BUR IANAGEMENT
UTAH

CULTURAL RESOURCE EVALUATION IN SOUTH CENTRAL UTAH 1977—1978

F. R. Hauck
Principal Investigator

CULTURAL RESOURCE SERIES
No. 4

BUREAU OF LAND MANAGEMENT
UTAH

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CULTURAL RESOURCE SERIES
No. 4

FOREWORD

"Cultural Resource Evaluation in South Central Utah" represents the fourth volume in a series of Cultural Resource Monographs published by the Utah State Office of the Bureau of Land Management.

"Cultural Resource Evaluation in South Central Utah" was prepared by Dr. F. Richard Hauck and staff of Archaeological Environmental Research Corporation of Salt Lake City, Utah. The study results from a contract awarded to Wayne T. VanWagoner and Associates of Salt Lake City, by the U.S. Geological Survey in consultation with the Bureau of Land Management. This study was necessary to analyze the impact coal mining in South Central Utah might have on cultural resource values.

Gary J. Wicks
State Director

ABSTRACT

The South Central Coal Cultural Resource study was designed to correlate cultural data with the potential adverse impacts related to the development of coal mining.

Class I and II cultural resource inventories were conducted on 2,981,000 acres of federal lands consisting of 1,499,000 BLM and 1,482,000 Forest Service-administered lands. By BLM definition, Class I studies provide a review and synthesis of existing cultural resource information while Class II inventories identify and record, by sampling, all cultural resource sites within a study area.

Stratified by vegetation this Class II study inventoried 27,680 acres or nearly one percent of the total available acreage. The 168 randomly selected sample units produced 348 cultural sites.

Richard E. Fike

PREFACE AND ACKNOWLEDGEMENTS

The 1977-1978 Southern Coal Project was conducted by AERC under a joint USGS, BLM, and Forest Service contract awarded to the Wayne T. VanWagoner and Associates firm, of Salt Lake City during the spring of 1977. The purpose of the project was to evaluate the coal industry-related impact potential upon the cultural resources of 2,981,000 federal acres in southern Utah. Working under a separate contract to the VanWagoner firm, AERC initiated an extensive records evaluation of prehistoric and historic data and conducted an intensive field survey of 27,680 acres contained in 168 randomly selected sample units of 160 acres each. The final three volume report, designed to correspond with the earlier Central Coal Project of Utah, and entitled, "The Southern Coal Project of Utah," was completed for VanWagoner and Associates in the spring of 1978. Elements of those three volumes were incorporated into VanWagoner's report, "Determination of Impacts of Coal Mining on the Cultural Resources of Southern Utah," which was submitted to the USGS. The report prepared herein consists of a modification of AERC's original Volume II which was entitled, "The Cultural Resources of the Southern Coal Project Area."

Although the project contract originated in the Washington, D.C., offices of the USGS under the direction of Esther Williams and Mary S. Ridgeway, various BLM and Forest Service personnel in Utah contributed to its preparation through the evaluation of research criteria and the selection of the random sample units. Douglas McFadden, Gardiner Dalley, and Evan DeBloois participated in this effort. Richard Fike, BLM Archeologist in the Utah State Office, coordinated the proposal development and eventually was designated as the project COAR. Our appreciation is extended to Richard Fike, Evan DeBloois, Forest Service Region 4 Archeologist, Frank McElwain, Forest Service Coordinator for the Southern Utah Task Force on Coal Development, and all other government administrators who contributed to this project.

Acknowledgement must also be made to a number of past and present AERC employees who contributed to the preparation of the initial AERC report. Asa Nielson, the field coordinator for the archeological research, and crew chiefs, Casey Shumway, Alan Spencer, Samuel Kennette, Marian Jacklin, Michael Bensen, Dean Schliesman, Justin Brydson, and Stephen Hayes participated in the difficult compilation of field data. Writers and researchers who contributed to the original report include Lawrence Harmon, geographer, Garry F. Rogers, geographer, Heidi Roberts, data control, LaMar Drollinger, historian, and V. Garth Norman, Andrew McDonald, and William Lucius as archeologists. Linda Edeiken of City Scape and Wayne VanWagoner and his associates also contributed to the successful completion of the project; Linda as an excellent cartographer, and Wayne as the primary contractor and general project administrator. Finally, my appreciation is extended to all the general field, laboratory, and office personnel who participated in the project.

F. R. Hauck
August, 1979

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Chapter 1

BACKGROUND INFORMATION

PART A: INTRODUCTION

From September, 1977, through February, 1978, the Archeological-Environmental Research Corporation of Salt Lake City conducted a cultural resource survey of the Southern Coal Project area in two research stages. The first stage was a Class I Survey involving a compilation of previously known and recorded cultural information for the entire project area. The second research stage was an intensive archeological field survey (Class II) of a one percent sample of the study area. The sample consisted of 168 quarter section sample areas of 160 acres each. The purpose of the Southern Coal Project has been to correlate the cultural data base with the adverse impact potential related to the development of the coal mining industry in the project area. These syntheses of cultural, environmental, and coal developmental data have resulted in a classification of adverse impacts, an outline of recommended mitigational techniques, and three separate sets of guidelines which can be used by government and industry in planning coal development projects which will have minimal potential for disrupting cultural resources.

The Southern Coal Project was composed of six Bureau of Land Management and four Forest Service planning units in southern Utah (Figure 1-1). Portions of the study area were in Garfield, Iron, Kane, Piute, Washington, and Wayne Counties. The BLM planning units involved included Cedar, Escalante River, Garfield, Paria, West Zion, and Zion. They have a total BLM acreage of about 1,499,000 (ca. 606,626 ha.). The Forest Service units consisted of Aquarius, Boulder,

SOUTHERN COAL PROJECT GENERAL LOCATION MAP

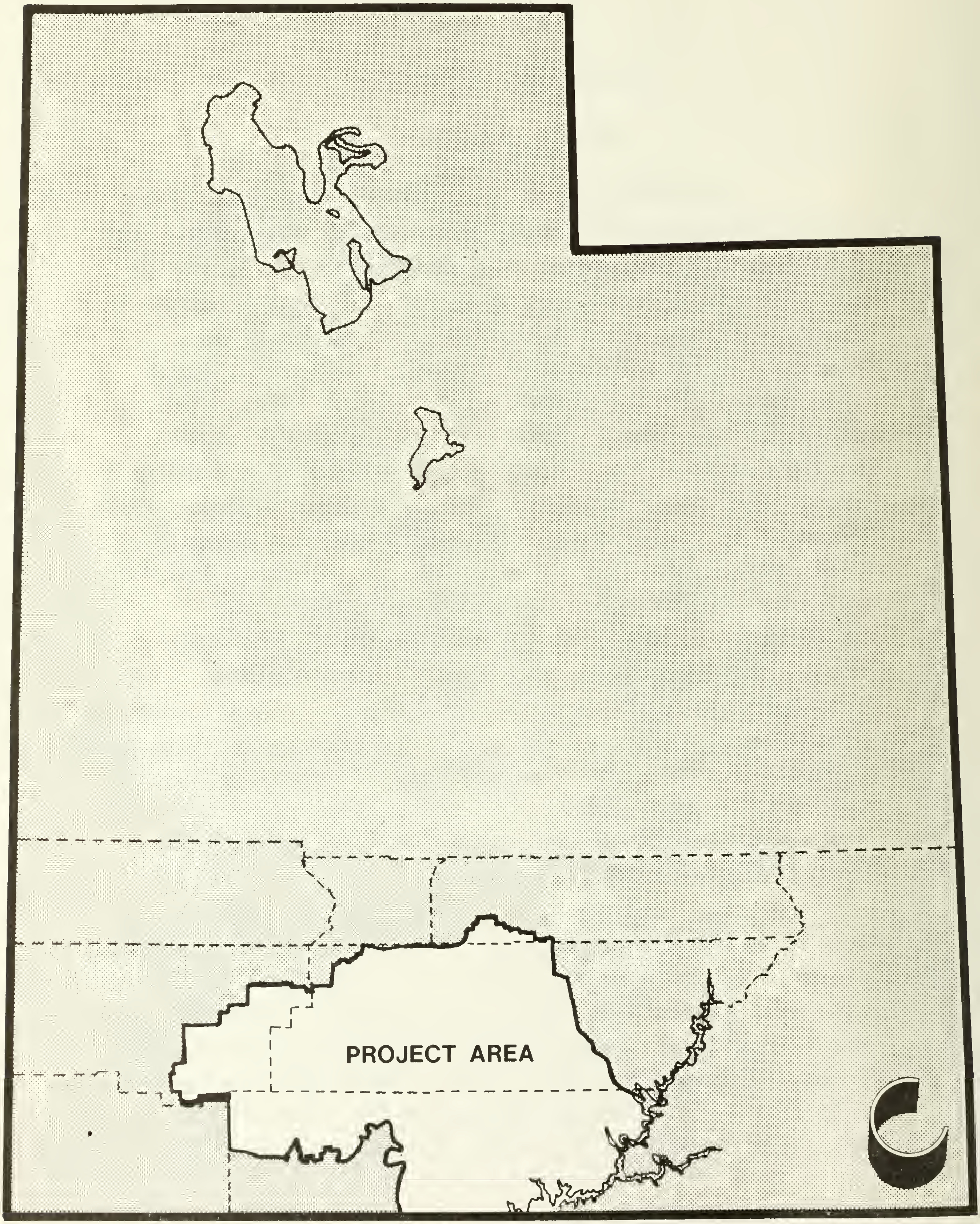


FIGURE 1-1

Markagunt, and Paunsaugunt-Sevier with about 1,482,000 acres (ca. 600,000 ha.) of Forest land (see Figure 3-1). Sample areas are apportioned among the planning units as outlined below:

Planning Unit	Number of Sample Areas
Cedar	4
Escalante River	72
Garfield	6
Paria	0
West Zion	1
Zion	10
Aquarius	17
Boulder	3
Markagunt	15
Paunsaugunt-Sevier	40

The final report of the Southern Coal Project (SCP) was prepared by AERC in three parts titled Volumes I, II, and III.

Volume I, entitled A Summary Report of the 1977, 1978 Southern Coal Project in Utah, provides a brief synopsis of archeological, cultural, and environmental information engendered during the research and also reviews an evaluation of potential impacts to be expected during the development of the coal industry in the area. A variety of methods useful in mitigating potential negative impacts are reviewed in Chapters 4 and 5 of Volume I.

Volume II, The Cultural Resources of the Southern Coal Project Area, contains five chapters which detail the cultural and environmental relationships and information obtained during the project.

Probable Coal Mining Impacts on Cultural Resources in the Southern Coal Project Area, reported in Volume III, completes the final investigative reports by evaluating correlations between negative impact types and both cultural and environmental factors in the SCP area.

This report consists of a modified version of the original Volume II of the Final Report for the Southern Coal Project which contained only five chapters. Each chapter involves a major body of information necessary for a complete explanation of the background, methods, and results of the various research groups involved with the Southern Coal Project.

The first chapter provides a brief and general introduction to the project and contains information on the environment of the project area. Each chapter is outlined and explained as to its content and purpose.

Chapter 2 is entitled "A Summary History of Man in the Study Area", and is broken down into three parts. Part A discusses the prehistoric peoples of Utah and addresses the way in which the Paleo Indian, Archaic, Fremont, Anasazi, and Shoshonean cultures utilized the available natural resources in order to maintain their existence. Part B begins with the earliest known Euro American entry into the Southern Coal Project area, and shows how the various historic peoples have initiated differing patterns of resource exploitation in the area.

Chapter 3, a "Report on the Class I Survey", primarily examines the operations of Research Group One (RG-I), which was responsible for researching previously recorded sites in the Southern Coal Project area. Part A of Chapter 3 explains site classifications, and provides a list and definition of site types encountered during the various research processes. Part B begins with a general background of the Class I research, including a brief introduction, a statement of sources consulted, an account of time and personnel involved, and a discussion of problems encountered during the Class I survey. Part C in Chapter 3 provides an outline of the history of archeological research in the SCP area.

Chapter 4 furnishes a report on the Class II Survey which involves the activities of Research Group Two (RG-II). This group discovered and recorded historic and prehistoric sites situated in a one percent sample of the SCP surface area, consisting of 168 sample areas of 160 acres each. Part A explains the research methodology employed by RG-II, including a description of the approach, an enumeration of the crews and the personnel, the dates of survey, and operational details of the survey. Part B provides a planning unit description narrative coordinated with maps and site tables. Part B consists of a correlation between the environmental variables, cultures, and various types of sites discovered during the RG-II survey. Part C concludes the chapter by presenting an inventory and analysis of lithic and ceramic artifacts collected during the archeological research.

Chapter 5, "Recommendations for Future Research," utilizes the findings of this project to discuss specific cultural resource investigations which are needed in the SCP area. Part A of this chapter reassesses the various data gaps which have become apparent during the research. Recommendations for future research and the rationale behind these recommendations are provided in Part B.

A glossary and bibliography complete the report.

A brief comment concerning the selection of the sample units is necessary. The samples utilized in AERC's surveys of the nine surveyed planning units (Class II) were drawn in two different contexts. Sample areas for the five BLM planning units were stratified in a random manner based upon a 1% proportion of the various vegetation zones to the total federal acreage of each unit. The units on National Forest lands (Aquarius, Boulder, Markagunt, and Paunsaugunt-Sevier) were stratified quarter sections oriented to the location of known coal resources rather than vegetation types. These stratified samples were based upon a 1% proportion of the acreage within each unit's coal resource zone and not in proportion to the total federal acreage of these National Forest units. Each stratified sample area, whether located on BLM or National Forest lands, consisted of a legally definable quarter section of 160 acres.

Both the Bureau of Land Management and AERC vegetation classification systems were used to compute site density correlations (cf Volume II, Table 4-8). The Bureau of Land Management vegetation types were the basis of the sample area selections made by the BLM and include the barren, sage, shrub/brush, grasses, and pinyon-juniper types. AERC recognizes six general ecozones: alpine, montane, mountain brush, pinyon-juniper, arid transitional, and arid, which have subzones that are generally complimentary with the BLM vegetation types. AERC had to employ the ecozone, subzone, and habitat/community ecological approach in order to adequately evaluate the vegetational context of the archeological sites recorded in the Class II survey. Sample areas defined within the barren zone type by the BLM frequently contained small pinyon-juniper habitats where the cultural resources were discovered. Hence, AERC's designation of the sites within a pinyon-juniper habitat in the data compiled in Chapter 4, although correct and valuable, was not relatable to BLM statistical evaluations in terms of vegetation type per se. Hence, the need for two different sets of data relating site numbers to vegetation as a means of providing a predictive base. The first set shown in Table 4-2 is a basic statement of site densities by specific ecozones and/or habitats wherein the sites were recorded. This table demonstrates that 77.8% of the Class II sites were found either in the pinyon-juniper ecozone, subzones, or pinyon-juniper habitats. The arid transitional ecozone contained 15.8% of all newly recorded sites, while only 3.4% of the Class II sites were found in the montane ecozone. The mountain brush and arid ecozones each contained only 1.4% of the Class II sites.

To aid the BLM in evaluating site density by their vegetation type system explained above, AERC initiated a separate evaluation involving all the Class II sites found in BLM defined vegetation types and then computing a series of percentages based on these correlations. A total of 260 sites in the Cedar (10), Escalante River (208), Garfield (23), West Zion (0), and Zion (19) Units were evaluated. The National Forest Units were not included, since vegetation-type data were not submitted to AERC for these sampled planning units. The evaluation of these sites to BLM vegetation types demonstrates that the BLM pinyon-juniper type contained 45.7% of the sites found in these five planning units. The brush/scrub type contained 35%, barren--15%, grassland--2.6%, conifer--.7%, and the mountain scrub and sage types each had .38%. These results are comparable with AERC's system as noted above. AERC's higher percentage of sites within the pinyon-juniper ecosystem would be reflected in the BLM vegetation system if that typology were to include a habitat level evaluation system rather than a reliance on gross vegetation types.

PART B: THE ENVIRONMENT OF THE PROJECT AREA

Introduction

In the following discussion, a general description of the physical environment of the entire study area proceeds detailed descriptions of each of the ten Southern Coal Project planning units. The subjects covered include location, geomorphology, geology, hydrology, climate, soils, and biology.

LOCATION

The Southern Utah Coal area includes over three million acres (1,215,000 ha.) and is located in south central Utah. The area is approximately 140 miles (225.26 km.) across from east to west, and approximately 90 miles (144.81 km.) at its greatest dimension from north to south. Only a small amount of land is private property. Most is publicly owned and is administered by the Bureau of Reclamation, Bureau of Land Management, Park Service, the Forest Service, and the State of Utah.

The boundary of the area is quite irregular. In some places, it follows natural hydrologic or topographic features, and in others, it is formed by the borders of various administrative units, including states, counties, parks, etc. In the south, the boundary line follows the Utah-Arizona border east from the Paria River to the Colorado River, a distance of approximately 30 miles (48 km.). The line then follows the Colorado River northeast until it reaches Bullfrog Basin, a few miles northeast of the junction of the Escalante and Colorado Rivers. Here the line turns northwest and follows Waterpocket Fold until it reaches the boundary of Capitol Reef National Monument.

Continuing northwest along the west boundary of the monument, it reaches the border of Wayne and Garfield counties, which is also the northern boundary of Dixie National Forest, approximately 60 miles (97 km.) northwest of Bullfrog Basin.

From there, the line extends westward for about 50 miles (80 km.), then moves southward, then to the west to cross the northern end of the Hurricane Cliffs into Parowan Valley. The line then proceeds southwesterly through Cedar Valley until it turns south, west of Cedar City. Twenty miles (32 km.) farther south, it reaches the Washington County boundary and then follows the boundary southeasterly for about twenty miles (32 km.), after which it stretches eastward for about sixty miles (97 km.) and then turns south and rejoins the southern boundary of the area on the Utah-Arizona border.

