative effect on relations with the Navajo, the project was halted before the skeletal material left the monument. No examination was attempted. The bones were subsequently returned to Massacre Cave.

Evaluation: The context of the skeletal material was irreparably disturbed; the project's potential consequences were not adequately considered at the start.

Records: No report was written and all materials were returned to the cave.
Principal Investigator: Wesley R. Hurt, Jr.

Sponsoring Institution: None.

Project Title: None.

Date: Summer, 1941.

Location: An indeterminate area within Canyons del Muerto and de Chelly and near the Spider Rock overlook road was surveyed.

Purpose: Hurt wished to trace the development of architecture within the monument, from slab-lined pithouses to above-ground masonry structures. The survey was undertaken by Hurt on his own initiative while he was a seasonal ranger at the monument.

Procedures: Hurt did not discuss his techniques of field examination, other than to categorize his survey as a reconnaissance and to suggest that some features exposed by erosion or previous excavation were further cleared. There is no explicit discussion of areas surveyed or of amount of time spent in the field and there is no comprehensive list of sites recorded and their location.

Results: One site at the mouth of Canyon de Chelly, possibly BCH 4; one site in Canyon del Muerto, 3.2 km below Antelope House, and a group of sites near the Spider Rock overlook road were briefly discussed. Stratigraphic superposition and architectural data from other Anasazi localities were used to order architectural features of the sites in a development sequence from slab-lined pithouses through slab-base masonry-superstructure surface rooms through surface rooms built entirely of horizontal masonry. The possibility of diffusion of horizontal masonry into the Four Corners area was considered and rejected for lack of a precedent in nearby areas. In addition, two groups of Navajo hogans were encountered near the Spider Rock overlook road during the survey; a descriptive report on the hogans and associated artifacts was written. Tree-ring dates in the late 1700s were obtained from the hogans, making them the oldest dated Navajo structures in the monument.

Evaluation: The reconnaissance produced little information about the range or location of archaeological sites present in the monument, since so few sites were discussed. This could be anticipated, since the goal of the project was stated to be elucidation of the development of masonry architecture. Many sites lacking such architecture, therefore, would tend to be overlooked. In addition, Hurt seems to have believed that Anasazi architecture could be easily classified into a relatively small number of distinct chronological and structural types. This would further reduce the need for discussion of large numbers of sites. A few structures, representative of their types, could be discussed. The research resulted in one of the few available discussions of Basketmaker III, Pueblo I and Pueblo II architecture in the monument (Hurt 1942). The dates for the Navajo hogans have been revised (Bannister, Dean and Gell 1966: 33, Brugge 1967) and are no longer the earliest for Navajo structures in the monument.
Records: The location of Hurt's field notes and photographs is not known. Hurt (1942, 1947) published two articles on his work.
Principal Investigator: Charlie R. Steen.

Sponsoring Institution: National Park Service.

Project Title: None.

Dates: May 27 - June 10, 1941.

Location: White House.

Purpose: Stabilization of the lower unit.

Procedures: Masonry veneer and lintels were replaced, holes in walls were patched and buttresses were built in 11 rooms and three kivas in the lower unit. Patching and bracing were done with stone gathered from the site and set in a soil cement mortar. One hundred twenty-seven person-days were spent on the field portion of the project.

Results: The walls appear to have been effectively stabilized. No scientific or interpretive data were obtained.

Evaluation: It appears from before and after photographs of the stabilized areas that their architectural details were sometimes substantially altered. The west wall of Room 7, in which most of the veneer was rebuilt, is one example. Thus, in recording the architecture of the site, the stabilization report should be consulted if it is necessary to learn about the unmodified condition of the site.

Records: The stabilization report, photographs and artifacts found during stabilization are at the Western Archeological Center in Tucson, Arizona.
Principal Investigator: Charlie R. Steen.

Sponsoring Institution: National Park Service.

Project Title: None.

Dates: May 29 - June 13, 1942.

Location: Antelope House and Mummy Cave.

Purpose: Stabilization of the above sites.

Procedures: Erosion was felt to be the most significant threat to Antelope House. Deposits along the stream bank were collapsing and threatening to undermine the site. Consequently, two retaining walls were built along the front of the north room block. Walls in Rooms 10, 28 and Kiva A were also patched, using stone and adobe mortar. Some research excavation was also attempted. In order to determine whether the Central Plaza was a kiva, two trenches were dug in its interior, one from northeast to southwest and the other at right angles to it in the center of the plaza. At Mummy Cave, fill was removed from five rooms to relieve pressure on their walls, completing work begun the year before by James Spuhler. Rooms affected were Rooms 16, 19, 48 (in Richert's 1961 numbering system) and the two unnumbered rooms in the tower unit in front of Kiva E and Kiva F. Artifacts were recovered from both Antelope House and Mummy Cave. In addition an eroded Navajo burial near Antelope House was salvaged. There is no explicit discussion of excavation techniques. Stratigraphic records or point proveniences for the recovered artifacts are not available. Sixty person-days were spent on the fieldwork.

Results: Portions of Room 27 and Room 91 were excavated in the northeast-southwest plaza trench. Both plaza trenches encountered disturbed fill containing Navajo material, such as peach pits. The nature of the central plaza was not determined. At Mummy Cave, an unusual horseshoe-shaped masonry column was found against the north wall of the unnumbered room in front of Kiva E. A double row of upright sandstone slabs ran from the column to the south wall of the room. The function of these features was not determined.

Evaluation: No new interpretive information was obtained for either Antelope House or Mummy Cave, reflecting the difficulty of dealing with the limited amount of material recovered. Modification of architectural details was substantially less than that resulting from the previous year's stabilization at White House.

Records: The stabilization photographs and reports (Steen 1942 a and b) are on file at the Western Archeological Center in Tucson, Arizona, as are the artifacts. A report on the Navajo burial was written by Tanner and Steen (1955).
Principal Investigator: David L. de Harport.

Sponsoring Institution: Peabody Museum, Harvard University.

Project Title: None.