Access to the study area is provided by several major highways. On the west, Interstate Highway 15 crosses a portion of the area and on the southwest, State Highway 14 runs easterly from Interstate 15 to Highway 89 in the southwestern quarter of the area. From this intersection, Highway 89 extends to the north through the western part of the area and to the east through the southern part of the area. In about the central western part of the study area, State Highway 12 leaves Highway 89 and crosses much of the area to the northwest as far as the town of Boulder. Access is further provided by a number of smaller highways and unpaved roads throughout the region. The density of the network, however, is somewhat less than for many other areas in this region.

GEOMORPHOLOGY

The land forms in the study area have been studied frequently in the past and are well described in several publications (Hunt 1956, 1974). They have been mapped by

Raisz (1957) and more recently by Ridd (1960). Most of the area is covered by large scale topographic maps available from the U. S. Geological Survey.

Most of the study area is located within the Colorado Plateau Physiographic Province (see Figure 1-2). The only exception is the small section west of Cedar City which lies within the Basin-Range Province. The western half of the area forms the southern portion of the High Plateau Section of the Colorado Plateau Province and the highly characteristic horizontal strata forming steep sided mesas and plateaus with nearly level tops is common. The eastern half of the area lies within the Canyonlands section of the Colorado Plateau, and the many canyons cut through large expanses of exposed sandstone are typical of the section.

Several structural upwarps occur in the Canyonlands section and the flanks of these structures, together with the deeply eroded canyons, form almost impassable barriers to travel, especially in directions at right angles to the common trend of these canyons, which is from the northwest to the southeast. The structures formed by the anticlinal upwarps are generally referred to as hogbacks, but are locally called reefs. Capitol Reef National Monument which forms the northeast boundary of the study area, is associated with the Circle Cliffs Upwarp (see Figure 1-3).

The major topographic features of the Canyonlands section include the Echo Monocline in the south, the Kaibab Monocline in the southwest, the Straight Cliffs and Kaiparowits Plateau in the southeast, and the Circle Cliffs and Waterpocket Fold in the east. Also prominent are the many canyons, the largest of which are the Escalante in the east, the Paria in the west, and the Colorado in the southeast. Other common features are natural sandstone arches and natural bridges as well as tanks and alcoves occurring in sandstone exposures along cliffs throughout the area. These latter two features are of particular importance because of water storage by the

INDEX MAP: COLORADO PLATEAU

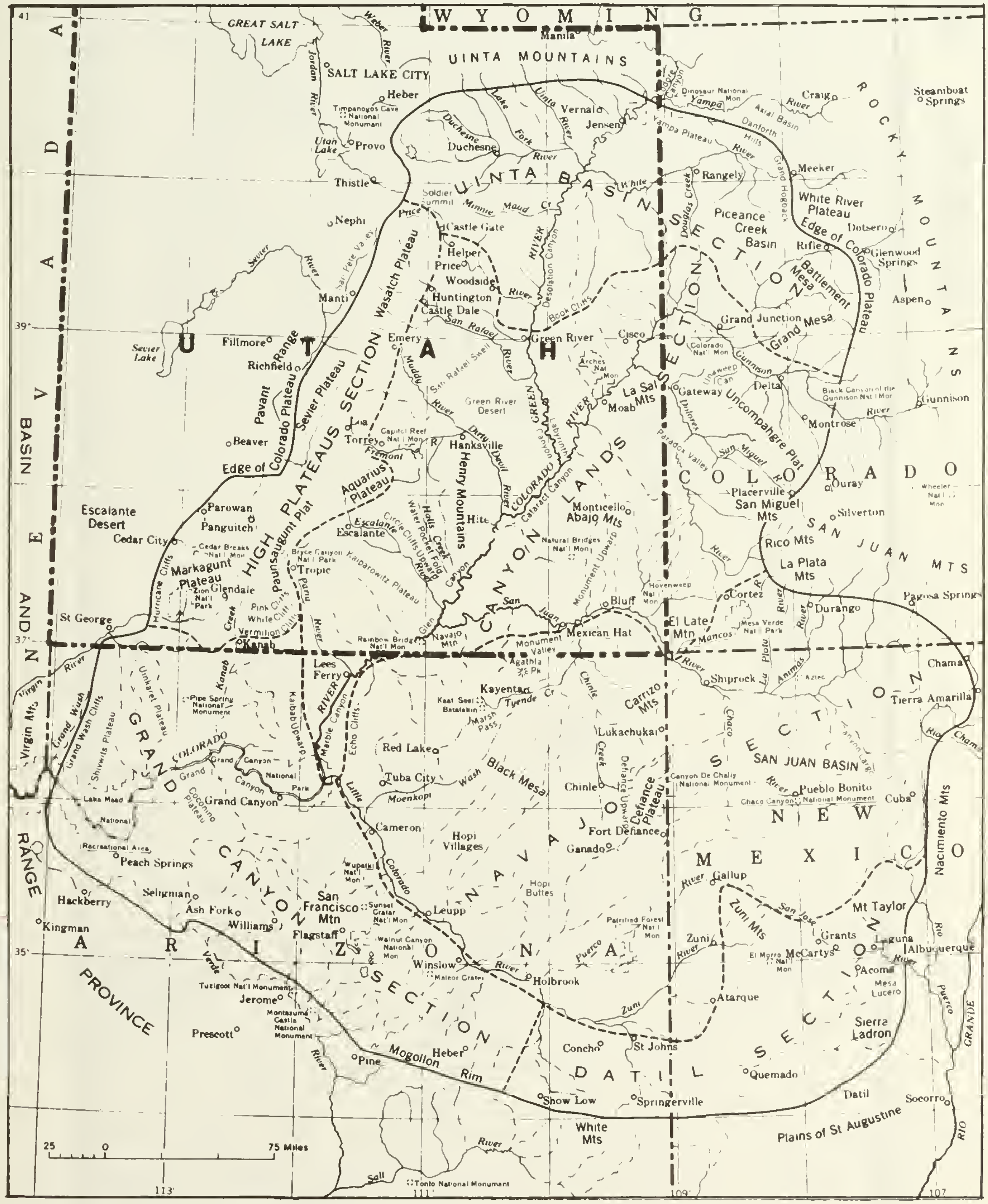


FIGURE 1-2

STUDY AREA RELIEF
GENERAL VIEW

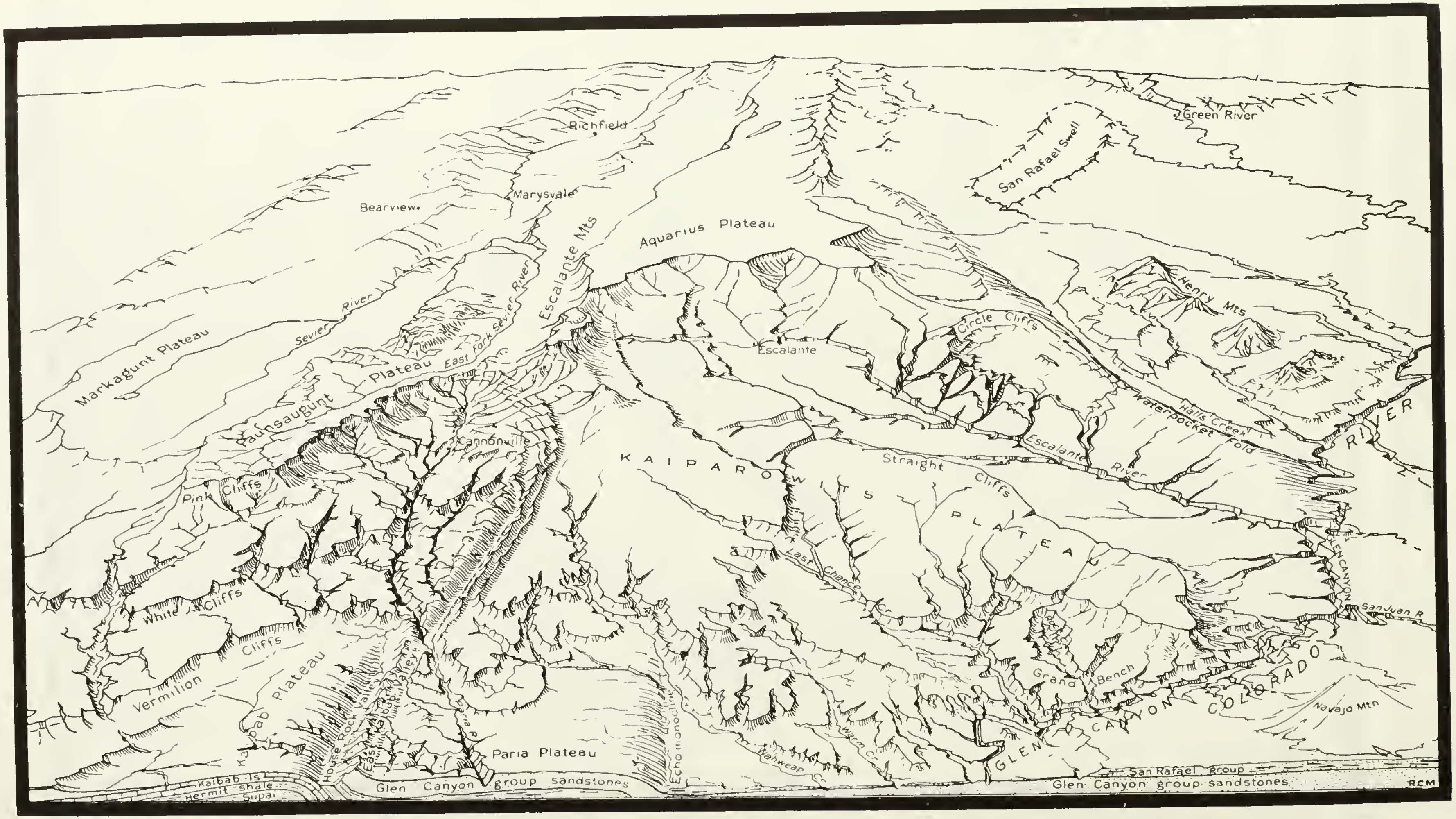


FIGURE 1-3
from U.S.G.S. Professional Paper 164

natural tanks or water pockets as they are sometimes called, and because of the habitations frequently associated with the alcoves.

The High Plateaus Section of the study area forms most of the western boundary of the Colorado Plateau physiographic province. The plateaus of this Section mostly consist of northerly trending fault blocks. Many of them are lava-capped with abrupt margins and steep sides. The southern limit of this section occurs diagonally across the study area from the southwest to the northeast. The limits of this boundary are formed by high cliffs overlooking the Canyonlands and Grand Canyon Sections to the south. The major cliffs along this line include the Pink Cliffs, White Cliffs, and Vermilion Cliffs, which form the Grand Staircase of Utah, south of the Paunsaugunt Plateau in the central part of the study area, the Table Cliffs in the central part of the study area, and the Aquarius Plateau in the northeast (see Figures 1-4 and 1-5).

The major structural features of the High Plateaus Section include the Hurricane Fault on the western border and the Kolob Plateau adjacent to the fault. The Kolob Plateau is separated from the Markagunt Plateau to the east by another fault. The Markagunt Plateau is separated from the Paunsaugunt Plateau farther east by the Sevier Fault. The Paunsaugunt is bounded on the east by the Paunsaugunt Fault. East of this is located the Table Cliffs and farther east (in the northeastern corner of the study area), the Aquarius Plateau, on which Boulder Mountain is located. Because the strata of the Colorado Plateau is tilted downward towards the northeast, the High Plateaus generally exhibit the highest elevations in the province.

Elevations in the study area range from around 4,000 feet (1,219 m.) in the lower portions of the Canyonlands along the Colorado River, to about 12,000 feet (3,658 m.) in the higher portions of the High Plateaus Section. This minimum to maximum elevation change is exhibited by the general trend within the study area from low elevations in

RELIEF PICTORAL MAP

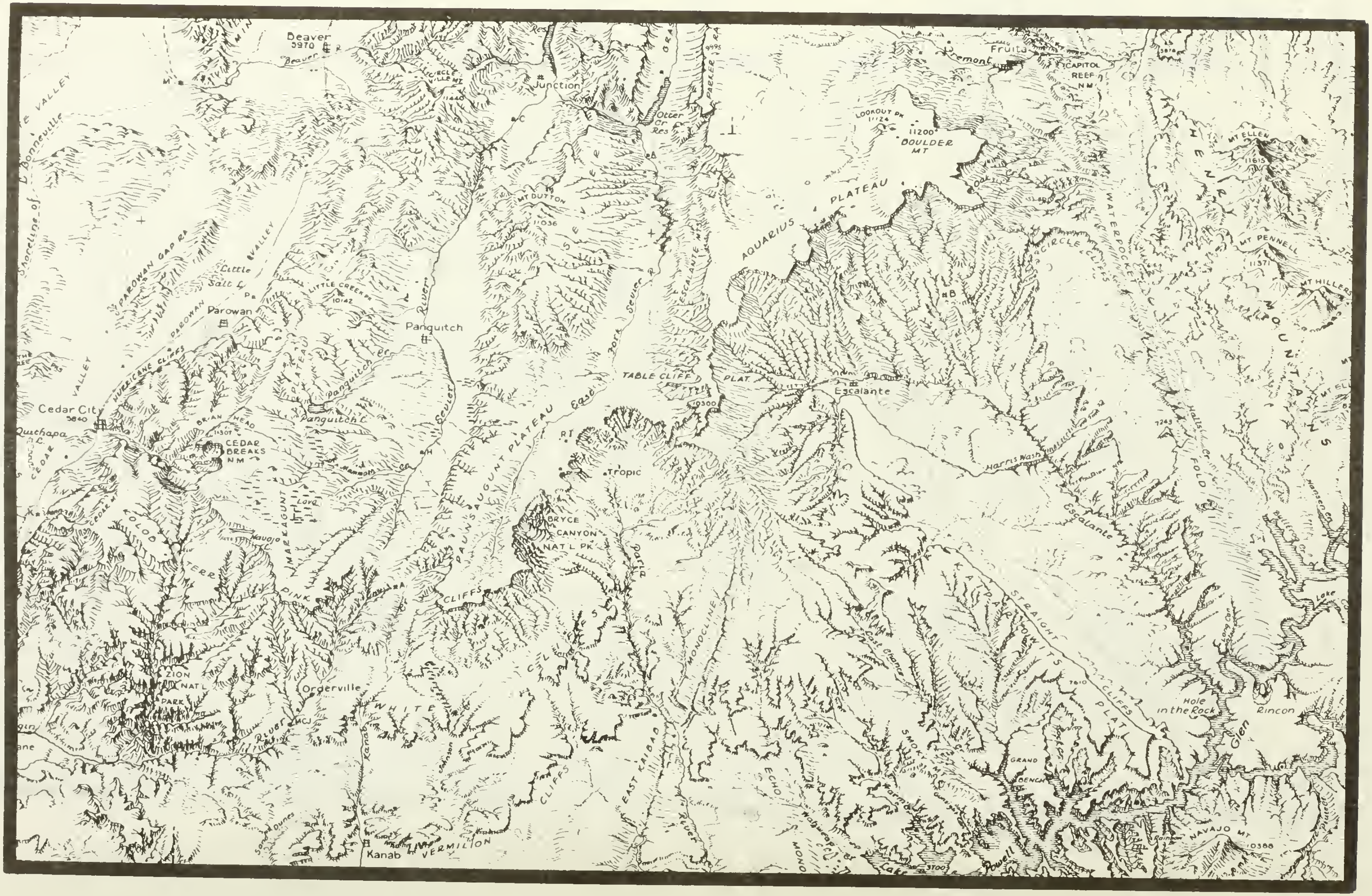


FIGURE 1–4
from Ridd 1960

GEOLOGIC MAP

from U.S.G.S. Professional Paper 669

EXPLANATION

QT

Quaternary and upper Tertiary sedimentary deposits

Bidahochi Formation (Pliocene) in the Little Colorado River valley; Muddy Creek Formation (Pliocene?) at the mouth of the Grand Canyon; North Park Formation (Miocene) in Middle Park at the head of the Colorado River

Te

Lower Tertiary formations

Mostly Paleocene and Eocene rocks in Uinta Basin and San Juan Basin

Tv

Tertiary volcanic rocks

In the San Juan Mountains, the volcanic rocks are mostly Oligocene to Pliocene; on White River Plateau they are mostly Miocene; elsewhere they are mostly Pliocene. Laccolithic intrusions at the Henry, La Sal, Abajo, Ute, and Carrizo Mountains are mostly lower Miocene. (For locations see fig. 29)

K

Cretaceous formations

JꝚ

Jurassic and Triassic formations

P

Paleozoic formations

p€

Precambrian rocks

Contact

River basin boundary

FIGURE 1-5

the southeast to high elevations in the west. The interior valleys of the High Plateaus are all above 6,500 feet (1,981 m.), whereas peaks exceeding 7,500 feet (2,286 m.) are rare in the Canyonlands.

GEOLOGY

The geology of the Colorado Plateau is relatively well-known. Studies began in the late 1800's and except for a brief respite near the end of the nineteenth Century, have been continuous to the present. Recently, comprehensive accounts have been provided by Charles B. Hunt (1956, 1974), and fairly detailed maps by Hintze (1963, 1975) and Hintze and Stokes (1964) are available. Partly because of the typical horizontal structures, the temporal trend in exposures is from younger formations at higher elevations on the plateaus of the west toward older formations at lower elevations in the Canyonlands to the east. The oldest exposures are Permian in age and are found in the Circle Cliffs Upwarp. Permian age exposures do not occur elsewhere in the study area, although they are present in several nearby locations. Jurassic and Triassic materials are fairly common in the Canyonlands, but are not nearly so abundant as Cretaceous materials. In the High Plateau Section, very few exposures are older than Tertiary age. It is in this section that Tertiary volcanics are very abundant. Further details on the exposures in the study area are provided in Table 1-1 , which is taken from Hintze (1975), and the general age of the surface rocks is shown in Figure 1-5.