Dates: Fieldwork began with two short visits in 1946. Another short visit was made in August of 1947. These were primarily reconnaissance trips which facilitated planning of the actual survey. The survey was conducted in 1948, 1949, 1950 and 1951. The first three field seasons were two months long and the 1951 season lasted four months. De Harport returned for two days in 1953 to draw three cross-sections of the canyon bottom; he made brief visits in 1957 and 1958.

Location: Canyon de Chelly was intensively surveyed from its mouth to a point 44 km up-canyon. The south rim of the canyon from monument headquarters to Spring Canyon and south to the Fort Defiance Road was surveyed. The rim itself was explored as far as Bat Canyon and the peninsula area between Canyon del Muerto and Canyon de Chelly was visited three times. The original intent had been to survey Canyon del Muerto and Monument Canyon, as well, but recording the large number of sites in Canyon de Chelly used up the time allotted for surveying those areas. Small scale excavations were undertaken at CDC 45, CDC 245, CDC 275 and CDM 4.

Purpose: The survey was intended to form the basis of settlement pattern study similar to that undertaken in the Viru Valley of Peru. De Harport was struck by an analogy between the Viru Valley and the monument; both were relatively well-watered areas within an arid region, thus becoming foci of settlement, and both had the potential for providing information about changing patterns of land use over a long period of time in a relatively restricted and well defined area. In addition, de Harport recognized a number of deficiencies in archeological knowledge of the monument: little was known about architecture prior to the Pueblo II period, open sites had not generally been investigated, minor artifacts of the Pueblo II and Pueblo III periods had received little study, the nature of the Hopi occupation of the monument was not known and rock art had received little attention. The reasons for the excavations are not explicitly stated, except at CDM 4, where an Anasazi mummy was removed at the request of a Navajo living nearby. Pueblo V "ramada" structures at CDC 245 and 275 were excavated, perhaps in an attempt to recover information about the Hopi occupation of the monument. CDC 45 is a pithouse site and its excavation appears to have been an outcome of de Harport's desire to learn more about architecture prior to Pueblo II.

Procedures: The survey was essentially an individual effort. De Harport was assisted by his father in 1946 and during two weeks of the 1950 season. A student also assisted de Harport for the final three weeks of that season. With those exceptions, de Harport worked alone. Initially, survey areas were repeatedly traversed on foot until de Harport felt that all sites had been recorded. Later, survey intensity was determined
by topography. Ridges, spurs, talus slope bases, rock shelters and eroded banks were examined. The river flood plain, its first terrace, Navajo fields and other low, flat areas were less intensively searched or were avoided, as de Harport's experience demonstrated that such areas contained few or no sites. While there was a certain degree of subjectiveness in the procedure, since the association of sites with certain topographic areas was not quantified or statistically tested, few sites overlooked by de Harport have subsequently been discovered and the survey should be regarded as intensive and effective. De Harport (1959: 58) defined sites as groups of culturally produced elements occurring in close proximity to each other and which could potentially be assigned a chronological position. De Harport felt that previous definitions of archeological sites had overemphasized architecture and resulted in failure to record such sites as sherd scatters. De Harport felt that recording of these less substantial sites would allow him to make more detailed statements about settlement pattern variations. Sites were plotted on a 1:48,000 topographic map, photographed and sketched. The type of site, features, size, topographic setting and access were also recorded. Sherd collections were made. De Harport attempted to collect all types present on a site in proportion to their frequency, always leaving some sherds in place. The sample obtained may be characterized as a judgment sample. The procedure was felt to be suitable for dating the period or periods of occupation of sites (Basketmaker III, Pueblo I or the like). Sites and their locations were to be compared, period by period.

Results: De Harport recorded 369 sites, ranging from Basketmaker II to Pueblo V in date. Navajo sites were also observed, but they generally were not recorded unless they also contained Anasazi or Hopi materials. Eight types of site were defined: lithic scatters, sherd scatters, retaining wall sites, pithouses, great kiva-like sites, masonry ruins, pictograph sites and rock shelters. Three topographic zones were defined in Canyon de Chelly: lower, middle and upper. The lower zone extends from the mouth of the canyon to its junction with Canyon del Muerto, the middle zone extends from the junction to The Window and the upper zone extends from The Window to the head of the canyon. Most of de Harport's settlement pattern statements are phrased in terms of all sites, rather than in terms of specific site types. For example, Anasazi sites were said to have been built near, but not on, arable land. Site "densities" per mile were computed on the basis of all site types. De Harport's use of broad topographic categories and of site totals as a basis for his conclusions may have been due to a lack of familiarity with statistical procedures, which would facilitate analyses of the relationships between larger numbers of variables, or to a lack of facilities (computers, etc.) for such analyses. His conclusions included the above-mentioned observation about the relationship between Anasazi sites and arable land, a statement that the concentration of population in Canyon de Chelly may have shifted from the lower to the upper zone between Basketmaker II and Pueblo I and estimates of population sizes for each of the chronological units discussed. Descriptive reports, focusing on architecture, resulted from de Harport's excavations.
Evaluation: The survey was quite effective in terms of locating sites within Canyon de Chelly, but it seems to have failed to achieve its objective as a study of settlement patterns. For example, the canyon bottom received much more intensive coverage than did the plateau; the peninsula between Canyon de Chelly and Canyon del Muerto received three brief visits and only one site was found. The results of the Canyon del Muerto Survey, however, show that the peninsula was more intensively utilized than these results would suggest. Fourteen Pueblo sites were found on the peninsula alone. These appear to be not permanent habitations, but special-activity sites, perhaps for the gathering of pinyon nuts. Thus at least one component of the monument settlement system may have been overlooked during de Harport's survey. A second problem may have been created by de Harport's primary reliance on pottery to date the occupation of sites. This would hinder the recognition of Paleo-Indian, Archaic and Basketmaker sites and would have made it difficult to date later special-activity sites if pottery were not used. This, in turn, would have distorted population estimates and site distribution statements. Such estimates and statements would be further distorted by being based on site counts. Such a procedure does not effectively compensate for the fact that some sites were special-activity sites without permanent residents. De Harport may have misinterpreted the nature and size of the Pueblo IV and V occupation of Canyon de Chelly by assuming that pottery represented cultural groups. This led him to identify many Navajo sites with Hopi trade ceramics as Hopi sites. Thus, another of the survey objectives was not achieved. De Harport's success in achieving the rest of his objectives was mixed. Open sites were more thoroughly recorded than had previously been the case. Some descriptive detail concerning Basketmaker architecture was gained through his excavation of CDC 45 and his surface observations on other sites. Little was learned about Pueblo II and III minor artifacts because few could be gathered without large-scale excavations. Little information about rock art seems to have been produced. Finally, de Harport's conclusions were not tested statistically and may be subject to undetected biases. One of the few statistical measures used, that of site "density" per mile, is actually meaningless, since density is a function of area rather than of linear distance. However, it should also be said that de Harport's data are consistent and cover basic details, such as the stages during which sites were occupied and the numbers and types of features present. Extensive photographic coverage was obtained and ground plans were drawn. These data are the basis for much of what is currently known about the archaeology of the monument.

Records: De Harport (1951, 1953, 1959) reported on his survey in two short articles in El Palacio and in his Ph.D. dissertation. His photographs are at the Museum of Northern Arizona. The sherd collections were sent to the Peabody Museum at Harvard, while some other items were given to the National Park Service and are now stored at the Western Archaeological Center. The location of de Harport's field notes is not known. It is possible that de Harport retained them.
Principal Investigator: Charlie R. Steen.

Sponsoring Institution: National Park Service.

Project Title: None.

Dates: June 15 - October 10, 1949 and July 15 - October 1, 1950.

Location: Tse-ta'a (CDC 86 and 87).

Site Description: Tse-ta'a is a deeply-stratified site on bottom land under a high overhang on the north side of Canyon de Chelly. It contains at least two Basketmaker pithouses, 30 Pueblo rooms and six kivas.

Purpose: Salvage of a severely eroded site threatened with complete destruction by the action of the Canyon de Chelly stream.

Procedures: The southern portion of Tse-ta'a, labeled CDC 86 by de Harport, was entirely excavated. The Pueblo III levels of the northern portion, labeled CDC 87, were also excavated. During the first season a series of points at 3.05 m (10') intervals was laid out along the base of the cliff and lines perpendicular to the cliff face were run to the edge of the eroded bank. A series of blocks was formed in this manner and fill was removed from the blocks in .3 m (1') levels. Steen (1966: 2) considered excavation by natural stratigraphy to be a "hopeless task." If a structure or feature ran outside a block, the excavation was carried to the external limits of the feature. Such occurrences were probably quite common, since the site was more architecturally complex than Steen originally believed. During the second season, therefore, a base line was established for making triangulated measurements as a means of maintaining provenience control. There was no intention of preserving the site for interpretation and so structures were destroyed as they were excavated.

Results: Fifty-nine structures, ranging in age from a possible Basketmaker II slab cist to modern Navajo corncribs, were excavated, producing a considerable quantity of artifacts. Steen's analysis focused on the description, classification and chronological placement of the structures and artifacts excavated, and in that respect reflects the research orientation of the years prior to World War II. It may also reflect the fact that the work was viewed primarily as a salvage project and that it does not seem to have been undertaken with explicit research objectives in mind. Two conclusions were emphasized in the summary of the final report. First, Canyon de Chelly was seen as a cultural backwater. Analysis of materials from Tse-ta'a and previous research in the monument provided no evidence that any social or technological innovations originated in the canyon. Secondly, the canyon was believed to have supported a relatively small population, not greater than approximately 350 persons. This conclusion was reached through an analogy with the population supported by Navajo agriculture and through a subjective assessment of the amount of arable land available prehistorically.
Evaluation: No significant revisions of culture history resulted from the work. Steen's assessment of the monument as a cultural backwater, whose inhabitants developed culturally as a result of diffusion from other areas, is inadequate. It does not explain why the developments occurred in other localities or why they developed elsewhere first and says little about the circumstances under which social or technological innovations were adopted in Canyon de Chelly. Steen's conclusions regarding population size are also debatable. The use of Navajo farming practices and population to estimate the prehistoric population of the monument overlooks the availability of improved farming implements to the Navajo, pays little attention to possible differences in types and subsistence potential of Navajo and Anasazi crops and ignores the relative contributions of hunting, livestock and wage labor to Anasazi and Navajo subsistence. Steen, who did not make explicit his criteria for assessing the productivity of farmland, lacked geomorphological data with which to make statements about changes in area of arable land. The work suffered from a number of procedural problems as well. It is not clear that the possibilities for interpreting the natural stratigraphy of the site were "hopeless." Such was not the case at Antelope House, a site at least as complex as Tse-ta'a (Don P. Morris 1975: personal communication). Finally, it may be argued that excavation of Tse-ta'a to prevent further loss of data from erosion was unnecessary. Construction of rock and wire revetments and vegetation planting at White House sufficed to remedy a similar situation.

Records: Field notes, photographs and manuscripts for the final report (Steen 1966) are on file at the Western Archeological Center, Tucson. The collections are also housed at the center.
Principal Investigator: Gordon Vivian.

Sponsoring Institution: National Park Service.

Project Title: None.


Location: Antelope House and Mummy Cave.

Purpose: Stabilization of cracked upper wall sections in Antelope House, patching of eroded wall bases and vertical cracks at White House and capping of low walls damaged by livestock at White House.

Procedures: Steel ties and plates were installed in the upper stories of walls in the south room block at Antelope House. Forty-five person-days were spent on the project. Masonry work at White House was done with tinted cement, pointed with soil mortar. Approximately 54 person-days were spent in work at White House.

Results: Some leaning and weak walls could not be repaired because of a lack of funds and time. No new scientific or interpretive data were gathered.

Evaluation: As with Steen's earlier work at White House, many architectural details were modified by stabilization; should an architectural study of White House become desirable for archeological purposes, the stabilization report will have to be consulted frequently.

Records: The stabilization report, with photographs, for White House (Richert 1957) is filed at the Western Archeological Center, Tucson. No report on the stabilization work at Antelope House could be located.
Principal Investigator: Roland Richert.