HYDROLOGY

The study area is divided between two major drainage systems. Most of the High Plateau Section drains westward into the Great Basin Hydrographic Province, and all of the Canyonlands Section of the study area drains into the Colorado River. The major streams draining the

Table 1-1 Geology of the study area[1]

System	Group	Formation
Quaternary		Alluvium and Sand Dunes
		basalt flows and volcanoes
		Pleistocene erosion surfaces slump masses and glacial deposits
		Quaternary and Tertiary deposits and surfaces
Tertiary		Muddy Creek formation
		Green River formation
		Page Ranch volcanic rocks
		Rencher formation (21 million years old)
		Quichapa formation (24 million years old)
		Isom formation
		Needles Range tuff (29 million years old)
		Claron or Cedar Brakes formation (Bryce Canyon and Cedar Breaks)
		Kaiparowits formation (southern Utah)
		North Horn formation (central Utah)
Cretaceous	Mesa Verde	Price River formation
		Castlegate Sandstone
		Blackhawk formation
		Star Point Sandstone
		Wahweep Sandstone — Iron Springs Formation
		Straight Cliffs formation — Iron Springs Formation
		Tropic Shale — Iron Springs Formation
Jurassic		Brushy Basin Mbr — Morrison Formation (Arches)
		Salt Wash Mbr — Morrison Formation (Arches)
		Entrada Sandstone
		Carmel formation
		Navajo Sandstone (Zion National Park and Rainbow Bridge)
Triassic	Glen Canyon	Kayenta Sandstone
		Wingate Sandstone
		Moenave formation
		Moenkopi formation
Permian	Cutler	White Rim Sandstone
		DeChelly Sandstone (Monument Valley)
		Organ Rock Shale
		Cedar Mesa Sandstone (Natural Bridges)
		Halgaito formation

[1] Data from Hintze, 1975.

Canyonlands Section are the Escalante River toward the east, and the Paria River in the south. The High Plateau Section is drained by the Sevier River, which flows northward from the study area, and flows ultimately into Sevier Lake in the Great Basin. Other drainage from the High Plateaus is from small streams emptying into the Cedar and Parowan valleys to the west. Both sections contribute to the Virgin River system through several streams, and both also contribute to Kanab Creek, which flows southward to the Colorado River in the Grand Canyon. The typical annual flow of the Sevier River is higher than that of the Escalante and Paria (Jeppson, et al, 1968). This is largely because the Sevier River drains higher elevation areas which receive much greater precipitation throughout the year than falls in the Canyonlands Section.

A variety of stream channel patterns are found in the Colorado Plateau. Some uncommon features have developed due to continuous uplift of the plateau throughout its geologic history. Streams formerly flowing across alluviated valleys have cut downward during the process of uplifting, and in several locations have cut through previously buried mountain ranges, creating what are known as dioric valleys. Variations of the processes are referred to as antecedents, superposition, or a combination of the two called antiposition (Hunt 1974:69-70). The continuous uplift has resulted in deeply incised stream channels, especially in the Canyonlands Section. These deep canyons have nearly vertical sides, which, as mentioned earlier, create barriers to travel.

Most streams arising in the Colorado Plateau are intermittent, and flow only after precipitation occurs. Other sources of water include springs which are most common in the mountainous areas, especially at the toe of boulder fields and at the edge of gravel benches, and tanks--the natural water pockets formed in sandstone outcrops. Subsurface water bearing strata have been located in a few places, but the quantity and quality of ground water is certain throughout much of the area (Hunt 1974).

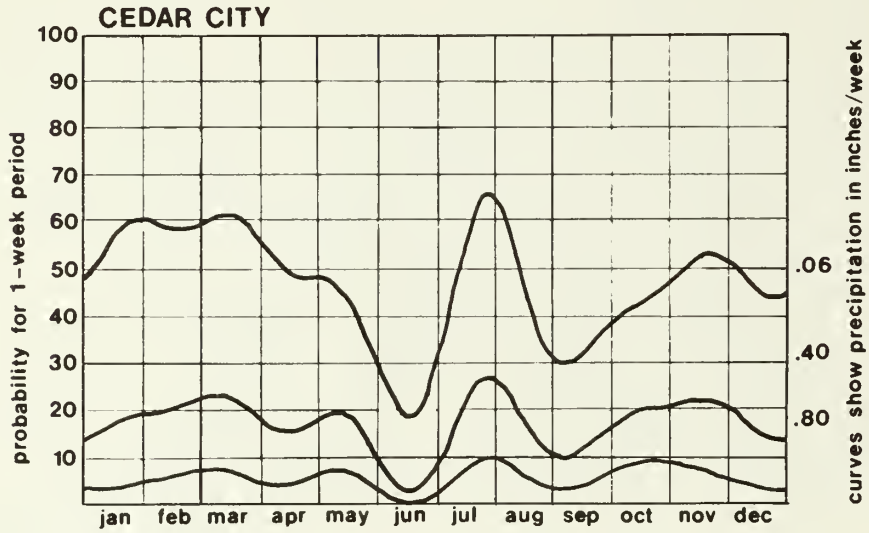
CLIMATE

Although a variety of studies concerned with the weather and climate of the region have been produced, detailed investigations have been limited by the sparse network of meteorological stations in the area. Most of the following information concerning the various climatic parameters are taken from the various maps and charts produced by the Utah Water and Power Board, and from the Hydrologic Atlas of Utah (Jeppson, et al, 1968).

The Canyonlands Section of the study area is quite dry and has a potential evapotranspiration rate far in excess of average annual precipitation. Moving westward across the study area, elevation increases, the amount of precipitation increases, the amount of evaporation decreases, and the climate becomes more humid and capable of supporting greater amounts of vegetation. Precipitation amounts vary from about six inches (152 mm.) annually at lower elevations around the Colorado River, to about forty inches (1,016 mm.) at higher elevations in the west. About one-half of the area receives less than sixteen inches (407 mm.) of precipitation per year.

The seasonality of precipitation is apparent, and generally over half, or about sixty percent, falls during the winter, between the months of October and April. The Plateaus Section experiences three maximums of precipitation resulting from frontal systems during March, convectional thunderstorms during August, and low-pressure loft activity in October. The Canyonlands Section also receives three peaks of precipitation. In the summer, this is a result of thunderstorm activity with a secondary peak occuring in October, and a minor winter frontal maximum which merges with the activity loft resulting in another peak during May (Jeppson, et al, 1966). This seasonality is illustrated by graphs of precipitation at four stations in or near the study area (see Figure 1-6).

PRECIPITATION PROBABILITIES IN SOUTHERN UTAH



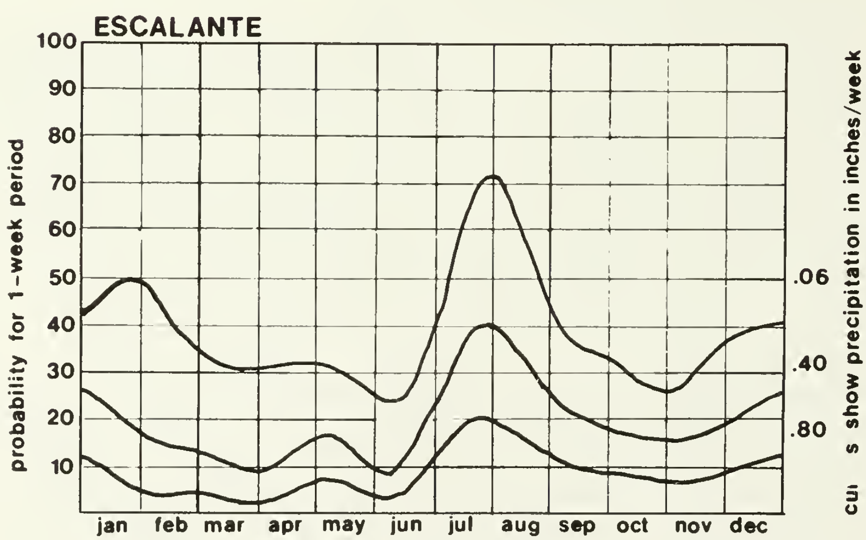
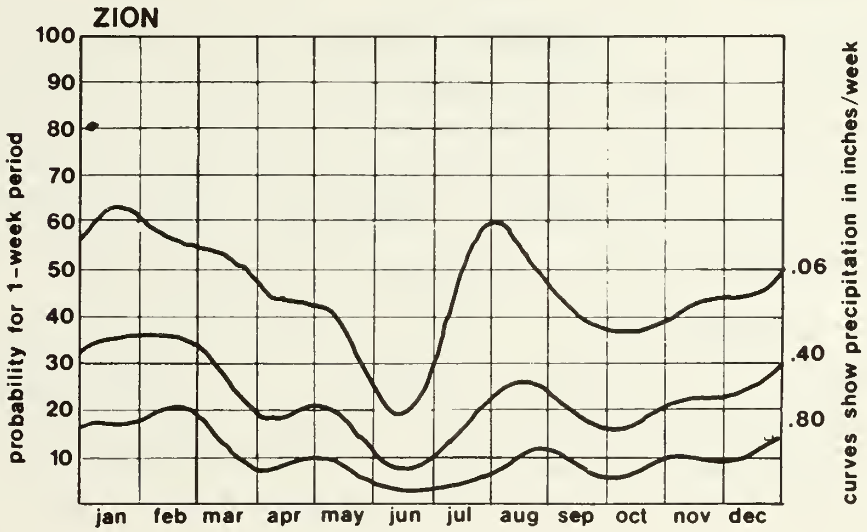


FIGURE 1-6

After Jeppson etal. 1968

PRECIPITATION PROBABILITIES IN SOUTHERN UTAH



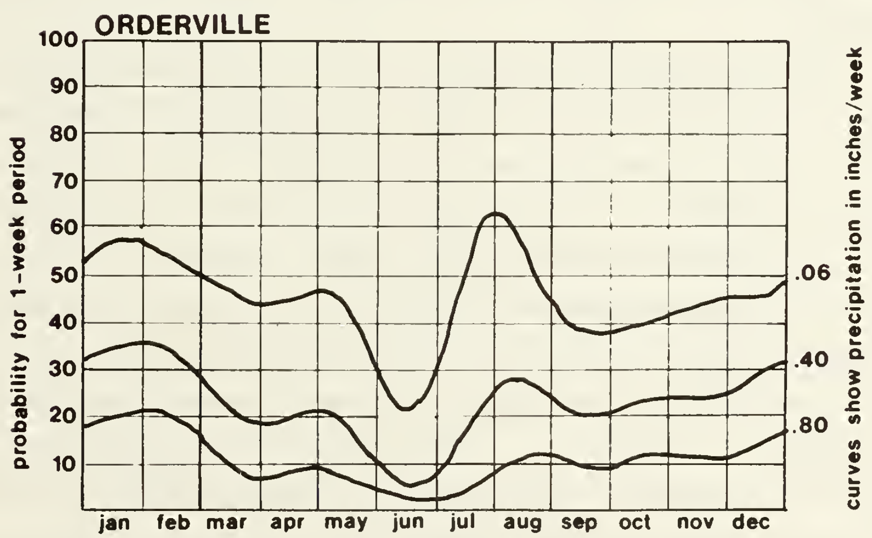


FIGURE 1-6(continued)

Unlike precipitation, the available heat energy in the area is distributed inversely with elevation. The maximum potential evapotranspiration of 36 inches (813 mm.) or more occurs in the southeast along the Colorado River and the minimum evapotranspiration of 18 inches (457 mm.) or less occurs at higher elevations in the west. Approximately one-half of the area has potential evapotranspiration rates above 20 inches (508 mm.) annually. The association of air temperatures with this pattern is quite clear. The mean maximum temperature for July is 100°F. (30°C.) in the southeast at the lowest elevations, and 72°F. (22°C.) at higher elevations in the west. During January, the mean minimum temperatures at the higher elevations are 6°F. (-15°C.) and 20°F. (-6°C.) at the lowest elevations (see Table 1-2).

The maximum freeze-free period expressed as the number of days annually without temperatures below 32°F. (0°C.) ranges from 200 days in the southeast to 20 days in the west. Most of the area has between 100 and 200 days without freezing temperatures each year (Jeppson, et al, 1968).

An important phenomenon often associated with atmospheric conditions is wildfire occurrence in natural vegetation. Wildfires are actually quite rare in the Canyonlands Section of the study area, due to the scarsity of fuels. At higher elevations in the plateaus to the west, there are approximately 100 fires reported annually. Most of these fires are started by lightning, mainly during the summer months at the times of thunderstorm activity (Forest Service, 1977). Because of the scarcity of fuels, it seems likely that people living on the Colorado Plateau would have made very small use of fire, except in the more mountainous areas.

Location	Mean Maximum January	Mean Maximum July	Mean Minimum January	Mean Minimum July
Lower elevations in the east	44^{o}	100^{o}	20^{o}	68^{o}
Higher elevations in the west	28^{o}	72^{o}	6^{o}	44^{o}

Table 1-2 Ranges of mean air temperature in the study area[1]

[1]Data from the Hydrologic Atlas of Utah (1969)

SOILS

Little detailed soil information is available for most of the study area. No soil surveys have been published, and only in the High Plateau Section are surveys in progress (Wilson, et al, 1975). The comments on soils provided in this report are based largely on the small-scale soil map of Utah, produced by the Soil Conservation Service and the Utah Agricultural Experiment Station (1975), and the accompanying guide book (Wilson, et al, 1975).

Much of the southeastern part of the study area has no soil or has shallow dry soils with frequent rock outcrops. In contrast, there are large areas of cool, moist mountain soils in the western part of the study area. Because of the great environmental variations, a large variety of soils are present, and 40 of the 71 soil associations and land types occurring in the state of Utah are present in the study area. The major soil associations and land types are shown in Figure 1-7 and are listed in Table 1-3.

The sandy soils found in the eastern part of the area are often very erodible, and the sediment yields from the soils range from one-half to one acre-feet per square mile per year. In most of the northwestern part of the area, the annual sediment yield is less than .5 acre-feet per square mile per year (Wilson, et al, 1975:58). Critical wind erosion occurs only in limited areas in the Canyonlands Section.

The agricultural potential of the entire study area is quite low. The aridity, high temperatures, lack of irrigation water in the east, and the cool temperatures and shorter growing season in the west have prevented extensive farming. Livestock grazing occurs throughout the study area, but is more important in the west,

SOUTHERN COAL SOIL TYPES

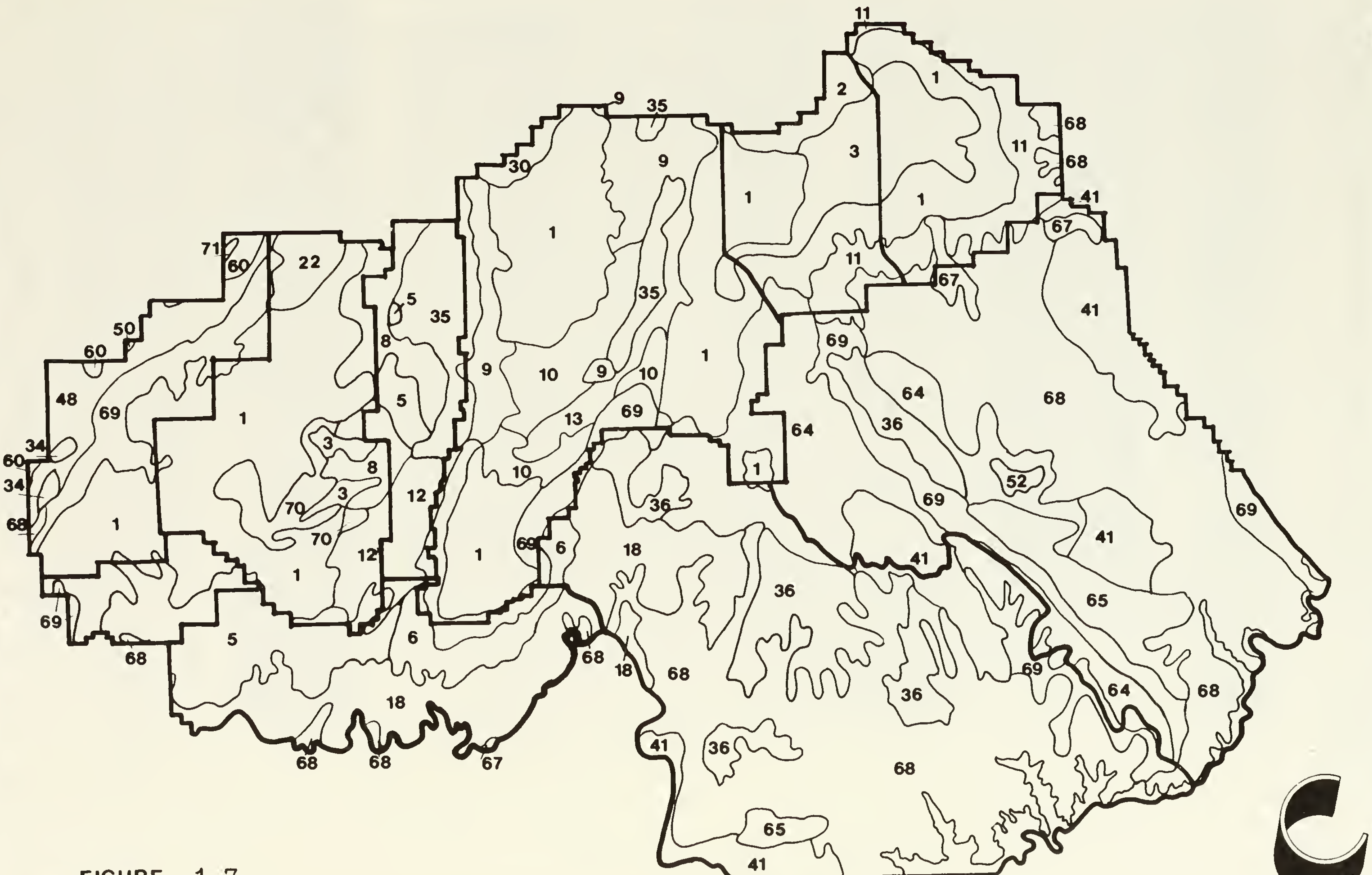


FIGURE 1-7

After Wilson etal. 1975

Table 1-3 Soil associations[1] of the study area[2]

Dark and light-colored soils of the high mountains that are usually moist have an AAP 1/ of 45-100 CM (18-40 in.) and MSST 2/ of less than 15°C (59°F)

1. Argic Cryoborolls-Pachic Cryoborolls-Cryic Paleborolls association
3. Lithic Cryoborolls-Mollic Cryoboralfs-Rock Outcrop association
4. Typic Cryorthents-Typic Cryochrepts-Mollic Cryoboralfs association

Dominantly dark-colored soils of the mountains and plateaus that are usually moist in some parts during the summer, have an AAP of 35-55 CM (14-22 in.) a mast 3/ of less than 8°C (47°F) and a MSST of more than 15°C (59°F)

5. Typic Argiborolls-Lithic Argiborolls-Typic Haploborolls association
6. Typic Argiborolls-Typic Ustorthents association
8. Lithic Argiborolls-Typic Argiborolls association
9. Lithic Argiborolls-Rock Outcrop-Typic Argiborolls association
10. Typic Haploborolls-Typic Argiborolls-Typic Calciborolls association
11. Lithic Haploborolls-Lithic Argiborolls-Typic Haploborolls association
12. Lithic Haploborolls-Lithic Calciborolls association
13. Typic Ustochrepts-Cumulic Haploborolls association

Dominantly dark-colored soils of the upland plains and terraces that are usually moist in some parts during the summer, have an AAP of 30-35 CM (12-14 in.) a MAST of 8-15°C (47-59°F) and a MSST of more than 15°C (59°F)

18. Aridic Argiustolls-Typic Argiustolls associations

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[1]Numbers refer to the map in Figure 1-5.