Sponsoring Institution: National Park Service.

Project Title: None.

Dates: October 11 - October 21, 1958.

Location: White House.

Purpose: Stabilization of the soil underlying White House to prevent shifting and settling due to a fluctuating water table. This shifting and settling threatened to collapse walls in lower White House.

Procedures: A contract was granted to Intrusion-Prepakt, Inc., for intrusion grouting of the soil below White House. Intrusion grout is a slurry composed of water, portland cement and chemicals to enhance penetrability and compensate for shrinkage on setting. It is injected under pressure sufficient to fill cracks, seams and cavities in soil and concrete and masonry structures. When hardened, it prevents soil shifting and settling. Grout was injected into the soil beneath Rooms 3, 4, 6-12, 14 and 16, and in a line across the front of the west side of the site. The depth at which it was injected varied from 3.0 to 7.6 m. Walls were observed for signs of shifting due to the pressure of the injection process and grouting was halted if shifting occurred.

Results: Shifting and settling of soil beneath White House and, therefore, of the site's walls, was effectively halted.

Evaluation: While the project achieved its objectives, consideration should have been given to the possibility of disturbance of the archeological deposits underlying White House by the injection process, and to means by which the negative effects of potential disturbances could have been avoided or decreased.

Records: A report (Richert 1959) and photographs are on file at the Western Archeological Center, Tucson.
Principal Investigator: Roland Richert.

Sponsoring Institution: National Park Service

Project Title: None.

Dates: September 6 - October 25, 1961.

Location: Mummy Cave.

Purpose: To halt slipping of the upper portions of the refuse deposits in the eastern alcove and to prevent the collapse of rooms built above the refuse. He also hoped to stabilize as many of the Pueblo III structures in the eastern alcove as possible.

Procedures: A retaining wall was built across the upper portion of the refuse talus in the eastern alcove to halt downslope movement of the deposits. A trench was dug through the talus and the wall was footed on bedrock. In addition, 20 rooms in the eastern alcove were repaired. Walls were patched and capped, lintels were strengthened and rebar was built into some wall sections to strengthen them. The upper courses of the retaining wall were composed of stone gathered from within the site, in order to make the retaining wall blend in with the prehistoric structures. The lower courses, which were covered when the trench was backfilled, were built of cinder block to conserve the sandstone. Tinted cement mortar was used. It was painted and concealed with soil mortar made by pulverizing, soaking and reworking clods of prehistoric mortar obtained from collapsed walls. Sand for the cement mortar was obtained from the banks of the stream below the cave. A mixing area was established on the natural talus below the ruin and an aerial tramway was constructed for hauling material into the cave. The total number of person-days spent on the project was not reported. The crew consisted of two archeologists and eight Navajo laborers.

Results: The stabilization work appears to have been effective in halting movement of the upper portions of the refuse talus and in correcting deteriorated wall conditions. During excavation of the retaining wall trench, numerous artifacts and several features were uncovered. The features included Basketmaker slab cists, a massive dry masonry retaining wall, two plaza surfaces and a Basketmaker slab-lined pithouse. No archeological report on the artifacts or features was written. The eastern 7.3 m of the retaining wall trench encountered previously excavated deposits, probably representing Earl Morris' work in the cave.

Evaluation: Stabilization goals were achieved, but failure to analyze and report on artifacts and features found in the retaining wall resulted in a loss of archeological information which might have been avoided.

Records: A stabilization report (Richert 1961) and photographs are on file at the Western Archeological Center, Tucson.
Principal Investigator: Roland Richert.

Sponsoring Institution: National Park Service.

Project Title: None.


Location: Mummy Cave.

Purpose: Completion of the stabilization of Pueblo III structures in the eastern alcove begun in 1961 and stabilization of Pueblo III structures in the western alcove and tower unit.

Procedures: Stabilization procedures were the same as those employed in 1961, except that the soil mortar used to point and conceal the work was obtained from the banks of the stream below the cave. The amount of excavation was limited, since no project similar to the 1961 retaining wall was undertaken. Excavation consisted primarily of clearing some of the Basketmaker structures in the east alcove, originally excavated by Earl Morris, to show them to better advantage. No figure for the total number of person-days spent on the project was provided. The field crew consisted of two archeologists and 11 laborers.

Results: Stabilization was completed. Little artifactual material was recovered and no new interpretive data appear to have been obtained.

Evaluation: Stabilization objectives were achieved. Alteration of architectural detail was an inevitable consequence of stabilization and requires that the stabilization report be consulted as a background to any future discussion of the architecture of Mummy Cave.

Records: A stabilization report and photographs are on file at the Western Archeological Center, Tucson.
Principal Investigator: Martin T. Mayer.

Sponsoring Institution: National Park Service.

Project Title: None.


Location: White House.

Purpose: The aims of the stabilization project were to repair undercut wall bases; to stabilize weak walls in the central rooms; to repair damage resulting from visitor traffic, and to restrict access to some areas of the site.

Procedures: Steel members were set in the caps of weak walls. Walls were grouted with tinted cement concealed with adobe. Some replastering was done. Sand and water were obtained from the stream in front of the site and stone for repair work was obtained from the talus slope beneath Sliding Ruin. One hundred ninety-eight person-days were expended on the project.

Results: Stabilization objectives were achieved.

Evaluation: Architectural details of the site were further altered, complicating the study of the prehistoric architecture.

Records: A stabilization report and photographs are on file at the Western Archeological Center, Tucson.
Principal Investigator: Alexander J. Lindsay, Jr.

Sponsoring Institution: Museum of Northern Arizona.

Project Title: None.

Date: October 23, 1967.

Location: CDM 193, Canyon del Muerto.

Purpose: Inspection of an Anasazi site, thought to have been previously unexplored, to determine its nature and research potential.

Procedures: The site was entered by two persons; notes were made on the architecture and on other features, such as burials and artifacts visible on the surface. Some artifacts were collected. One burial was probed for positive identification as a human burial.