[2]After Wilson et al, 1975.

Table 1-3 Soil associations of the study area--Continued

Dominantly dark-colored soils of the mountains, plateaus, and mountain valleys that are usually dry during the summer, and have an AAP of 35-55 CM (14-22 in.), a MAST of less than 8°C (47°F) and a MSST of more than 15°C (59°F)

22. Typic Argixerolls-Typic Haploxerolls association

Dominantly dark-colored soils of the mountains and plateaus that are usually dry during the summer, have an AAP of 30-35 CM (12-14 in.), and have a MAST of less than 8°C (47°F) and a MSST of more than 15°C (59°F)

30. Lithic Argixerolls-Aridic Haploxerolls-Aridic Calcixerolls association

Dominantly dark-colored soils of alluvial fans, terraces and hills that are usually dry during the summer, have an AAP of 30-35 CM (12-14 in.) and have a MAST of 8-15°C (47-59°F) and a MSST of more than 15°C (59°F)

34. Aridic Calcixerolls-Xerollic Calciorthids association

Dominantly light-colored soils of the valleys, terraces and fans that are usually dry, but are moist in some parts during the summer, have an AAP of 20-35 CM (8-14 in.) a MAST of less than 8°C (47°F), and a MSST of more than 15°C (59°F)

35. Ustollic Torrifluvents-Borollic Calciorthids association

Dominantly light-colored soils of the valleys, terraces, and mesas that are usually dry but are moist in some parts during the summer, have an AAP of 20-35 CM (8-14 in.), a MAST of 8-15°C (47-59°F) and a MSST of more than 15°C (59°F)

36. Ustic Torrifluvents-Ustic Torriorthents association
41. Lithic Ustollic Calciorthids-Lithic Ustic Torriorthents association

Table 1-3 Soil associations of the study area--Continued

Dominantly light-colored soils of the desert mountains, valleys, terraces and fans that are usually dry have an AAP of 20-35 CM (8-14 in.) a MAST of 8-15^{o}C (47-59^{o}F) and a MSST of more than 15^{o}C (59^{o}F)

48. Xeric Torrifluvents-Xerollic Calciorthids association

Sodic-saline soils on valley bottoms and flood plains

60. Typic Natrargids-Xerollic Natrargrids-Typic Calciorthids association

Highly erodible soils

64. Ustic Torriorthents (shallow)-Rock Outcrop association

Dominantly sandy soils

65. Typic Torripsamments-Typic Torriorthents association
67. Ustic Torripsamments association

Miscellaneous land types

68. Rock land
69. Badland-Rock land association
70. Rock land of the High Mountains

1/ AAP = Average Annual Precipitation

2/ MSST = Mean Summer Soil Temperature

3/ MAST = Mean Annual Soil Temperature

particularly in the summer. Grazing is sparse in the Canyonlands Section. Commercial forests occur in the west in the Dixie National Forest. Principal species are: Ponderosa pine, fir, and spruce (Choate 1965). Pinyon-juniper woodland covers most of the area, particularly in the west, but is of very low commercial value.

BIOLOGY

Although a variety of studies of the plant and animals found within the study area have been conducted, the fact remains that relatively little is certain concerning the ecological life-histories of any of the individual species, or the synecological community relationships that occur. For example, the blackbrush community, which is fairly extensive, is one of the least studied of the major plant communities in the state of Utah. Regionalization of the study area, on the basis of plant species present, places it in the Great Basin Floristic Province (Gleason & Cronquist 1964) and on the basis of both plants and animals, in the Artemesian Biotic Province (Dice 1943). Faunal subdivisions of the study area based on mammals include the southern High Plateaus' sub-center, which is spatially coincidental in the study area with the High Plateaus, and the Kaiparowits sub-center, which includes the Canyonlands Section of the study area (Durant 1952). Similarly, the Floristic Sections of the study area are nearly coincident, both in name and area, with the physiographic section. The only difference is that the western portion is referred to floristically as the Utah Plateaus rather than the High Plateaus (Cronquist, et al, 1972). General descriptions of the plant communities occurring in the area are provided by Cronquist and his colleagues (1972) and by Foster (1968). Reasonably detailed maps of the vegetation are available from Foster (1968) and the Bureau of Land Management (anon., n.d.).

Flora

Because of relatively few gaps in the mountains surrounding the Canyonlands, the area is particularly rich in endemic plant species (Cronquist, et al, 1972:103). Cronquist and his colleagues provide a list of 69 species of endemic plants, many of which are thought to have evolved in place rather than immigrating and dying off elsewhere. The flora of this section is generally similar to that of the rest of the Intermountain Region, but some differences occur due to the isolation mentioned above and to the abundance of blackbrush in the area which exceeds its occurrence in the remainder of the province.

The Utah Plateau Section is second in the number of endemic species only to the Canyonlands Section of the Great Basin Floristic Province. Cronquist and colleagues list 39 species, the genera of many being the same as those of the Canyonlands. Many similarities also exist between this area and the flora of the Rocky Mountains of Colorado.

Vegetation

Sequential altitudinal zonation of the vegetation in the study area occurs, although it is not clearly visible in any one location. Cronquist, et al, (1972: 109-159) provide a detailed discussion of the zones occuring in the region. Their zones are based primarily on the definitions provided by Billings (1951). Those occuring in the study area include the Shadscale Zone, the Sagebrush Zone, the Pinyon and Juniper Zone, and the Mountain Zones. As will become obvious in the individual planning unit descriptions, the Shadscale Zone occurs in valleys and lower elevations, and is generally surrounded by the Sagebrush Zone in upper valleys and lower foothills, with pinyon-juniper and sometimes mountain brush in the foothills

FIGURE 1-8 Desert Shrub Zone in Kane County

FIGURE 1-9 Desert Shrub Zone in Kane County

FIGURE 1-10 Desert Shrub Zone in Kane County

FIGURE 1-11 Transitional Desert Shrub and Pinyon-Juniper Zone in Garfield County

above the sagebrush. The Mountain Zones include the coniferous forests and aspen forests at higher elevations. Cronquist (et al, 1972) discusses 23 plant communities and associations occurring in these zones. The occurrence of individual communities in the study area, however, is more clearly indicated in the study by Foster (1968) and by his accompanying map.

With increasing elevation in the study area, the plant communities encountered would be likely to occur in the following sequence: (1) greasewood, (2) blackbrush, (3) shadscale, (4) galleta grass, (5) ephedra, (6) rice grass, (7) rabbitbrush, (8) sand dropseed, (9) sagebrush, (10) pinyon-juniper, (11) ponderosa pine-bearberry, (12) mountain brush, (13) white fir, (14) aspen, (15) Douglas Fir-blue spruce, (16) alpine fir-Englemann spruce, and (17) grass-shrub communities in alpine areas. This transition is paralleled by one from fine dry alkaline soil to coarse, moist acidic soils. Variations of these communities occur and are discussed in the planning unit descriptions later in the report. The dominant and most common species of each community are listed below with a brief comment on representative locations within the study area. The "ecozone" (CCP) into which each community may be placed is also indicated. A list of scientific names corresponding to the common names used here is given in Table 1-4.

Greasewood Community: (Desert Shrub Ecozone) Greasewood, the dominant plant in this community, is a phreatophytic deciduous shrub capable of growing in fairly saline soils. Common associates of greasewood include seepweed, saltgrass, pickleweed, and foxtail barley. The major distribution in the study area is along the Escalante River.

Blackbrush Community: (Desert Shrub Ecozone) Blackbrush, the dominant plant in this community, derives its name from its charcoal gray coloring which tends to

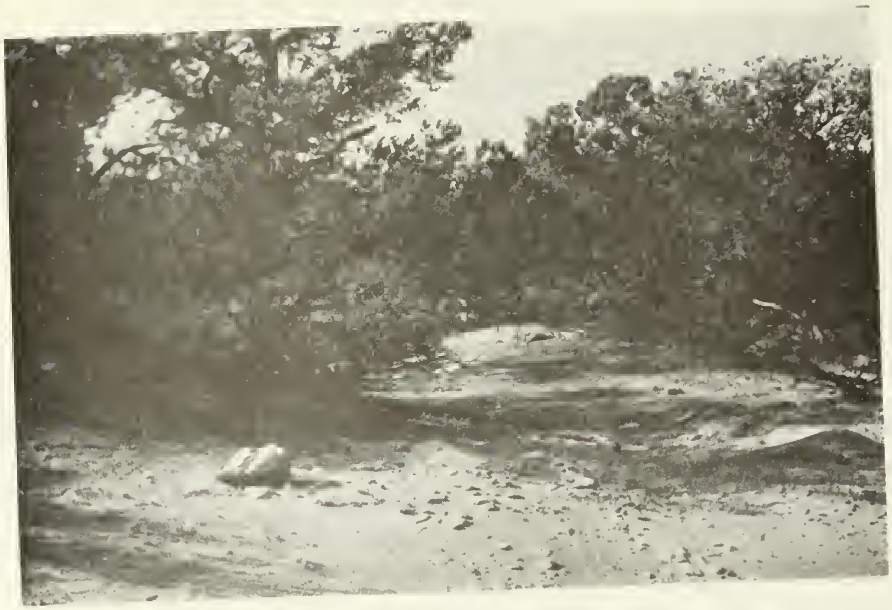


FIGURE 1-12 Pinyon-Juniper Zone in Garfield County

FIGURE 1-13 Mountain Zone in Garfield County

Table 1-4 Common and scientific names of plants

Common	Scientific	Common	Scientific
alpine fir	*Abies lasiocarpa*	Indian rice grass	*Oryzopsis hymenoides*
Arctostaphylos	*Abies lasiocarpa*	juniper	*Juniperus* spp.
aspen	*Populus tremuloides*	lumber pine	*Pinus flexilis*
bearberry	*Arctostaphylos uva-ursi*	little rabbitbrush	*Chrysothamnus stenophyllus* and *C. viscidiflorus*
big rabbitbrush	*Chrysothamnus* naus *nauseosus*	*Mahonia repens*	none
bigtooth maple	*Acer grandidentatum*	Mormon tea	*Ephedra viridis*
bitterbrush	*Purshia tridentata*	mountain mahogany	*Cercocarpus ledifolius*, *C. intricatus*, and *C. montanus*
blackbrush	*Coleogyne ramosissima*	needlegrass	*Stipa comata*
black sagebrush	*Artemisia nova*	Oregon grape	*Mahonia repens*
blue grama	*Bouteloua gracilis*	pickleweed	*Allenrolfea occidentalis*
blue spruce	*Picea pungens*	pinyon	*Pinus* spp.
bristlecone pine	*Pinus aristata*	ponderosa pine	*Pinus ponderosa*
buckbrush	*Ceanothus greggii*	prickly pear	*Opuntia* spp.

Table 1-4 Common and scientific names of plants--Continued

Common	Scientific	Common	Scientific
budsage	Artemesia spinescens	rabbitbrush	Chrysthamnus spp.
buffaloberry	Shepherdia rotundifolia	ricegrass	Oryzposis hymenoides
Ceonothus velutinus	none	Rocky Mountain juniper	Juniperus scopulorum
cheatgrass	Bromus tectorum	Russian thistle	Salsola kali
chokecherry	Prunus virginiana	sagebrush	Artemisia tridentata
cliffrose	Cowania mexicana	saltgrass	Distichlis stricta
common juniper	Juniperus communis	sand dropseed	Sporobolus cryptandrus
Douglas fir	Pseudotsuga taxifolia	Sandburg bluegrass	Poa secunda
Englemann spruce	Picea engelmanni	sedge	Carex spp.
Ephedra	Ephedra viridis	seepweed	Suaeda torreyana and S. fruiticosa
fescue	Festuca spp.	serviceberry	Amelanchier utahensis and A. alnifolia
fourwing saltbush	Atriplex canescens	shadscale	Atriplex confertifolia
foxtail barley	Hordeum jubatum	shrub live oak	Quercus turbinella

Table 1-4 Common and scientific names of plants--Continued

Common	Scientific	Common	Scientific
Fremont mahonia	Mahonia fremontii	singleleaf ash	Fraxinus anomala
galleta grass	Hilaria jamesii	singleleaf pinyon	Pinus monophylla
Gambel oak	Quercus gambelii	snakeweed	Guiterrezia sarothrae
grama grass	Bouteloua spp.	snowberry	Symphoricarpos vaccinioides
gray molly	Kochia vestita	squawbush	Rhus trilobata
greasewood	Sarcobatus vermiculatus	squirreltail	Sitanion hystrix
greenleaf manzanita	Arctostaphlos patula	Utah juniper	Juniperus osteosperma
Halogeton	Halogeton glomeratus	western wheatgrass	Agropyron smithii
honeysuckle	Lonicera spp.	wheatgrass	Agropyron spp.
hopsage	Grayia spinosa	white fir	Abies concolor
horsebrush	Tetradymia spinosa and T. glabrata	winterfat	Eurotia (Ceretoides) lanata

color the landscape where this low shrub is abundant. Other species occurring with blackbrush include: Mormon tea, hopsage, Indian rice grass, galleta grass, little rabbitbrush, and shadscale. In the study area, the community is found primarily along the Colorado River in the southeast, growing on sandy soils.

Shadscale Community: (Desert Shrub Ecozone) This community, dominated by the small shrub shadscale, is the most extensive of the salt bush dominated communities in Utah. Associated species in the study area include: blackbrush, Indian rice grass, and galleta grass. Other species sometimes found in shadscale are grey molly, budsage, four-wing salt bush, Halogeton, Mormon tea, squirrel tail, horsebrush, and winterfat. The community is found within the Canyonlands Section of the study area.

Galleta Grass Community: (Desert Shrub Ecozone) Although often growing in pure stands, galleta is sometimes associated with shadscale, prickly pear, and rabbitbrush. It occurs in the study area with sand dropseed in a limited area in the southeast in the central part of the Escalante River Planning Unit.

Mormon Tea Community: (Desert Shrub Ecozone) Mormon tea is commonly associated with the blackbrush community where sandy soils are common. There are no large areas in the study area which it dominates.

Indian Rice Grass Community: (Desert Shrub Ecozone) This community occurs in the study area only in the central part of the Escalante River Planning Unit, where it is accompanied by dropseed. Indian rice grass is one of the more important desert grasses in Utah.

Rabbitbrush Community: (Desert Shrub Ecozone) Rabbitbrush occurs as a sub-dominant in the study area and is most common in the southern part of the Paria Planning Unit.

Sand Dropseed Grass Community: (Desert Shrub Ecozone) Sand dropseed does not occur as a major dominant in the study area. It is a sub-dominant species in the two areas of desert grasses found in the Escalante River Planning Unit.

Sagebrush Community: (Big Sagebrush Ecozone) Sagebrush dominated communities are uncommon in the Canyonlands Section of the study area. They occur mainly along the Paria River and Johnson Wash in the south and on the east fork of the Virgin River farther west. In the Plateau Section, major communities are located above the Hurricane Cliffs in the west, and in the Garfield Planning Unit along the Sevier River in the north. Common associates include: black sagebrush, needle grass, big rabbitbrush, sand dropseed, blue grama grass, cheat grass, Russian thistle, snakeweed, little rabbitbrush, shadscale, winterfat, western wheatgrass, and Indian rice grass.

Pinyon-juniper Community: (Pinyon-juniper Ecozone) This is the most extensive community in the study area, and covers much of the southern and southeast portions. Utah juniper is the dominant tree with true pinyon being next in importance, except for small areas in the Cedar Planning Unit, where single-leaf pinyon becomes important. Hybrids of the two pinyons are common. Associated species include: Rocky Mountain juniper in moist habitats and buffalo berry throughout the area. Single-leaf ash, Fremont mahonia, mountain mahogany, Gamble oak, bitterbrush, cliffrose, and serviceberry are present, but are generally more characteristic of the mountain brush communities. Bluebrush wheatgrass, needle-grass, Sandburg bluegrass, and cheat grass also occur, but are more common to the sagebrush communities.

Ponderosa Pine Community: (Ponderosa Pine Ecozone) Ponderosa pine occurs in the northeastern section of the study area, in the central section between the Sevier and Paunsaugunt Plateaus, and in the southwest. Common associated species are: greenleaf manzanita, and other mountain shrubs, such as bitterbrush and service-berry.

Mountain Brush Community: (Mountain Brush Ecozone) This community occurs in the southwestern part of the study area, in the West Zion Planning Unit and the west side of the Zion Planning Unit. It also occurs in the north along the west side of the Sevier Plateau and in the northeast in the southern portion of the Boulder Planning Unit. Common dominants and associates include: Gamble oak, shrub live oak, bigtooth maple, mountain mahogany, cliffrose, bitterbrush, serviceberry, buckbrush, chokecherry, and snowberry.

White Fir Community: (Spruce, Fir, Douglas fir, Aspen Ecozone) White fir occurs only as the dominant species in the southwestern part of the study area. It is a co-dominant on the Markagunt Plateau and occurs as a sub-dominant species elsewhere in the Plateaus Section. Most of the coniferous species in the mountains occur in this community.

Aspen Community: (Spruce, Fir, Douglas fir, Aspen Ecozone) Aspen is the dominant species in the western part of the study area near Cedar Breaks National Monument, and on the Markagunt Plateau. It also dominates a sizeable area in the Escalante Mountains to the north, and is co-dominant with several grass species in the Boulder Planning Unit. Aspen is common throughout the High Plateaus and is often mixed with stands of Douglas fir, white fir, and blue spruce. Understory species often include sagebrush, bluegrass, Oregon grape, and Mahonia repens.

Spruce-Fir Community: (Spruce, Fir, Douglas fir, Aspen Ecozone) At lower elevations, 7,000 to 9,000 feet (2,134-2,743m.), this community is dominated by white fir, blue spruce, and Douglas fir, and at higher elevations by alpine fir and Englemann spruce. Douglas fir is dominant on the Sevier Plateau, and is co-dominant with blue spruce on the southern Paunsaugunt Plateau. Alpine fir and Englemann spruce dominate on the Markagunt Plateau, and

Englemann spruce, without alpine fir, is dominant on the northern Sevier Plateau. Other species of this community are: common juniper, _Ceonothus velutinus_, limber pine, and bristlecone pine.

Grass-Shrub Community: (Mountain Meadow Ecozone) The largest areas of this community in the study area are in the northeast in the Aquarius and Boulder Planning Units. Dominant species include: wheatgrass, bluegrass, needle-grass, and sedges. Fescue occurs as a sub-dominant. Large areas dominated by grama grass occur just to the north, outside the study area.

Planning Units

CEDAR

Location

The Cedar Planning Unit (Bureau of Land Management) consists of 70,000 acres (28,350 ha.) and is located in the northwest part of the study area, in the eastern end of Iron County. Cedar City is located in the central-western portion of the unit, and the city of Parowan is located in the northern portion of the unit. The Cedar Mountains run from southwest to northeast at the south end of the unit and the Hurricane Cliffs run from southwest to northeast in the north. The eastern boundary of the unit is formed by the Dixie National Forest boundary and the western boundary of the unit moves through Parowan Valley in the north and Cedar Valley in the south. Access is excellent with a major highway, Interstate 15, running northeast through the western portion of the area, and two State Highways, #14 and #143, running eastward, out of the unit.

Geomorphology

This unit lies largely in the High Plateau Section of the Colorado Plateau Physiographic Province. The western edge, however, extends into the Bonneville Basin Section of the Basin and Range Province. The elevation of this unit is generally quite high, ranging from 10,023 feet (3,053 m.) at Pine Spring Knoll to about 5,400 feet (1,646 m.) northwest of Cedar City in Cedar Valley. The Kanarra Mountains are located in the southern portion of the unit, and reach an elevation of 9,084 feet (2,769 m.). The Cedar Mountains, running northeast, are generally at an elevation of about 9,000 feet (2,743 m.). The area is bisected by Cedar Canyon, running southeast from Cedar City. The Hurricane Cliffs are a dominant feature in the northern portion of the area, rising abruptly from the basin to the northwest and reaching elevations of 9,000 feet (2,743 m.) or more.

Geology and Hydrology

The dominant rock exposures in the Cedar Planning Unit are those of the Upper Cretaceous age, Mesa Verde Group. Included are the Price River and Blackhawk Formations and Castlegate and Star Point Sandstones. Next in importance as a surficial type is the Quaternary valley alluvium in Cedar and Parowan valleys in the western portion of the unit. Tertiary volcanics are common in the central portion, and in the north the Cedar Breaks Formation occurs in the highly faulted zone along the Hurricane Cliffs. In the southern portion of the unit, limited exposures of Quarternary basalt, the Jurassic age Carmel Formation, and the Triassic age Moenave Formations are found in the Cedar Mountains. Normal faulting is very common throughout the central and northern portions of the unit.

Drainage is mostly to the west into the Great Basin Hydrographic Province. The main flow is Coal Creek through Cedar Canyon in the central part of the unit, and in Parowan Creek down Main Canyon in the north. A limited area to the south drains southerly toward the Colorado River.

Climate

The climate of the unit is quite variable, especially in terms of amounts of precipitation. The range in precipitation is from about nine inches (228 mm.) in the west to thirty inches (762 mm.) at higher elevations in the east. The potential evapotranspiration exceeds the precipitation over much of the area ranging from eighteen inches (457 mm.) annually in the east to thirty inches (762 mm.) annually in the west. The mean maximum July temperatures in the Cedar Planning Unit reach 78°F. (23°C.) in the eastern part of the unit and 88°F. (31°C.) in the west. the mean minimum July temperature ranges from 48°F. (9°C.) in the east above the Hurricane Cliffs to 56°F. (14°C.) in the valleys to the west. The winter temperatures are quite cool in this area with mean minimum January temperatures dropping to 8°F. (-13°C.) in the southeast and being only slightly higher, or 12°F. (-10°C.) elsewhere. The freeze-free season is relatively short throughout the unit reaching a maximum of 120 days in the western valleys and dropping to 40 days at higher elevations in the east.

Soils

The dominant soils in the planning unit are found at higher elevations to the east and are typical of the dark and light colored soils of the high mountains throughout Utah. These soils are usually moist and have relatively low temperatures. They are representative of soil association one from Table 1-3, Soils of the Study Area. Limited areas of association number 69, the Badlands-Rockland Association occur in the central part of the unit, and limited areas of association number 68, the Rockland Type is found in limited areas in the south. Soil association number 48 is dominant in the valleys to the west, and association number 34 occurs in two small areas west of Cedar City (see Figure 1-7).

Vegetation

Fairly large areas of cultivated land occur at lower elevations in the western valleys. These are surrounded by a belt of sagebrush in the higher valleys and lower foothills, and above this, at slightly higher elevations, is found the pinyon-juniper community in which both species of pinyon, single-leaf and true pinyon, are present with Utah juniper. Above, and somewhat intermixed with the pinyon-juniper, is the zone dominated by Gambel oak, mixed with communities dominated by mountain mahogany. At higher elevations, Englemann spruce and alpine fir communities are intermixed with fairly large stands of aspen. Numerous other coniferous trees and shrub species are present in these communities.

GARFIELD

Location

The Garfield Planning Unit (Bureau of Land Management) consists of about 90,000 acres (39,690 ha.), and is located in the central-western portion of the study area in Garfield County, Utah. This unit consists of a high valley bordered on the east and west by Dixie National Forest boundaries. The unit is elongated north and south, and is no more than about fifteen miles (24 km.) in width. Panguitch, Utah is located in the north-central part of the unit, and Hatch, Utah is in the south-central. Access is excellent, with U.S. Highway 89 going north and south through the entire area. Between Hatch and Panguitch, State Highway 12 leaves Highway 89 and heads eastward out of the planning unit.

Geomorphology

The area consists almost entirely of a high elevation valley which separates the Markagunt Plateau on the west from the Paunsaugunt and Sevier Plateaus to the east. Elevations in the planning unit range from 6,400 feet (1,951 m.) in the north to about 8,200 feet (2,499 m.) in the west

Geology and Hydrology

The major surface material is Quaternary alluvium occuring mainly in the north. Next in importance is an extensive exposure of Tertiary age Cedar Breaks Formation occurring in the southern third of the unit. In the west-central portion, there may be found representative materials of the Tertiary Muddy Creek Formation and the Mesa Verde Group. Also in this area, extensive outcrops of Quaternary Basalt are present. Some normal faulting occurs in the center of the unit. The Sevier River runs north through the area carrying surplus water to the Great Basin.

Climate and Soils

The climate of this planning unit is dry and cool. The maximum precipitation is 20 inches (508 mm.) in the higher southeastern corner, and the minimum precipitation falls below 10 inches (254 mm.) in the central valley area. This is contrasted with a potential evapotranspiration of 18 inches (457 mm.) in limited areas in the west, ranging to 24 inches (610 mm.) in the north. The mean maximum July temperature ranges from 84°F. (28°C.)

in the northwest to 80°F. (26°C.) in the south. The mean minimum July temperatures range from 44°F. (7°C.) in the north, to 48°F. (9°C.) in the south. This anomalous situation with the central part of the valley being cooler is probably due to night time air drainage. The mean minimum January temperature in the unit ranges from 8°F. (-13°C.) in the south to 6°F. (-14°C.) in the southeast, and is about 8°F. (-13°C.) over most of the area. The freeze-free season, or number of days between occurrences of temperatures below 32°F. (0°C.) ranges from 80 in the north-central part of the area to 100 days in most of the rest of the unit.

The major soil association in this area is number 35 (see Table 1-3 and Figure 1-7), which is a normally light colored soil occurring in valleys and terraces. These soils are usually dry, but are moist during at least some parts of the summer. The darker and moister soil association numbers 5 and 8 occur in more limited areas in the western and southern portions of the unit.

Vegetation

The largest expanse of sagebrush in the study area occurs in this planning unit, primarily in the northern section of the valley. With increasing elevations to the east and to the west, pinyon-juniper becomes more important. Along the western and southern margins of the area, ponderosa pine and Utah juniper are dominant.

ESCALANTE RIVER

Location

The Escalante River Planning Unit (Bureau of Land Management) is 1,144,000 acres (463,323 ha.) in size and is located in Garfield, Wayne, and Kane Counties in the southeastern part of the study area. The only town is Escalante in the northwest corner of the unit. The Escalante River runs southeast from the center of the unit to the Colorado River, and is the major physical feature. The boundary line follows the Colorado River from just south of the Kaiparowits Plateau northeast until reaching Waterpocket Fold; then it turns northwest and follows the fold and the boundary of Capital Reef National Monument along the northeastern corner of the planning unit. Then the line turns west and follows the Dixie National Forest Boundary across the northwest and western limits of the area. On the southwest, the boundary moves across the Kaiparowits Plateau following the Straight Cliffs part of the way, and the cliffs on the northeast side of Fifty Mile Mountain the remainder of the distance to the Colorado River. Access is relatively limited; the only paved highway runs through the town of Escalante to the town of Boulder in the northern portion of the unit--a fairly short distance. There are a number of gravel and dirt roads in the area, but these are relatively few compared to some of the other units. The Glen Canyon National Recreation Area covers about the southern one-third of the unit.

Geomorphology

This unit is located in the Canyonlands Section of the Colorado Plateau. The elevation rises from about 4,000 feet (1,292 m.) in the southeast along the Colorado River to about 7,200 feet (2,207 m.) in the northwest above the rim of the Straight Cliffs. The major topographic features include the Kaiparowits Plateau in the west, the Straight Cliffs also in the west, and the Straight Cliffs and Fifty Mile Mountain on the southwestern border of the unit. In the central part of the unit is a large highly dissected plain through which runs the Escalante River to the Colorado River. The Circle Cliffs form the northeast boundary and Capital Reef National Monument and Waterpocket Fold are along the eastern boundary. The canyons developed throughout the unit are notable and include the Escalante in the south and the Colorado River in the southeast.

Geology and Hydrology

A large area of Jurassic and Triassic Sandstones of the Glen Canyon Group forms the main rock type of this planning unit. It parallels both sides of the Escalante River through the center of the unit, from the northwest to the southeast, and consists of Navajo Sandstone, Kayenta Sandstone, and Wingate Sandstone. The oldest material is found in the eastern sections of the exposure. Next in extent is the Straight Cliffs Formation atop the Kaiparowits Plateau, along the southwestern side of the unit. In the northeastern section of the unit, composing most of the Circle Cliffs Upwarp, is a Triassic exposure consisting mainly of Chinle and Moenkopi Formations, along with lesser quantities of Shinarump Conglomerate. In the central part of the upwarp occur limited exposures of Permian materials, the oldest exposed in the study area. Also occurring in limited quantities are Cretaceous Tropic Shale and the Brushy Basin member of the Morrison Formation along the Straight Cliffs, and extensive areas of Quarternary alluvium paralleling the cliffs on the east. Normal faulting is common in the Circle Cliffs Upwarp. The Escalante unit is drained mainly by the Escalante River which runs southeast through the center of the unit to the Colorado River.

Climate and Soils

The climate of this planning unit may be classified as true desert, in which the annual evapotranspiration rate always exceeds the annual precipitation rate over the entire area. The annual precipitation in the southeast along the Colorado River reaches about seven inches (178 mm.) annually and reaches about sixteen inches (407 mm.) in limited areas to the northeast. At least one-half of this planning unit receives less than ten inches (254 mm.) of precipitation per year. In contrast, the evaporation rate reaches thirty-eight inches (865 mm.) in the southeast along the Colorado River, and drops only to twenty inches (508 mm.) in very limited areas in the north. The mean maximum July temperatures range from 84°F. (28°C.) in the northwest to 96°F. (36°C.) in the southeast. The mean minimum July temperatures range from 50°F. (10°C.) in the northwest to 66°F. (19°C.) in the southeast. The mean minimum January temperatures range from 20°F. (-6°C.) in the southeast quarter of the area and reach a minimum of 8°F. (-13°C.) in the extreme northwestern corner. Three-fourths of the area has a mean minimum January temperature above 16°F. (-8°C.). The freeze-free period ranges from 200 days along the Colorado River in the southeast to 120 days in the northwest.

The poorest soil development found in the study area occurs in this planning unit. The dominant surface material is the Rockland type, number 68 (see Table 1-3 and Figure 1-7), which occurs throughout the central portion of the area paralleling the Escalante River drainage. Other important soil associations include number 41 in the northeast around the Circle Cliffs Upwarp, and also occur in the south-central part of the area, and in the west on the Kaiparowits Plateau. Association numbers 64 and 69 occur along the Straight Cliffs in the west, and number 36 occurs in a small area just south of the town of Escalante. Number 65 is present in the south-central portion of the area, and number 67 occurs in a small area in the north, near the border of the planning unit.

Vegetation

Blackbrush is the dominant plant species at low elevations in the southeast along the Colorado River. Sub-dominant plants in this community include shadscale, Indian rice grass, and sand dropseed. In some of the higher elevations toward the west is a fairly large area dominated by shadscale. This is a typical shadscale community with salt grass and greasewood both present, along with several species of drought tolerant grasses. Surrounding this area is an extensive pinyon-juniper community, with no sagebrush community present between the two. The pinyon-juniper is dominated by Utah juniper and true pinyon, and forms a horseshoe open to the southeast surrounding the shadscale community. There are two small areas dominated by grasses in the shadscale community near the center of the unit. The first of these is dominated by wheatgrass, with sand dropseed as a sub-dominant, and the second is dominated by Indian rice grass, with sand dropseed again as the major sub-dominant. Greasewood communities occur primarily along the Escalante River.

PARIA

Location

The Paria Planning Unit (Bureau of Land Management) is roughly the same size as the Escalante River Unit, and is also located in the southeastern portion of the study area, primarily in Kane County, with an extension north into Garfield County. The Escalante River Unit forms the northeastern boundary of the Paria Unit. The major towns include Tropic and Henryville in the north. The Paria River flows from the southwestern corner of the unit, and the Kaiparowits Plateau, the second major topographic feature, is located to the east. The boundary line in the south follows the Utah-Arizona border east until it reaches the Colorado River, then moves northeast about twenty miles along the river until it reaches the western portion of the Escalante Unit. Then it moves northwest along the Fifty Mile Mountains, swinging across the edge of the Straight Cliffs and continues north across the Kaiparowits Plateau, finally reaching the southern boundary of the Dixie National Forest before it heads west, then southwest along the forest border. The line then moves southeast along the Paria River and then south to Kaibab Gulch, following which it returns to the southern boundary of the unit.

Access is somewhat better in this unit than in the Escalante River Unit, but is still quite limited. State Highway 12 enters the area near Tropic and travels about thirty miles, leaving the unit in the northeastern corner. In the south, U.S. Highway 89 enters the unit on the Arizona border and moves northwest, leaving the unit after about thirty miles heading westward. There are unimproved roads throughout the area, but travel is limited, especially in an east-west direction, due to the rough terrain.

Geomorphology

This unit is located in the Canyonlands Section of the Colorado Plateau. Elevational extremes are from 4,000 feet (1,219 m.) in the southeast along the Colorado River, to 8,620 feet (2,627 m.) on the northern border near the boundary of the Paunsaugunt-Sevier Unit. The major topographic features include the East Kaibab Monocline and Cockscomb Ridge running north across the western-central part of the area, and the Kaiparowits

Plateau in the northeast. Fifty Mile Mountain is found in the eastern part of the area, Smokey Mountain is located in the southeast, and the Echo Monocline is located in the south. A number of bench areas are found between the canyons throughout the area. Prominant among these, are Jacks Rig Bench and East Clark Bench in the southwest, and Nipple Bench, a little farther south.

There are numerous well-developed canyons throughout the area, all of which carry water to the Colorado River. They include Cottonwood Creek along the Cockscomb and Hackberry Canyons to the west; Paradise Canyon and Last Chance Creek in the east-central part of the area which flow south from the northern border; and Wesses Canyon in the south-central part of the area and Wildwood Creek in the southwest, both flowing to the Colorado River.

Geology and Hydrology

The major rock exposure occurs in the southern and eastern portions of the unit, and consist of the Iron Springs Formation, including Wahweap Sandstone, the Straight Cliffs Formation, and Tropic Shale. In the north, the Kaiparowits Formation appears, and to the west of the East Monocline is found the Iron Springs Formation, and in the south lies a large area of the Jurassic Carmel Formation and Navajo Sandstone. Cottonwood Creek and Hackberry Canyon carry most of the surplus water from the northern and western parts of the unit into the Paria River, and then from the Colorado River to the south. Although canyons and dry washes are common, few are of any great size. The largest in the central part of the unit is Wahweap Creek, which drains south to the Colorado River, and in the east, Last Chance Creek, also draining to the Colorado.