Results: The site consists of two units: a ledge-floor rock shelter about 60 m above the canyon floor and a small alcove 30 m lower. The upper unit contains two prehistoric rooms, a kiva, refuse, rock art and two burials. One of the burials, from which beads and some textile fragments were collected, was probed and found to be historic. Pottery sherds and a partially restorable neck-corrugated vessel were collected from the upper unit. The lower unit contained three rooms, a kiva and a slab-lined cist. The rooms of this unit were found to have been cleared of accumulated deposits, indicating past exploration of the site, which had also been used as a shelter for sheep. Laboratory analyses of the collected materials had not been attempted at the time the report on the inspection visit was written. No subsequent report that analyses had been performed is available. Stabilization of the site to halt destruction by weather, sheep and human visitation was recommended.

Evaluation: The project achieved its objective of determining what was in the site. No new interpretive data for the monument as a whole were obtained.

Records: Notes, photographs, collections and the inspection report are on file at the Museum of Northern Arizona, Flagstaff.
Principal Investigator: Don P. Morris.

Sponsoring Institution: National Park Service.

Project Title: None.

Dates: June 16 - June 23, 1969.

Location: White House.

Purpose: Stabilization of weak walls in the upper unit.

Procedures: Since the ruin is sheltered and cannot be entered by visitors, work was confined to the repair of structurally weak, damaged or missing masonry, which threatened collapse of surrounding wall sections. No wall capping was performed. An attempt was made to retain without modification as much as possible of the original structure. Access was obtained by constructing scaffolding to the height of the shelter in which the site is located. Approximately 35 person-days were spent on the project.

Results: Minor patching was done in Rooms 1, 2, 9-11, 15 and 16.

Evaluation: Stabilization goals were achieved.

Records: A stabilization report and photographs are on file at the Western Archeological Center, Tucson.
Principal Investigator: Jon Young.

Sponsoring Institution: National Park Service.

Project Title: None.

Dates: Fall 1969.

Location: The proposed realignment of the Spider Rock overlook road was surveyed from centerline 607+00 to 776+00, roughly from the turnoff of the Fort Defiance road to the parking area. A trash deposit adjacent to a Pueblo site (SRM 4) at centerline 673+50 to 674+00 and a Navajo hogan 20 m west of centerline 672+23 were excavated.

Purpose: Location of archeological materials which would be damaged by construction of the new road alignment and salvage of those materials.

Procedures: The centerline was surveyed with "varying degrees of thoroughness (Young 1971: 54)," apparently by Young alone. The survey was said to be "especially cursory" between 607+00 and 645+00. Surface collections were made at 14 of the 18 sites recorded and small test excavations were made at three of the sites. Little effort was made to determine the precise dimensions of the sites. No further information on the survey procedures is contained in his report (Young 1971). Excavation of the pueblo site required two and one-half weeks, with a field crew of six persons, including Young. No other information on procedures is provided in the report. Evidently, all detectable features lying within the right-of-way were excavated.

Results: Eighteen archeological sites were located and brief descriptions of artifacts and features visible on the surface were presented in the report. The bulk of the sites are sherd and lithic scatters and some also contain hearths. In addition to the excavated pueblo, a second pueblo of six to 10 rooms was recorded. The descriptive data were not discussed further. At the excavated site, 10 hearths, seven burials, four postholes and a pit were found. A descriptive report on the site was written, in which it was classified as Pueblo II. A number of problems were raised in the concluding remarks. Young questioned why the faunal collection from SRM 4 was composed of two thirds rabbit (based on a count of individuals) and had few turkey and deer, while at Tse-ta'a rabbit, turkey and deer occurred with equal frequency, in terms of number of individuals. He suggested that perhaps rabbits were more available on the plateau or that the sites may have been occupied during different seasons. Young also questioned why most of the black-on-white ceramic bowls were decorated with a carbon paint in a Sosi style, while most of the jars were painted with mineral paint in a Mesa Verde style. No answer was suggested. Young was also intrigued by a number of stone artifacts found at the site and suggested that they were arrow nock files.

Evaluation: The survey report lacks some basic details regarding the sites recorded, such as their sizes and discussions of when they were
occupied. In addition, no research objectives seem to have been developed prior to the fieldwork and this seems to have hindered analysis of the results. For example, if determining the time of year in which SRM 4 was occupied had been defined in advance as a research objective, Young might have been led to take pollen samples and flotation samples that would have provided botanical evidence to supplement the faunal data. Also, research objectives should have been formulated in advance of the project because right-of-way surveys and archeological salvage tend to produce restricted samples of archeological materials. These samples may well be biased. For example, certain types of terrain may not be included and this may limit conclusions about site locations. As a result, research objectives for right-of-way surveys should be clearly defined in advance, with consideration given to the limits imposed by the nature of the sample. Failure to do so may have contributed to Young's emphasis on description and to the lack of additional interpretation in Young's report.

Records: The survey report, collections and photographs are on file at the Western Archeological Center, Tucson. The field notes are not on file and may have remained with the author.
Principal Investigator: Don P. Morris.

Sponsoring Institution: Laboratory of Tree-Ring Research.

Project Title: None.

Date: April 25, 1970.

Location: CDC 232.

Site Description: CDC 232 is a four-room Navajo granary complex at the base of Spider Rock.

Purpose: Dating of Navajo structure and collection of modern tree-ring series.

Procedures: Coniferous species present at CDC 232 were cored and a map of the site was prepared, showing the locations from which cores were taken. Douglas fir on the talus slope immediately south of Spider Rock were cored to obtain a modern ring series. Less than one person-day was spent on the project.

Results: Three samples from CDC 232 produced dates, suggesting that CDC 232 was constructed at about 1800.

Evaluation: Although there are few dates from CDC 232, the dating of the site is considered secure. It is one of the earliest dated Navajo structures in the monument. The significance of this early date, however, is problematic, since the sample of early Navajo dates is limited.

Records: Specimens are stored at the Laboratory of Tree-Ring Research, University of Arizona. Field notes and a report (Don P. Morris 1975) are on file at the Western Archeological Center, Tucson.
Principal Investigator: Don P. Morris.

Sponsoring Institution: National Park Service.

Project Title: Antelope House Project.