Climate and Soils

The climate of this unit is very similar to that of the Escalante River Planning Unit. The precipitation throughout the year is considerably less than the potential evapotranspiration rate. Therefore, the area is classed as a true, if not an extreme, desert area, where vegetation is necessarily very sparse and no streams have flowing water throughout the year. The annual precipitation ranges from six inches (152 mm.) in the southeast along the Colorado River to about sixteen inches (407 mm.) in limited areas to the north. At least seventy-five percent of the area has less than twelve inches (305 mm.) of precipitation per year. This may be compared to the potential evapotranspiration rate which ranges from a high of thirty-six inches (813 mm.) or more in the southeast, to eighteen inches (457 mm.) in the north. The evapotranspiration rate in the seventy-five percent of the area exceeds twenty-seven inches (686 mm.) annually. The mean maximum July temperature ranges from 84°F. (28°C.) in the north, to 100°F. (38°C.) in the south. The mean minimum July temperatures range from 48°F. (9°C.) in the north to 68°F. (20°C.) in the south along the Colorado River. The mean minimum January temperature ranges from 20°F. (-6°C.) in the south to 8°F. (-13°C.) in the north. At least seventy-five percent of the area has mean minimum January temperatures above 16°F. (-8°C.). The frost-free season in the study area ranges from 200 or more days in the southeast along the Colorado to 110 days in the north.

The soil development in this planning unit is generally quite poor. The largest area occupied by a single type occurs in the south and in the central portions of the area. The type is the Rockland Type and is number 68 in Table 1-3. Other soil associations include numbers 41 and 36, scattered primarily through the east-central part of the area, and a small amount of number 36 in the north. Soil association number 18 is found in the northwest and number 6 is found in a smaller area, also in the northwest. The highly erodable soil association number 64 is located in limited areas to the north (see Figure 1-7).

Vegetation

The vegetation of this unit is similar to that of the Escalante River Unit. At lower elevations along the Colorado River, blackbrush communities with shadscale, Indian rice grass, and sand dropseed as sub-dominants are common. At slightly higher elevations to the northwest is a fairly large area of shadscale, with blackbrush and rabbitbrush as the major sub-dominants. Further to the northwest is a very expansive pinyon-juniper dominated community, in which Utah juniper and true pinyon dominate, with an understory composed largely of sagebrush, buffaloberry, and other shrubs and grasses. Included among these are a few stands of greasewood, some seeded grasses, and a few sage-dominated communities. A few patches of Gambel oak are present in the northern part of the area.

ZION

Location

The Zion Planning Unit (Bureau of Land Management) consists of 179,000 acres (72,495 ha.) and is located in the southern part of the study area in western Kane County. The major towns in this unit are small and are located along U. S. Highway 89, and include Mt. Carmel Junction, Mt. Carmel, Orderville, and Glendale. The boundary of the unit follows State Highway 14 easterly, beginning in the southwest corner of the unit, and runs along the White Cliffs, swings northeast at Timber Mountain, and moves northeast until reaching the boundary of the Paria Unit. It then turns northwest to the boundary of the Dixie National Forest and then west to the Washington County boundary, and then south to the starting point. Access to the area is somewhat better than the last two units, because U. S. Highway 89 runs north to the central-northern portion of the unit, and because of a greater number of unpaved roads in the area.

Geomorphology

This planning unit includes parts of both the High Plateaus and the Canyonlands Physiographis Sections of the Colorado Plateau. The major topographic features include the Pink Cliffs forming the northern border, and Zion National Park located to the southwest. The area is highly dissected by numerous canyons. Elevation ranges from 6,000 feet (1,829 m.) along the southern border to 8,123 feet (2,476 m.) in the Clearcreek Mountains in the southwest. The unit is bisected by Long Valley Canyon. In the south are large level terraces, the western portion of which is referred to as the Glendale bench. The major portion of Glendale bench, Skutumpah Terrace, lies at an elevation of about 6,600 feet (2,012 m.). This terrace runs into the Timber Mountains, which are an extension of the terrace in the southeast part of the area.

Geology and Hydrology

The rocks of the Zion Planning Unit occur as spreading terraces having younger material at the apexes to the north, and with progressively older material occurring to the south. In the north, limited areas of the Tertiary Kaiparowits Formation occur and moving southward, large areas of the Cretaceous Mesa Verde Group are exposed resting on tropic shale in the western portions of the unit.

The Jurassic age Carmel Formation is in the central and eastern section, and in the extreme south, Navajo sandstone appears. Normal faulting is common throughout the central portions of the area.

A part of the Colorado River Basin, this unit drains southerly into the East Fork of the Virgin River in the west, and into Kaibab Creek from the central portion. Numerous dry washes which carry surplus water south are found throughout the unit.

Climate and Soils

The climate of the Zion Planning Unit is somewhat more favorable than that of the units to the east. The area receives slightly more precipitation and temperatures do not reach the extremes found at lower elevations along the Colorado River. Precipitation ranges from a minimum of about 14 inches (36 cm.) in the eastern part of the unit to 30 inches (76 cm.) in the northwest. About one-half of the area receives 16 inches (40 cm.) or less of annual precipitation. In contrast to this, the evaporation rate varies from 18 inches (45 cm.) in the north to 33 inches (84 cm.) in the extreme southwest. The evaporation rate of about one-half the area is more than 27 inches (68 cm.) annually. The mean maximum July temperatures range from 80°F (26°C) in the north to 92°F (33°C) in the south, and reach as high as 94°F (34°C) in the southwest. The mean minimum July temperatures range from 50°F (10°C) in the north to 58°F (15°C) in the southwest. Winter temperatures are quite cool and the mean minimum January temperatures range from 12°F (-11°C) in the north to 22°F (-5°C) in the south. The number of freeze-free days in the planning unit ranges from 100 in the north to 140 in the south.

Mountain soils are fairly common in this unit. Associations number 5 and number 6 (Table 1-3 and Fig. 1-7) are extensive in the north and number 18 is extensive in the south. A small area of land type number 69, the Badland-Rock land Association, occurs in the northeast.

Vegetation

The vegetation of this unit is dominated by the pinyon-juniper community, which occurs throughout with two minor incursions of sagebrush in the south and with ponderosa pine common in the north. Gambel oak along with a variety of chaparral shrubs and some white fir and ponderosa pine occur in the northwest. Most other communities are of little importance, although ponderosa pine together with some chaparral species, such as <u>Arctostaphylos</u>, is found in the north-central western part of the area.

WEST ZION

Location

The West Zion Planning Unit (Bureau of Land Management) contains 8,000 acres (3,240 ha.) and is the smallest unit in the study area. It is located in the southwest corner of the area, in the northwestern corner of Kane County. There are no major towns in this planning unit. The boundary line follows the Kane and Washington County boundaries in the west, and the Iron County boundary in the northwest. To the northeast the boundary follows the Dixie National Forest, and then moves along the Zion Unit boundary in the southeast. Access to this unit is limited to dirt roads.

Geomorphology

The West Zion Planning Unit is part of the High Plateau section. Elevations range from 6,500 feet (1,981 m.) in the south to 8,860 feet (2,701 m.) in the north. Much of the area is dominated by the Plains, a southeastern section of the Kolob Terrace. Straight Canyon forms the eastern border of the area, and Corral Canyon in the west. Cogswell Point in the southwest overlooks the northern entrance to Zion Canyon.

Geology and Hydrology

The geologic exposures consist mainly of members of the Mesa Verde Group and Quaternary basalt. Normal faulting is common in the area. This unit, which is just within the Colorado River drainage system, drains mainly into Deep Creek in the west and the north fork of the Virgin River in the east.

Climate and Soils

The climate in this unit is relatively cool and moist compared to the units further east. Annual precipitation ranges from 22 inches (56 cm.) in the south to about 40 inches (100 cm.) in the north. The evaporation rate, on the other hand, does not exceed 24 inches (60 cm.) in the south and drops to 18 inches (45 cm.) in the north. The mean maximum July temperatures range from 76°F (25°C) in the north to 88°F (31°C) in the south, and the mean minimum July temperatures range from 48°F (9°C) in the north, to 56°F (13°C) in the south. Mean minimum January temperatures drop as low as 8°F (-13°C) in the north and reach 16°F (-9°C) in the south. There is a freeze-free season of about 60 days in the north, and about 110 days in the south.

The soils occurring in this unit consist mainly of the four soils typical of soil association number 1 (Table 1-3 and Fig. 1-7), with a little of association number 5 occurring in the southern part.

Vegetation

This unit is dominated primarily by mountain brush vegetation with Gambel oak the principal species. Common subdominant species include squawbush, serviceberry, and honeysuckle. In the northeastern corner of the unit there is a fairly large community dominated by white fir and ponderosa pine.

AQUARIUS

Location

The Aquarius Planning Unit (National Forest Service) is about 252,000 acres (102,060 ha.) in size and is located mainly upon the Aquarius Plateau in the northeastern part of the study area in Garfield County. There are no major towns in the unit, and access is limited to unpaved roads. The boundary of the unit follows an irregular line in the east along the western boundary of the Boulder Planning Unit. In the north and south, the boundary coincides with that of the Dixie National Forest. In the south, the line joins the northeastern corner of the Escalante Unit. The western boundary moves irregularly along the eastern boundary of the Paunsaugunt-Sevier Planning Unit.

Geomorphology

This unit is part of the High Plateau Section and is dominated by the Aquarius Plateau in the north, which is very high with elevations entirely above 9,000 feet (2,743 m.) and much of it above 10,000 feet (3,048 m.). Elevations range from 7,000 feet (2,134 m.) in the southern part of the unit to 10,130 feet (3,088 m.) near Cyclone Lake, close to the center of the planning unit. The southern portion of the area forms a transition into the Canyonlands and is much more highly dissected and broken than the northern plateau land.

Geology and Hydrology

The Aquarius Plateau consists mainly of Tertiary volcanics and Pleistocene erosion surfaces with slump masses and glacial deposits being common. Cretaceous sandstones occur in the southwest and Jurassic sandstones in the southeast. Some faulting occurs in the northern-central part of the unit. The northwestern section of this planning unit drains into the Great Basin through the Sevier River system. Pine Creek drains most of the unit to the south towards the Colorado River. Small lakes are abundant on the Aquarius Plateau.

Climate and Soils

The climate over most of this planning unit is quite cool and relatively moist. Precipitation varies from 16 inches (40 cm.) in the south to 25 inches (64 cm.) in the central part of the area on the Aquarius Plateau. In the northern extreme of the planning unit, the precipitation drops to 20 inches (50 cm.). The evaporation rate varies from a potential of 18 inches (45 cm.) or less on the Aquarius Plateau to a potential of 21 inches (53 cm.) in the southern part of the unit. Seventy-five percent of the area has an evaporation rate of less than 18 inches (45 cm.) annually. The mean maximum July temperatures range from 84°F (28°C) in the south to 72°F (22°C) in the northeast. The mean minimum July temperatures range from 48°F (9°C) in the central part of the area to a maximum of 52°F (11°C) in the south. Freezing temperatures are very common on the plateau and there are only 40 days out of the year between the last frost in spring and the first in the fall. The number of freeze-free days reaches 110 in the southern part of the unit.

As might be expected, the soils of the area consist primarily of associations number 1 and number 3 (Table 1-3 and Fig. 1-7), the cool, moist mountain soils typical of high elevation areas throughout the state. Some areas of soil association number 1 are found in the south and limited areas of the highly erodable soil association number 64 occur in the southwestern part of the unit.

Vegetation

The northeastern part of this unit is dominated by Englemann spruce and alpine fir. To the west and southwest are aspen mixed with white fir and alpine fir. In the central part of the unit, with a tongue extending toward the west, is a large grassland community dominated by wheatgrass, bluegrass, and fescue. In the south, there is an extensive area dominated by ponderosa pine, aspen, and white fir.

BOULDER

Location

The Boulder Planning Unit (National Forest Service) consists of 250,000 acres (101,250 ha.) and is located in the northeastern section of the study area in Garfield and Wayne Counties. No major towns are present in the area, which is named after Boulder Mountain, the highest part of the Aquarius Plateau. The boundary of the unit follows Dixie National Forest in the east and northeast, and the Aquarius Planning Unit boundary in the west. The Dixie National Forest boundary forms the limits of the unit in the south at the corner of the northern boundary of the Escalante River Planning Unit.

Geomorphology

A part of the High Plateau physiographic section, this planning unit has elevations ranging from about 7,000 feet (2,134 m.) in the south to 11,200 feet (3,414 m.) on the Aquarius Plateau in the north-central part of the area. The central section of the unit is a level plateau on which is located Boulder Mountain and Lookout Mountain to the northwest. The southeastern and northern margins of the area are highly dissected by drainages flowing into the Canyonlands section of the study area. The southern part drains into the Escalante River Unit.

Geology and Hydrology

Tertiary volcanics appear in the northwest and are surrounded to the east and south by Pleistocene erosion surfaces, slump masses, and glacial deposits. Jurassic and Triassic sandstones occur in the east and along the southern margin of the unit. Faulting is present only in the northwest. This unit drains southward in Boulder Creek and its various tributaries to the Escalante River, and then on southeast to the Colorado River. Small lakes are common over much of the area on the Aquarius Plateau.

Climate and Soils

The climate of the area is relatively cool and moist. The annual precipitation ranges from 16 inches (40 cm.) in the south, east and north, to 30 inches (76 cm.) atop the Aquarius Plateau in the central and western parts of the unit. The potential evapotranspiration rate, on the other hand, ranges from 18 inches (45 cm.) on the plateau in the west to 24 inches (60 cm.) in the east. The mean maximum July temperature ranges from 86°F (29°C) in the southeast to 72°F (22°C) on the plateau and in the west. The mean minimum July temperatures range from 48°F (9°C) in the west to 60°F (16°C) in the east. The mean minimum January temperature drops to 6°F (-15°C) on the Aquarius Plateau and reaches only 10°F (-12°C) in the southeastern part of the unit. The freeze-free period drops to a maximum of 20 days on the plateau and reaches only 120 days annually in the eastern part of the unit.

The major soil association in this area is number 3, which is located primarily in the western part of the unit and soil association number 1, found in the east. There are small areas of association number 11 in the east and the south, and a few areas of number 68 occur in the east and the south. A small area of number 67 occurs in the south-central part of the unit (see Table 1-3 and Fig. 1-7).

Vegetation

The major vegetation type is Englemann spruce and alpine fir which covers most of the northern two-thirds of the area. A large portion of the north-central part of the community is dominated by wheatgrass, bluegrass, and sedges. In the extreme east, some pinyon-juniper occurs, and to the northwest is a large area of ponderosa pine mixed with serviceberry and other chaparral species. In the southern part is a community dominated by aspen, needlegrass, and bluegrass, with some common juniper and some serviceberry. A small Gambel oak group occurs on the southern border.

MARKAGUNT

Location

The Markagunt Planning Unit (National Forest Service) consists of 400,000 acres (162,000 ha.) and is located in the northwestern part of the study area in Iron, Garfield, and Kane

Counties. Settlements include Long Valley Junction in the southeast, and Cedar Breaks National Monument and Brian Head Ski Resort in the west. The boundary of the unit is composed entirely of Dixie National Forest boundary. In the south, the boundary line contacts the Zion Planning Unit; on the east, the boundary moves along the western boundary of the Garfield Unit; and in the west, it moves along the eastern boundary of the Cedar Unit. Access is good; State Highway 14 runs across the southern part of the unit, and State Highway 143 runs north through Cedar Breaks National Monument past Brian Head to Interstate 15 to the north. U.S. Highway 89 crosses the southeastern corner of the unit, and a number of gravel roads and narrow paved highways are present. In the north, there are well-developed dirt roads, but no paved roads.

Geomorphology

Elevations in this unit range from about 7,000 feet (2,134 m.) in the north and south to above 10,000 feet (3,048 m.) in the central part of the unit atop the Markagunt Plateau. This plateau is very high with much of it exceeding 10,000 feet (3,048 m.), and there are extensive lava flows. Cedar Breaks National Monument is in the extreme west of the unit on the western edge of the Markagunt Plateau. The western section of the unit is highly dissected and drains to the west. The southern boundary is formed by the Pink Cliffs which overlook the Zion Planning Unit to the south, and which form the eastern section of the Markagunt Plateau. Brian Head is located in the western part with elevations above 11,000 feet (3,353 m.). Little Creek Peak is the highest point in the north at 10,142 feet (3,091 m.). Numerous canyons are present, particularly in the south.

Geology and Hydrology

The Markagunt Plateau in the north is covered by extensive areas of Tertiary volcanics with Quaternary basalt common toward the south, and large expanses of the Cedar Breaks Formation to the south, atop the Pink Cliffs. Faults occur throughout the unit. Limited areas of the Kaiparowits Formation occur in the south and southwest and the Mesa Verde Group appears in the extreme southwestern corner of the unit.

This unit, with only the southeastern corner as an exception, drains east into the Sevier River and then into the Great Basin. The larger streams draining the plateau include Asay Creek in the south, Mammoth Creek in the south-center, and Panguitch Creek, which runs northeast from Panguitch Lake to the center of the unit. The area in the vicinity of Cedar Breaks National Monument in the western part of the unit drains into Coal Creek through its two main tributaries, Ashdown Creek and Crow Creek. Small lakes are most common in the north-central part of the area.