Location: Antelope House and CDC 206 were excavated. Canyon del Muerto was surveyed from its junction with Canyon de Chelly to Standing Rock (CDM 9).

Purpose: Antelope House was excavated and stabilized to allow its incorporation in the monument's interpretive program. A survey of Canyon del Muerto was begun in order to describe the settlement pattern of which Antelope House was a part. CDC 206 was excavated to salvage material from two hearths and a pit visible in an arroyo bank.

Procedures: Approximately 85% of the Pueblo III village at Antelope House was excavated and earlier strata were sampled. A large percentage of the site was excavated, in order to expose the village layout for interpretation to monument visitors. The choice of specific areas to excavate was based on potential visibility to visitors and on the logistics of moving backdirt. Horizontal provenience records were kept in terms of rooms, kivas, features and a 1 meter grid. Vertical provenience records were kept in terms of natural stratigraphy. Similar procedures were employed at CDC 206. Extensive dendrochronological, archeomagnetic and pollen sampling was undertaken at Antelope House and bulk vegetal material was collected and analyzed. Dendrochronological samples of hearth charcoal were collected at CDC 206. The average crew size, including supervisors, was 12 persons at Antelope House. Approximately 6,000 person-days were spent in the field. Two persons spent two days at CDC 206. The survey involved one or two persons traversing the survey area on foot until it was felt that all sites had been recorded. Approximately 170 person-days were spent on the survey. One hundred percent of the area within a 3.2 km radius of Antelope House was to be intensively surveyed.

Results: At Antelope House, structures from the Basketmaker III through Pueblo III stages were excavated. Most of the material came from Pueblo III strata, resulting in a relatively complete record of development of the pueblo from about AD 1050 to 1270. A large quantity of perishable material was recovered and considerable data was obtained on Pueblo III diet and environmental conditions. The site consists of two room blocks and a central plaza. The South Room Block was constructed during the Pueblo II stage and expanded through the addition of multiple-room units. Construction of the North Room Block began in the early Pueblo III stage (about AD 1100) and expanded through the addition of individual rooms. Both units experienced a major episode of expansion at about AD 1140. The environmental analysis suggested that this occurred during a period of extreme drought. The village appeared to have been abandoned by AD 1276,
and the environmental analysis suggested that erosion during a period of localized drought and above-average rainfall in the surrounding region may have been a major contributing factor. Dietary analyses demonstrated that while corn was a major food source, occurring more frequently in feces than any other food item (91% of the feces contained corn), wild foods were also important and were second and third in frequency of occurrence in feces (cactus epidermis was found in 42% of the feces and pine nut fragments were present in 29%). At CDC 206, the major occupation was found to have occurred during the Pueblo I stage. At least one Navajo structure, a subterranean roasting pit, was also present and yielded a series of tree-ring dates from charcoal, the latest of which was a cutting date of AD 1773. The survey of Canyon del Muerto recorded 126 sites, ranging from Basketmaker II to modern Navajo. Intensive survey was limited to the area within the canyon; the plateau on the north and south rims was reconnoitered. Additional work was not possible in the time available. The survey indicated that Antelope House did not differ from contemporary canyon-bottom villages in any significant aspect.

Evaluation: By analyzing such items as bulk vegetal material and feces, which were overlooked in previous research in the canyons, the Antelope House Project recovered environmental and dietary data that have provided considerable insight into the Pueblo III stage in the monument and suggested lines of investigation for such major topics as the abandonment of the monument. However, it is probable that similar results could have been achieved through sampling of the pueblo through formal statistical procedures and left more of the site for future research. Interpretation of the village architecture and layout might have relied more heavily on illustrated displays or pamphlets. It is difficult to state how well the Antelope House data represent the monument as a whole, since the site constitutes a limited sample and comparable data are not available from previously excavated sites. The excavation of CDC 206 yielded some early Navajo tree-ring dates, but their interpretation is difficult, since they may represent dead wood scavenged for a fire. The survey produced an inventory of sites within the area examined intensively, but additional work would be needed on the plateau and in the upper portions of the canyon before the results could be said to be representative of Canyon del Muerto as a whole.

Records: Collections, field notes and photographs from the excavation of Antelope House and CDC 206 and from the survey are on file at the Western Archeological Center, Tucson. A report on the excavation of Antelope House and on the survey is in preparation; drafts are on file at the center. Volume 41, Number 1, of the Kiva (1975) was devoted to articles on the Antelope House Project. Don P. Morris (1975) has written a report on the excavation of CDC 206.
Principal Investigators: V.K. Pheriba Stacy and Don P. Morris.

Sponsoring Institution: National Park Service.

Project Title: None.


Location: Spur roads leading from the Tsaile-Chinle highway to overlook points on the north rim of Canyon del Muerto were surveyed. These roads lead to Ledge Ruin, Antelope House, Mummy Cave and Massacre Cave.

Purpose: The survey was designed to locate sites which would be destroyed by the construction of roads and to develop data in support of the archeological aspects of an environmental impact statement.

Procedures: After a brief reconnaissance by car, the entire right-of-way was traversed on foot by a party of two; one member of the party walked about 3 m to one side of the staked centerline, the other positioned himself 9 to 10 m toward the outer edge of the right-of-way. They walked down one side of the road and back on the other. The survey may be characterized as intensive. Sites were recorded and photographed as encountered. Collecting was restricted to a minimal representative sample for most sites. Records were maintained on Arizona State Museum survey cards, with supplemental notes. A 1" by 2" location stake, with the site number marked in black felt tip marker, was placed on each site. A .25 km² area was surveyed in eight person-days.

Results: Twenty-one sites were located, including one site with a Basketmaker occupation, one site with a Pueblo II occupation, one site with a Pueblo III occupation, six sites with an indeterminate Anasazi occupation, 14 sites with a Navajo occupation and one site with an indeterminate occupation (some sites were occupied during more than one stage). The Anasazi sites were characterized as small and inconspicuous on the basis of the survey sample. They were contrasted with the numerous sites located within the canyons and it was suggested that the sites represented localized use of rim resources for specialized purposes on an intermittent, probably seasonal basis. It was hypothesized that use may have occurred during seasons when canyon resources were scarce or during an episode of farming of marginal cropland at an optimum climatic period or at a time of maximum population; available data did not permit a choice between the hypotheses. The Navajo sites were found to span a period from the late 1700s to about 1950. A movement of the Navajo population away from the canyon rim was hypothesized (Don P. Morris 1976: personal communication).

Evaluation: The survey resembled the road survey conducted by Jon Young, in that the primary objective was the assessment of data likely to be lost through construction of the overlook roads and because it lacked
additional research goals conceived in advance of fieldwork. The survey has been of greater value, however, in that the chronological and cultural affiliations of the sites were discussed, providing a much better indication of the nature of the archeological resources on the plateau. The survey suffers from the potential for bias inherent in right-of-way surveys.

Records: Photographs, field notes, collections and a survey report are on file at the Western Archeological Center in Tucson.
Principal Investigators: Alexander J. Lindsay, Jr. and Charles D. James III.

Sponsoring Institution: Museum of Northern Arizona.

Project Title: None.

Dates: September - October 1972.

Location: Sites located by Stacy and Morris within the right-of-way of the Canyon del Muerto north rim overlook roads (NRM 11-17, 19-21, 23-25, 27 and 28) were excavated. The latter have not been assigned NRM numbers, pending publication of the excavation report.

Purpose: Recovery of data from sites threatened with damage or destruction by construction of the overlook roads.

Site Descriptions: The sites ranged from a Basketmaker III site with four pithouses to Navajo sites of the late 1940s and early 1950s. Forked-pole, corbelled-log and stone hogans were excavated.

Procedures: The excavations are being written up now. Preliminary reports (James 1972 a-e) contain no explicit discussions of excavation procedures. The bulk of the excavated sites were Navajo; documentary research and informant interviews supplemented the information obtained from excavation. The area around the excavated sites was also surveyed.

Results: The results of the excavations have not yet been published, but a series of preliminary reports (James 1974: a-e) and a summary of the Navajo data (James and Lindsay 1973) have appeared. In the latter article the Navajo occupation of the Canyon del Muerto area was broken down into a series of phases and trends in Navajo settlement pattern and acculturation were discussed. The bulk of the early Navajo sites (prior to 1800) were found in the area of the present day del Muerto community, perhaps because of the presence of three trails giving access to the agricultural lands on the bottom of Canyon del Muerto. The sites were large, containing up to 11 hogans, and were situated in the open. From 1800 to 1850 settlements moved closer to the canyon rim and decreased in number and size; the plateau near Massacre Cave was settled. These trends were attributed to warfare and the resulting need for concealment in the rough terrain near the canyon rim or in the pinyon-juniper forest near Massacre Cave. Warfare increased until the Navajo were removed to Fort Sumner in 1864. Following their return in 1868 the Massacre Cave area was resettled first, perhaps because of closer proximity to the Fort Defiance ration center. From 1900 on the del Muerto community area had twice the population density of the Massacre Cave area, probably because of the absence of warfare and the construction of such facilities as trading posts and schools at Chinle.
Evaluation: The project cannot be meaningfully evaluated at present, since the results still await publication. The preliminary publications have provided a number of useful insights into the Navajo settlement pattern in the Canyon del Muerto area. These should be further tested against a sample of sites from a larger geographical area, since the work on the overlook roads was necessarily restricted in geographical coverage.

Records: Collections, photographs, copies of preliminary reports (James 1974 a-e) and drafts of the final report (James 1974 f) are on file at the Museum of Northern Arizona, Flagstaff.
Principal Investigator: Don P. Morris.

Sponsoring Institution: National Park Service.

Project Title: Canyon del Muerto Survey Photographic Reconnaissance.


Location: The rims of Canyon del Muerto and all its tributaries were walked on both the north and south sides, from the junction of Canyon del Muerto with Canyon de Chelly to the area of Poison Ivy Canyon. Photographs were taken of the canyon walls in this area.

Purpose: The objectives of the reconnaissance were to compile a complete photographic record of canyon wall resources, such as rock shelters, that were and are used by man and to gain information about the most efficient ways to enter cliff sites during the next field season of the Canyon del Muerto Survey.

Procedures: The north and south rims of Canyon del Muerto were walked and a continuous photographic record of the opposite canyon wall was made, using 4" x 5" black-and-white film and 35 mm color slides. Two persons were in the field during May and four were in the field in June. Approximately 90 person-days were spent on the work.

Results: The desired photographic record of the canyon walls was obtained and a number of new sites were identified on the basis of the resulting photographs. In addition to showing the location of habitable rock shelters and access routes for the shelters, it provided a record of canyon vegetation and geology. A road map of the canyon area was created to update the 1953 U.S. Geological Survey topographic maps.

Evaluation: The photographic reconnaissance has proven most useful as a source of information on canyon vegetation, topography and travel conditions. Some difficulties have been encountered during attempts to use the reconnaissance as a source of information on site locations, however. Site locations determined from photographs were plotted on archeological base maps, without visiting the site and sometimes without marking the site number on the photographs. When areas with sites identified in this manner have subsequently been visited it has been difficult to determine whether a specific site is one that was recorded by the photographic survey, since the scale of the base map creates some imprecision in the site location and since the photographs often cannot be used as references because they lack site numbers. In the future, site numbers should be assigned only after a site has been visited and recorded.

Records: Field notes, photographs and a report (Hall and Rock 1974) on the photographic reconnaissance are on file at the Western Archeological Center, Tucson.
Principal Investigator: Don P. Morris.

Sponsoring Institution: National Park Service.

Project Title: None.

Dates: August 4-7, 1974.

Location: CDM 140.

Site Description: CDM 140 is a late Basketmaker III pithouse on the north side of Canyon del Muerto, opposite Sheep Point Canyon.