Climate and Soils

The climate in this planning unit is quite variable, with annual precipitation amounts ranging from 13 inches (33 cm.) in the east to 40 inches (100 cm.) on the Markagunt Plateau in the west. Most of the plateau receives more than 20 inches (50 cm.). The potential evapotranspiration ranges from less than 18 inches (45 cm.) on the Plateau to 21 inches (53 cm.) on the plateau borders, and 24 inches (60 cm.) in the southeast. The mean maximum July temperatures reach 84°F (28°C) in the northeast and drop to 72°F (22°C) on the Markagunt Plateau in the southwest. The mean minimum July temperatures range from 50°F (10°C) in the south to 44°F (6°C) in the southwest, and reach 50°F (10°C) along the western border of the unit. The January temperatures are quite cool, especially on the plateau with the average minimum January temperature being 8°F (-13°C) in the southwest and central part of the unit and reaching 12°F (-11°C) in the southeast and northwest at lower elevations.

The most common soil association throughout the unit is number 1, with association number 22 occurring in the north, and land type number 70, which is referred to as Rock land of the high mountains, occurring in the south-central part of the area. Soil association numbers 5, 8, and 12 are found in limited areas on the eastern border of the unit (see Table 1-3 and Fig. 1-7).

Vegetation

In the extreme northwestern corner of the unit, the transition from sagebrush to pinyon-juniper to mountain brush is clearly visible moving southeast up the Hurricane Cliffs onto the plateau. The major vegetation type occurs in the southwest-central portion of the area and is dominated by Englemann spruce, and some alpine fir, with lumber pine, bristlecomb pine, common juniper, bitterbrush, and Oregon grape as major subdominants. The next major vegetation type is ponderosa pine dominated communities which have white fir and Arctostaphylos as important subdominants. This type is located primarily in the southeastern third of the unit. Gambel oak is common along with prickly pear cactus and a variety of other shrub species. Aspen communities are also common although not extensive in the area and occur in the west, southeast, and north-central parts of the unit. One fairly extensive area of sagebrush is in the northeastern central section.

PAUNSAUGUNT-SEVIER

Location

The Paunsaugunt-Sevier Planning Unit (National

Forest Service) consists of 580,000 acres (243,900 ha.) and is located in the north-central part of the study area in Garfield County, with a small extension in Kane County to the south. Bryce Canyon National Park is located in the southeastern part of the area. The boundary of the unit follows the Dixie National Forest boundary in the north, the Escalante River Unit in the southeast, the Paria nit in the south, and the Zion Planning Unit boundary in the southwest. In the west, the boundary follows that of the Garfield Unit. In the northeast, the boundary parallels the Garfield County boundary line, moving along the west side of the Aquarius Planning Unit. Access is reasonably good with State Highway 12 moving from east to west across the central portion, with a segment extending to the south to Bryce Canyon National Park. Moving north across John's Valley is another highway which crosses the unit, reaching Antimony on the northern border. Numerous gravel roads are present throughout the unit.

Geomorphology

The Paunsaugunt-Sevier Planning Unit is located within the High Plateaus physiographic section. The unit is dominated by the Sevier Plateau in the northwest and the Paunsaugunt Plateau in the southwest. The Pink Cliffs are located in the south, and the Table Cliffs are in the southeast. The Escalante Mountains in the east have elevations ranging from 7,000 feet (2,134 m.) in the north to 11,036 feet (3,364 m.) in the northwest. The central part of the unit is dominated by John's Valley.

Geology and Hydrology

The Sevier Plateau in the northwest is covered by Tertiary volcanic materials, with an extensive area of Quaternary and Tertiary deposits and surfaces in the north-central part of the unit. The Cedar Breaks Formation is widely exposed in the central and southern portion of the unit and limited exposures of the Kaiparowits Formation and the Mesa Verde Group appear on the margins of the southern part of the area. Tertiary volcanics dominate in the northeast, and Pleistocene erosion surfaces are replaced by Kaiparowits and Iron Springs Formations moving toward the eastern boundary of the unit. Faulting is quite limited and occurs in the northeast and in the west.

Except for the southeastern corner of the unit, which drains into the Escalante River, and the southeastern margin of Bryce Canyon National Park which drains to the Paria River, this area drains mainly into the East Fork of the Sevier River which flows north to the Sevier River and then into the Great Basin.

Climate and Soils

The climate of this planning unit is quite variable, with precipitation ranging from 10 inches (25 cm.) in the north to 12 inches (30 cm.) in the north-central part of the area, reaching 25 inches (63 cm.) along the Table Cliffs Plateau in the southeast. The maximum precipitation of 30 inches (76 cm.) happens on the Sevier Plateau. Maximum precipitation on the Paunsaugunt Plateau to the southwest is 25 inches (63 cm.) annually. Evaporation rates range from a low of 18 inches (45 cm.) to 21 inches (53 cm.) along the western border of the unit. The mean maximum July temperature varies from 80°F (26°C), in the north and in the south at higher elevations atop the plateaus, to 76°F (24°C) on the Sevier Plateau. The mean minimum July temperature ranges from 50°F (10°C) in the south to 44°F (6°C) in the west-central part of the unit. The January temperatures are quite cool reaching 6°F (-14°C) on each of the plateaus, and rising only to 14°F (-10°C) in the south. Much of the area atop the plateaus has mean minimum January temperatures at or below $8^{o}F$ ($-13^{o}C$).

As might be expected, large areas of soil association number 1, described in Table 1-3, occur in the northeast and southern portions of the area atop the plateaus. Soil association numbers 9, 10, and 13 are common in the central part of the area, and a small area of type number 69 occurs in the south along the border of the planning unit. Small areas of association number 30 appear in the northwest.

Vegetation

Agricultural land and sagebrush communities are extensive in the large central valley part of the unit. They are bordered on the west by pinyon-juniper and ponderosa pine, with Douglas fir, aspen, and alpine fir atop the Sevier Plateau farther to the west. On the western margin of the Sevier Plateau is a zone dominated by Gambel oak and lower on the western margin is a pinyon-juniper belt. The pinyon-juniper belt also occurs further south on the western edge of the Paunsaugunt Plateau on the southwestern margin of the unit. The eastern margin of the sagebrush zone and cultivated lands mentioned before, is bounded by pinyon-juniper in the north and above this are aspen, Douglas fir, and white fir as the dominants. This latter community forms the eastern margin of the central cultivated area in the east-central part of the planning unit. In the south, pinyon-juniper with chaparral shrubs form an extensive community, as do Douglas fir and blue spruce dominated communities with considerable bristlecomb pine and lumber pine present as codominants.

PART B: MAN'S UTILIZATION OF HIS ENVIRONMENT

Man has lived in the South Central Utah region for many thousands of years. To do so, man has utilized the available natural resources, and his degree of dependence on any resource, e.g., floral, faunal, lithic, has varied according to the economic demands and technology of the given culture. The dynamics of culture change and resource utilization in the Colorado Plateau can be clearly understood when used as an example of Leslie White's concept of energy in cultural evolution.

Culture, meaning the more general human culture, "is an organization of extra somatic ways and means employed by man in the struggle for existence and survival" (Bohannan and Glazer 1973:339). Culture, like genetic heredity, is continuous through time yet has the advantage of flexibility and rapidity of change. White separates the general cultural system into three intimately interrelated subsystems. These subsystems in order of importance are: the technological, the sociological, and the ideological. The technological subsystem serves man's primary needs of subsistence, protection from the elements, and defense from intruders. The maintenance of social interactions and belief systems are the primary functions of the sociological and ideological systems. Combined with the technological power for utilizing natural resources, these units of culture provide man with all his needs. Capsulized in the form of White's law of cultural evolution, "culture evolves as the amount of energy harnessed per capita per year is increased, or as the efficiency of the instrumental means of putting the energy to work is increased."

Energy is taken from natural resources. It is the mechanisms of exploitation that vary. Most pre-industrial cultures depend upon fire, water, flora-faunal, soil, and mineral resources for survival. The mechanisms of exploitation have varied temporally and spatially; however, general stages in cultural development have been recognized. These stages, in order of efficiency in energy use, are hunting and gathering, agricultural, and industrial.

In the southern Utah region, the major energy resource of hunting and gathering groups was man himself. Natural resources were not controlled by man. Groups utilized what was most readily collected or hunted.

The natural vegetation of the region has been utilized by human beings in almost every conceivable way. It has been used for food, clothing, construction materials, tools, fuel, dyes, and ornaments. Some vegetative materials which are consumed either directly or after processing include pinyon nuts, acorns, wild onions, tobacco, various berries, Mormon tea, prickly-pear, and other edible plants. Several plants of the region yield fibers which were used for cordage, clothing, and construction. Fibers were extracted from juniper and sagebrush bark and from the yucca plant. Many items were constructed in whole or in part from plant materials. Atlatls were often made from mountain mahogany. Willows and reeds, and even the lowly greasewood were used for dart and arrow shafts. Baskets were woven from willow, yucca, and other materials. Axes and other tools had wooden handles. Dyes were produced from several plants including juniper berries. The latter were also used as beads. Some prehistoric peoples built brush shelters in their camps. The use of vegetation for fuel hardly requires mention.

Animal life of all forms from insects through elk and bison were utilized whenever available for a variety of purposes including food, clothing, shelter, ornamentation, and tools. Part of the diet of different times and places included rabbits, hares, bighorn sheep, mule deer, antelope, elk, bison, and moose as well as insects, frogs, and rodents. The larger animals were important only in the High Plateau and Uintah Basin sections. Besides food, animals such as rabbits, bighorn sheep, and deer provided skins and hides for clothing and shelters. Tools and ornaments were made from bone and antlers as well as skins, quills, and feathers.

Water was needed for drinking. Fire, although used for cooking and warming purposes, cannot be considered a major energy source addition until the invention of the steam engine during the Industrial Revolution. Altitudinal variation in the region enabled the inhabitants of Utah to escape oppressive heat and severe cold. It also permitted a greater variety of floral and faunal resources to inhabit a more restricted area.

Utah's early hunting and gathering groups developed highly specialized tools and knowledge of their environment. They discovered the most successful trapping methods, they learned the habits of their prey, they developed specialized tools from a wide assortment of materials.

Man's increasing familiarity with plants and animals enabled him to take the first great strides toward resource control, i.e., agriculture and animal domestication. An increase in the quantity of usable energy accompanied control over plants and animals. The greater man's knowledge of these processes, the more skill and control he acquired. Man learned to selectively breed natural plant strains, he learned to supplement soil minerals with fertilizers, and by using irrigation, he learned to develop the usefulness of arid lands.

The first domesticated maize was cultivated in the Mexican highlands and diffused slowly northward into North America. Due to the aridity of Utah and the greater Southwest, man probably practiced some form of water control system for irrigation. In the Southwest, the only known domesticated animals were dogs and turkeys.

Leslie White has hypothesized that, as the amount of available energy increases, a noticeable change in the sociological, ideological, and technological subsystems also occurs. Political units become more complex, wealth is accumulated, and advancements occur in the arts and sciences. Increasing social complexity stimulates additional change in the technological subsystem.

All of these changes occurred in the Southwest, southern Utah, and in the Colorado Plateau. As Anasazi and Fremont horticultural populations increased, their social units became more complex, and the range and variety of trade expanded. By learning how to control photosynthetic energy, human societies of the Southwest underwent a short period of cultural florescence.

For presently unknown reasons, cultural abandonment and population decline in some areas of the Southwest followed the period of florescence. Although man hunted and gathered during agriculture periods after ca. A.D. 1250, native groups in southern Utah reverted back to a modified hunting and gathering lifestyle maintaining some reliance upon horticulture. A variety of possible explanations for this decline have been postulated. These include the idea that a drought period set in which resulted in loss of water and soil resources. Another theory charges that over-exploitation of the Southwest and central Utah resulted in widespread erosion and the possible lowering of the water table.

The Colorado Plateau and south central Utah have not been major providers of food, clothing, and shelter to large human habitations since ca. A.D. 1250. Early historic settlers grazed cattle and sheep and built irrigated farms in the river valleys where valuable soils and water had earlier been utilized by prehistoric cultures.

The tourist industry, agriculture, and the Glen Canyon water control project are several classes of modern resource exploitation being carried out in south and central Utah. Also, a continuing trend of mineral exploitation can be expected. Many specific environmental impacts of these endeavors are understood; others remain to be identified. Modern society has reached an energy exploitation level that relies on continued fossil fuel and uranium exploration; hence, the progress of modern society will continue to widen the energy gap between hunting/gathering and the industrial cultures. A balance between exploitation and energy resource conservation is being identified as evidenced through the growing awareness for the importance of ecosystemic research.

Chapter 2

SUMMARY HISTORY OF MAN'S ACTIVITY IN THE STUDY AREA

The variety of human cultures which have inhabited the Southern Coal Project (SCP) area can be examined from several perspectives. The temporal continuum extending over a range of 12,000 years involves such diverse groups as the early prehistoric big game hunters, the Archaic hunter-gatherers, the semi-horticultural Fremont, the Kayenta Anasazi, the nomadic Shoshonean bands, the early historic explorers, the Mormon colonists, the coal and cattle barons, and the final influx of farmers, small town settlers, and merchants. Man's social and technological variations mirror the complexity of economic means used to exploit the necessary resources of his changing ecological system. Understanding how man's past and present economic-technology in the SCP area interacts with his natural environment is the central theme of this report. The following pages will integrate the full range of culture history with environmental diversity by examining these historic and prehistoric cultures from their temporal, spatial, and economic-technological perspectives. Following this discussion, an evaluation and correlation of cultures, site types, and general environmental factors will be presented.

PART A: THE PREHISTORIC PERIOD

The Prehistoric period within the Southern Coal Project area may be subdivided into four temporal periods/ cultural stages: Paleo-Indian, Archaic, Fremont-Kayenta, and Shoshonean.

Paleo Indian Phase

The Paleo Indian phase in American prehistory is generally believed to have its beginning ca. 10,000 B.C. It is divided into three subphases which have been given the names Llano, Folsom, and Plano (Jennings 1974:81). The most recent subphase, the Plano, is believed to have terminated by ca. 5,000 B.C.

The time period assigned to the Llano subphase culture is between ca. 10,000 and ca. 8,000 B.C. It is characterized typically by the Clovis projectile point found at kill sites in association with mammoth remains. Llano culture is often referred to as Clovis culture or Clovis man.

Evidence of the Llano subphase has been found throughout a large area in the Intermountain West and southwestern United States. The Clovis point alone is the single defining artifact that can be used to infer the presence of Llano hunters. Clovis points found in association with mammoths are limited to eastern Colorado, most of New Mexico and eastern Arizona. However, isolated finds of Clovis, or Clovis-like, points range over the entire United States. A brief summary of Clovis or fluted points found in Utah has been given by Weder (1977).

The Folsom subphase followed immediately after the Llano, with perhaps some overlap in time. The temporal limits placed on Folsom range from ca. 9,000 to ca. 7,000 B.C. The characteristics that define Folsom culture are a change in subsistence and in artifact assemblage. Again, the primary defining tool is the projectile point. The Folsom point is smaller than the Clovis; it is thinner with a concave base, bifacial fluting and basal ears. While the Folsom point is frequently found as an isolate, its faunal association is often the extinct Bison antiquus. Isolated finds are recorded in central and eastern Utah but are primarily found on the High Plains east of the Rocky Mountains, although they are known elsewhere in the United States.

The Plano subphase of the Paleo Indian phase is dated between ca. 7,000 and ca. 5,000 B.C. The basic subsistence pattern remained that of hunting large game like the bison. Two factors differentiate Plano from Folsom culture: The use of the jump-kill hunting technique and the introduction of new and various projectile point types that are typically lanceolate, precisely flaked and non-fluted.

The jump-kill hunting technique became widespread during this period. Using this method Plano hunters would drive a herd of animals over the edge of a cliff to injure and kill them in large numbers. The amount of meat and hides obtained for the amount of effort expended made this technique very important. The implications for population growth and social organization are subjects for serious investigation.

Sites with definite Paleo Indian affiliations have been found in the Southern Coal Project survey area. Folsom point fragments have been recorded at a site near Escalante, and mammoth petroglyphs have been recorded, although identification at this stage is not certain. A recent statement by Madsen, Currey and Madsen (1976) with respect to mammoth petroglyphs in Utah may serve to illustrate our thinking on this problem: "Mammoth-like zoomorphs are depicted at a number of rock art sites in Utah. Although such evidence should only be used to supplement more concrete data, the rock art sites do suggest that man and mammoths were contemporaneous in the region".

No conclusions can be made regarding the extent of the Paleo Indian activity in this area on the basis of the data collected. Further investigation may prove more enlightening.

Archaic Phase

The Archaic phase is one that witnessed major changes in subsistence patterns and cultural assemblages. During this phase, people began to exploit all available resources for food, both animals and plants. The term, total exploitation, has been used to describe the subsistence practices of Archaic phase peoples (Willey and Phillips 1958). Hunters and gatherers, or collectors, is another term that is often used to refer to peoples of this period.

Defining characteristics of Archaic phase assemblages are: Ground and polished stone, mortars and pestles, milling stones and the appearance of the spear thrower (atlatl) and dart, with its two or three component shaft (Weder 1977; Willey and Phillips 1958).

Dates for the beginning of the Archaic phase in Utah may be as early as ca. 8,000 B.C. at Danger Cave (Jennings 1957). Other important sites that have contributed to the development of a cultural sequence for the Archaic in Utah are Hogup Cave (Aikens 1970) in the Great Basin, Sudden Shelter (Jennings, Schroedl and Holmer, in press) in the southern Wasatch Mountains, and at Cowboy Cave (Jennings et al, in preparation) in southeastern Utah. The Archaic has been divided into four subphases in southeast-central Utah based on changes in both projectile point types and population densities (Schroedl 1976).

The Black Knoll subphase begins ca. 6,300 B.C. and terminates ca. 4,200 B.C. (Schroedl 1976). Subsistence during this period was based on generalized gathering and hunting techniques. Faunal remains were primarily limited to deer and mountain sheep, although antelope and bison were also present. Dart points that are typically characteristic of this subphase are the Pinto and the Northern Side Notch (Schroedl 1976).

The Castle Valley subphase of the Archaic began ca. 4,200 B.C. and ended ca. 2,500 B.C. Subsistence patterns remained the same as in the earlier Black Knoll subphase, but there was a change in projectile point styles. Early in the Castle Valley subphase, dart points such as the Rocker Base, Sudden Side Notch and Hawken Side Notch appeared and continued in use until the end. During the later part of this period, Humboldt points appeared and became the dominant style (Schroedl 1976).