Purpose: Salvage of a site threatened by erosion by the main stream channel in Canyon del Muerto. Preliminary examination of the pithouse profile in the eroded streambank had shown that potentially datable charcoal was present. No ceramics could be found, suggesting that the site might have been Basketmaker II. These facts, in turn, suggested that a salvage excavation of the pithouse could contribute to the achievement of the research objectives of the Canyon del Muerto Survey, which included refinement of the beginning date for the Basketmaker II occupation of the canyon. Other objectives of the survey included the assessment of the relative importance of wild versus domesticated foods in prehistoric diets and it was hoped that material excavated from the pithouse would also be relevant to those objectives.

Procedures: The pithouse was excavated entirely by natural strata. The pithouse was mapped with an alidade and plane table. No artifacts were found in the fill. Those found on the floor were located on the pithouse map. Pollen samples were collected within the pithouse and soil samples were taken from a nearby stratigraphic cut.

Results: The pithouse was approximately 3.25 m north-south. Its eastern portion had been destroyed by erosion. It was not slab-lined. Floor features included a clay-lined hearth and two possible postholes. Artifacts on the floor consisted of one Lino Gray sherd and two disc-shaped stone objects. The structure apparently burned, since the floor was fire-baked and a mass of charcoal, evidently the remains of the roof, lay on it. Dendrochronological dates from the charcoal clustered between AD 691 and 696. An archeomagnetic date of AD 740 ± 19 was obtained from burned clay in the west wall, indicating the approximate time of the pithouse's destruction. The dates led to the classification of the pithouse as Basketmaker III.

Evaluation: The results of the pithouse excavation are difficult to interpret because there is very little within the monument with which the pithouse can be compared. Earl Morris did not publish on comparable structures encountered during his work. A similar structure of almost identical age was excavated by Don P. Morris at Antelope House and the results will be published soon, but the sample of excavated and published
Basketmaker III pithouses will remain too small for drawing meaningful conclusions. In terms of the stated objectives of the project, nothing was learned about the Basketmaker II occupation of Canyon del Muerto and no information about the relative importance of wild versus domesticated foods in the Basketmaker III diet seems to be forthcoming.

Records: Field notes, photographs and collections from CDM 140 are housed in the Western Archeological Center, Tucson. A report on the excavation (Thornton 1976) is on file at the center.
Principal Investigator: Don P. Morris.

Sponsoring Institution: National Park Service.

Project Title: Canyon del Muerto Survey.

Dates: June 2 - September 30, 1975.

Location: Canyon del Muerto.

Purpose: To describe and explain Anasazi and Navajo settlement patterns within the monument. The survey is designed to provide data about site types and locations, which will be usable in the formulation of development plans for the canyon and in testing hypotheses of scientific interest. Many of these hypotheses were based on research at Antelope House (Morris and Rock 1975a).

Procedures: The initial objective of the project was to conduct an intensive survey of 100% of the monument within and around Canyon del Muerto, but the photographic reconnaissance of 1974 suggested that the number of potential sites and difficulties of travel would preclude a 100% survey in the time available. Consequently, a sampling strategy was adopted. A systematic transect sample, consisting of a series of transects 140 m wide, 1.4 km apart (measured from center to center) and oriented 150° E, was investigated. The orientation of the transects assured that each would include Canyon del Muerto and the plateau on either side, thereby cross-cutting a series of environmental zones defined by Dennis (1975). Site locations were recorded in terms of these zones, as well as in absolute space (by UTM coordinates), in order to discover statistically significant correlations during later analysis. The entire length of the canyon was included in the transect system. The size of the field crew varied from one to eight persons. Smaller crews, consisting of one to three people, were generally utilized for special purposes, such as recording sites in locations which were difficult of access. Larger crews, consisting of three to eight people, were used to survey the transects. Crew members were spaced at 10 m intervals on the transect and the transect was traversed from end to end, with the traverses repeated until the entire width of the transect had been covered. When a site, defined by the presence of at least five artifacts in a 50 m² area, was found it was mapped, photographed in black-and-white and in color and recorded on a series of computer forms calling for data on natural environment, architecture, other features and artifact types and quantities. Collections were made when it appeared that laboratory analysis of artifacts would be necessary to determine the cultural affiliation of the site. Collecting employed an uncontrolled sampling procedure. Sixteen transects, comprising 6% of the area of the Canyon del Muerto branch of the monument, were surveyed in this manner. Approximately 450 person-days were spent in the field. Additional field work is scheduled for July, August and September of 1976.
Results: Three hundred twelve sites were recorded, bringing the total of known sites in Canyon del Muerto and its tributaries to 570. Of those sites, 174 had a Navajo component, one had a Pueblo V component, none had a Pueblo IV component, 25 had a Pueblo III component, 15 had a Pueblo II component, five had a Pueblo I component, seven had a Basketmaker III component and three had a Basketmaker II component. Sixty-six sites had Anasazi components whose stage affiliation could not be identified and 55 sites had components which could not be identified at all. Statistical tests of associations between sites, site features or artifact inventories and environmental zones have not been made, although they are planned. Some trends were noted by the investigators in the field, however. These include the presence of Basketmaker III and late Pueblo II-early Pueblo III sites on the plateau. It has tentatively been hypothesized that this represents variation in the intensity of utilization of the plateau caused by changes in seasonality or yearly total of precipitation.

Evaluation: The transect survey strategy has been shown to be an efficient means of archeological sampling, particularly for estimating numbers of sites within a survey area and for summarizing their environmental settings (Judge, Ebert and Hitchcock 1975). However, in order to acquire data about site relationships within environmental zones, the transect survey should be supplemented by a quadrat survey, which is planned for the 1976 field season. Some revision of the data recording procedures is also necessary and is planned. For example, given an attempt to conserve archeological resources by not surface-collecting sites unless laboratory identification of artifacts was necessary and given the uncontrolled nature of the collections, ceramic type frequencies were recorded in terms of frequency classes (e.g. 1-4, 5-9 and over 10 sherds present), rather than in terms of absolute numbers. This has hindered statistical studies of ceramic frequencies. Controlled surface collections are recommended to remedy the situation. Statistical measures can be based on numbers of items of a given type in the collection.

Records: Site records, photographs, collections and a survey report (McDonald, Thornton and Morris 1976) are on file at the Western Archeological Center, Tucson.
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