The Green River subphase had its beginning ca. 2,500 B.C. and terminated ca. 1,300 B.C. and manifests a western and eastern variant (Schroedl 1976). Both variants continue the subsistence patterns of earlier periods. The variants are distinguished by differences in dart point style. Gypsum and San Rafael Side Notch points are associated with the western variant and Duncan-Hannah and an unidentified triangular corner notch point are associated with the eastern variant.

The Dirty Devil subphase began ca. 1,300 B.C. and has been given an arbitrary termination date of ca. A.D.500 (Schroedl 1976). Evidence for corn horticulture in the late Dirty Devil subphase has been found at several locations: Cowboy Cave (Jennings et al, in preparation), Cottonwood Cave in western Colorado (Hurst 1948), and Clydes Cavern in central Utah (Winter 1973). Dart points characteristic of this period are the Gypsum point which continues from the earlier period as the predominant point type. Evidence for the advent of the bow and arrow was recovered from the uppermost level at Cowboy Cave (Jennings et al, in preparation) in the form of Rose Spring points, and was dated between ca. A.D.400 and ca. A.D.500.

The entire Archaic phase, which has been well defined through the analysis of excavated caves and rock shelter sites, is characterized by a hunting and gathering subsistence pattern and a sequence of distinct point types. While the atlatl was eventually replaced by the bow and arrow by Formative Stage cultures (Willey and Phillips 1958), it remained in use throughout the Archaic and was used along with the bow and arrow in Late Archaic times as evidenced by the contemporaneous manufacture of Gypsum and Rose Spring points at Cowboy Cave (Holmer in Jennings et al, in preparation).

On the basis of lithic artifact analysis, it would appear on the surface that there was a long occupation within the Southern Coal Project area of Archaic phase cultures. However, when this material is analyzed in conjunction with ceramics, and in light of previous work in the SCP and adjacent areas, a different cultural manifestation may be the case. This is especially true of the Escalante drainage west of the Colorado River. Archaic phase artifact types were found in association with ceramics and other lithic materials of later phases, either as carryovers from earlier occupations or as part of later phase assemblages. Jennings (1966) has stated that the later cultures of the area (Fremont, Sevier, Virgin and Kayenta) were essentially widespread Archaic populations that were borrowing traits like pottery, architecture, and agriculture from the Anasazi, but never becoming a fully developed Formative Stage culture. In his study of the Red Rock Plateau, Lipe (1970) has found that the earliest occupations in that area manifest a culture of the Basketmaker II type, considered by Willey and Phillips (1958) to be a late Archaic transitional phase. The distinction between Archaic and Formative stage cultures in their transitional phases is unclear and often confusing (Willey and Phillips 1958). Many of the sites in the SCP area may be seen as manifesting this transitional type of adaptation. For this reason, the earlier subphases of the Archaic are not clearly defined within the survey area, and indications are that there may have been a long period in which there was little or no occupation by Archaic Stage groups. This may be supported by the findings of the Glen Canyon Project in which it was determined that the area of the Glen Canyon does not show much occupation by man before the Christian era

(Jennings 1966:66). Further discussion of this problem is given in Chapter 4.

Fremont-Kayenta Phase

The Fremont culture of Utah has traditionally been divided into five regional variants: Parowan, Sevier, Great Salt Lake, Uinta, and San Rafael. However, a recent reevaluation has resulted in a threefold division. The Sevier culture now includes the Sevier, Great Salt Lake, and Parowan variants; the Uinta variant is replaced by an, as yet, unnamed northeastern Utah culture, and the San Rafael variant is designated as the Fremont culture. No cultural entity has been defined that can take into account the variation present between these three groups or areas. The differences are ascribed to separate origins (Madsen and Lindsay 1977).

All of these Utah cultures are characterized by the utilization of permanent dwellings, ceramics, and some degree of corn horticulture. The Sevier culture (ca. A.D.700 to A.D. 1300) was dependent on wild food collecting from marshland environments west of the Wasatch Plateau. The Fremont culture is found east of the Wasatch on the Colorado Plateau, north of the Colorado River and south of the Uinta Basin. Dates for the Fremont are from ca. A.D.500 to ca. A.D.1200. Fremont people relied heavily on corn horticulture and had settlement patterns which are distinctly different from those of the Sevier culture (Madsen and Lindsay 1977). Fremont villages are relatively small and are located adjacent to permanent streams. Anasazi influences are considerably more prevalent in the Fremont sites than in the Sevier culture sites. The defining characteristics of the unnamed northeastern Utah culture are not important to the discussion in this volume.

Hunting activities among the Sevier, Fremont, and unnamed cultures are evident from the many projectile point varieties recovered from excavations. Small stemmed, corner notched and side notched points (variously called Rose Spring and Desert Side Notch) are present in all three cultures. Sites from the southern portion of the Fremont area exhibit a distinctive point type which is long with a thin triangular shape and a shallow concave base. These points, tentatively named Bull Creek points, have been recovered from several sites in proportions roughly related to the percentage of Kayenta ceramics. Bull Creek points have been found in association with Fremont ceramics on southern Fremont sites and in association with Kayenta ceramics at Coombs Village (Lister and Lister 1961), Bull Creek, north of the Henry Mountains (Jennings et al, in preparation), Snake Rock Village (Aikens 1967), Old Woman and Poplar Knob (Taylor 1957). Dart points, the Elko series and Gypsum in particular, are also found in association with Fremont sites. Dart points, during the Archaic, were used as both projectile points and knives (Weder, in Jennings et al, in preparation), but their function in the Fremont context has not yet been determined.

The Kayenta culture, as previously stated, has been described by Jennings (1966) as a Late Archaic culture with Anasazi influences, at least in the south central Utah area. Kayenta influence is evident in Utah from the Glen Canyon area north through Coombs Village, past the Henry Mountains to Snake Rock Village on the east side of the Wasatch Plateau. It is also known northwest of Glen Canyon in the Kaiparowits Plateau area, and westward as the Virgin branch (Jennings 1966), or the Virgin Kayenta.

Manifestations of the Fremont-Kayenta phase within the Southern Coal Project area are many. As mentioned in discussing the Archaic phase, many of the earliest cultural evidences in the Escalante drainage are of a type consistent with the findings of the Glen Canyon Project as reported by Jennings (1966) and Lipe (1970). In other words, the cultural manifestations show definite associations with a phase or phases that are transitional from an Archaic to a Formative stage. Early Basketmaker-like sites can be seen as well as those of a later Pueblo kind with Kayenta influence. Fremont ceramics and typical projectile point types are also in evidence and become more prevalent as one moves further north and west from the Glen Canyon-Lake Powell area. Virgin branch ceramics were found at some sites in the area.

West of the Kaiparowits-Escalante area, especially in the survey areas of Iron County, many more sites of the Fremont type were located. One site in particular (42In439) yielded Fremont ceramics and a great many Gypsum points along with other point types. The overlapping of cultural influences within the survey area is a factor that should be taken into account when interpreting the prehistory of south-central Utah. Fremont and Kayenta peoples were contemporaneous in much of the area and basically shared a common cultural developmental type of adaptation to their environment.

Shoshonean Phase

The Shoshonean populations have been in the Great Basin and Utah regions since approximately A.D.1300. Several hypotheses have been expressed concerning their origin.

One hypothesis states that the Shoshoneans came from the southwest of the Great Basin at the time of the dispersal of the Sevier, Fremont, and Anasazi agriculturalists (Madsen 1975 and Lamb 1958). Gunnerson (1962) has stated that the Fremont, Sevier, and Virgin cultures were Shoshonean peoples who had taken up horticulture and ceramic ideas diffused from the Anasazi, but later reverted to an Archaic subsistence pattern after climatic changes that made agricultural techniques unproductive. A third hypothesis maintains that the Fremont peoples came from the northwest plains, became horticulturalists through diffused influence from the Anasazi, but were forced to move eastward by the Shoshoean expansion from the Great Basin.

Regardless of which hypothesis is correct, Shoshonean groups (Ute, Paiute, Shoshone and Bannock) were inhabiting the Great Basin and eastern Utah from ca. A.D.1300 until after the advent of Anglo European settlement.

Evidence for the presence of Shoshonean peoples within the SCP area is good. Campsites with teepee rings, ceramics, and the typical Desert Side Notch projectile points have been located, some as components of sites with earlier occupations. Shoshoneans are known to have had contact and trade in south-central Utah with the Hopi people from north-eastern Arizona (Lipe 1970). Temporary camps have been located in areas along ridges that might have provided good access routes through the Escalante drainage area northeast of the Kaiparowits Plateau, and in the canyons around Boulder, Utah. Shoshonean occupation in this area is known to have existed up to the period of white contact.

Summary

In general, the occupation of the Southern Coal Project area in prehistoric times is limited to those periods of time since the Late Archaic.

Evidence for Paleo Indian activity is limited to Folsom fragments and two petroglyphs that may be mammoths (see Chapter 4) but no artifacts that typify Paleo Indian activity or occupation were recovered. Archaic stage artifacts are sufficiently mixed in cultural context, and show so much variation in style, that the determination of truly Early and Middle Archaic occupations is doubtful. Point types that make their appearance in earlier times are often carried over into later times and occur alongside artifacts that are strictly of a Late Archaic or Early Formative stage culture. Later sites manifest assemblages that would indicate a more settled pattern of adaptation. Extended campsites, multiple habitations, either of stone masonry or jacal, and granaries are among those indications of more permanent settlement. The mixing of these more permanent indicators with ceramics and a variety of projectile point types from earlier times may be good evidence for an extensive adaptation in the area that was transitional from the Archaic to the horticultural subsistence levels. Evidence suggests that Archaic peoples may have been influenced by the Anasazi to the east and south (Jennings 1966). Among these horticultural groups are the Kayenta, Fremont, and the Virgin branch. The last prehistoric occupation of the area was by Shoshonean peoples whose origins are debated, but who manifested a modified Archaic stage including hunting, collecting and horticulture related to a semi-nomadic seasonal round. Campsites, ceramics and distinctive projectile point types testify of Shoshonean occupation throughout the project area.

PART B : THE HISTORIC PERIOD

The recorded history of the southern Utah area begins with the pioneering effort of the 1776-1777 Dominguez-Escalante Expedition. During their efforts to establish an overland link between the Spanish settlements in New Mexico and Monterey, California, the Dominguez-Escalante Expedition traversed a great deal of the present state of Utah.

The group crossed the Green River near the present town of Jensen in northeastern Utah and proceeded west until they reached the shores of Utah Lake on September 23. From here the expedition turned south, discovering the Sevier Lake on October 2. Just south of present-day Milford, dissension arose within the group as to the future course they should pursue. While the expedition leaders favored continuing on to California, the advent of winter and the rough terrain had convinced most of the men that a return to Santa Fe would be safer. Lots were drawn on October 11 to resolve the crisis, and as a result, the expedition turned for their original departure point of Santa Fe (Miller 1968:Map 9, 11, 12).

The major obstacle blocking the expedition's return was the Colorado River. The hunt for a suitable ford led the group far to the south and to an unsuccessful attempt to cross near the mouth of the Paria River at present-day Lee's Ferry. The search for the crucial ford stretched out for nearly two weeks, until the expedition waded the Colorado at Crossing of the Fathers (Ute Crossing) near the mouth of Navajo Canyon. Early the next morning, November 8, the trek was resumed, the expedition reaching Santa Fe on January 2, 1777, with invaluable knowledge of the area's geography and Indian populations (Miller 1968: Map 9, 11, 12).

Though the Dominguez-Escalante Expedition failed in its efforts to connect the scattered outposts of the Spanish Empire, subsequent efforts by trappers and traders working northward from Taos and Santa Fe succeeded, by the 1830's, in establishing a much-traveled route known as the Old Spanish Trail. This route, traveled in part by trapper Jedediah Smith and government explorer John C. Fremont, remained the primary connection to California until the Gold Rush inundations of 1849 shifted travel northward (Miller 1968:Map 20).

The first utilization of southern Utah for permanent settlement arose from the colonizing efforts of the Mormon Church under Brigham Young's guidance. Late in 1849, an exploring party of fifty persons under the direction of Parley P. Pratt was sent to systematically explore the area south of Salt Lake Valley with an eye to locating favorable spots for future settlement. The overall idea was to establish a chain of forts from Salt Lake City to the Pacific Ocean, A "Mormon Corridor", to link the church settlements near the southern California coast with the heartland of the Salt Lake Valley (Arrington 1958:86).

The key Utah colony in the corridor was established in the Little Salt Lake Valley at Parowan. A colony of 167 persons arrived there early in 1851. Parowan acted not only as a half-way station between southern California and the Salt Lake Valley, but as a source of agricultural products and support for the "iron mission" established later the same year at Cedar City. The 1849 exploration company had discovered a hill of rich iron ore at Iron Mountain in conjunction with thousands of acres of cedar trees which it intended to use as fuel. The colony at Parowan spawned numerous other southern Utah settlements during the 1850's and 1860's (Arrington 1958:86-87).

The Iron Mission at Cedar City, twenty miles south of Parowan, received strong support from Mormon church authorities. The development of natural resources in the core area of Mormon settlement was critical to the economic self-sufficiency which Brigham Young wished to achieve. During 1852, preparations were made for the colony and the iron works. A village was laid out, a fort constructed, a canal dug, and a cooperative farm planted. A vein of coal was discovered in Cedar Canyon and a road constructed to it, and a small blast furnace was constructed. On September 29, 1852, the first iron emerged from the furnace. A sample was dispatched for Brigham Young's inspection (Arrington 1958:122; Dalton n.d.:118).

In the meantime, Brigham Young had written to church leaders in Europe for the purpose of acquiring capital and experienced iron and coal workers to aid the efforts at Cedar City. The Deseret Iron Company was formed by these interests and they acquired control of the works in November of 1852.

The year 1853 saw the curtailment of work because of Indian hostilities and a devastating flood, and in 1854 it was necessary to construct a new blast furnace. During 1855, some production was obtained, but the creek froze late in the year for three months, denying the workers the necessary water supply. During 1856, a grasshopper plague brought near starvation, and in 1857, the danger of flood and the Utah Expedition against the Mormons curtailed work on iron production. In 1858, the furnace once again broke, and the inferior quality of coal obtainable at Cedar caused the iron mission to be abandoned. Most of the population of Cedar City turned from iron production to full-time farming and stock raising for their support (Arrington 1958:124-127).

Other early towns in this area, mostly settled by pioneers spreading out from Parowan, were abandoned and resettled several times because of the Walker War of 1853-1854 and the Black Hawk War of 1865-1867. Further Indian contentions arose with the Navajos, especially during the 1860's.

Another locus of early settlement in southern Utah was Kanab and the towns of Mt. Carmel, Orderville, Grafton, and Alton located in Long Valley in Kane County. This area was first peopled by pioneers who drifted from the harsh Dixie Mission in southwestern Utah, and members of the Muddy Mission in southeastern Nevada which had been recalled by the Mormon Church in 1870. When Jacob Hamblin passed through the area in 1858 on a mission to educate and convert the Moquis Indians east of the Colorado, he reported a new settlers dwelling in dugouts on what today is the western portion of Kanab. The first organized settlement occurred in 1864, the town serving primarily as a protective outpost for smaller communities. By 1866, the Indian situation had worsened to the point that Kanab itself was abandoned until 1870, when an infusion of settlers from the Cottonwood area in Salt Lake helped the colony take hold (Robinson 1970:6-7).

Long Valley above Kanab was permanently colonized in 1871 by the dispossessed pioneers of the Muddy Mission, although a few settlers were there as early as 1864. As in all of southern Utah, the earliest settlers were forced to flee to the more secure outposts of Cedar City and Parowan during the late 1860's. Indian hostilities could not be contained or controlled from a widely scattered series of weakly held positions. The subsequent resettlement by the original pioneers of Long Valley coincided with the movement into the area of the Muddy missionaries, and in most instances, a friendly molding of the two groups was achieved. Though most of the Muddy missionaries settled at Orderville, other groups chose to colonize Mt. Carmel and Glendale (Robinson 1970:302-303).

Many locations in Kane County were settled for their stock raising possibilities, although farming accounted for a number as well. An overriding problem with many locations in Kane County was water. Drought killed such towns as Georgetown, Clifton, Upper Kanab, Johnson, and Skutumpah. On the other hand, run-away erosion destroyed the towns of Paria and Adairville.

In June of 1852, a party of Mormon explorers from Parowan set out to evaluate the country between there and the Colorado River. They reported Panguitch Valley as a suitable place for fifty to one hundred families to settle and engage in the lumbering business (Golden Nuggets of Pioneer Days 1949:9). This report was not acted upon until May of 1864, when Jens Neilson and a party of pioneers reached the location of present day Panguitch. Because of the extreme altitude (ca. 6,600 feet above sea level) of the settlements in the Panguitch Valley, farming was not particularly successful. Most people directed their efforts to stock raising and establishing a strong lumber industry (Golden Nuggets 1949:9-11). The search for better locations for farming gradually led the pioneers of the Panguitch area to the east. The settlements of Tropic, Cannonville, Henrieville, Widtsoe, Henderson, Antimony, Clifton, Losee, Escalante, and Boulder were established during this probing for better farming and grazing lands.

As in all of southern Utah, water control has been crucial to the survival of most colonies. Drought drove the settlers out of Widtsoe, Losee, Clifton, and Henderson, while the difficulties involved with high altitude farming defeated the pioneers of Hillsdale and Asay Town (Carr 1972:122-125).

The primary supports of settlements in the SCP area during the past were cattle and sheep raising, lumbering, farming, and freighting. All of these industries underwent great growth during the time that the mines of southeastern Nevada and southwestern Utah were in operation, roughly 1864 through 1891. Since meat and farm produce were needed to feed the miners, and lumber was required for buildings and mine supports, local freighters carried most of the supplies to the mines. Over the passage of time, emphasis has shifted increasingly to the expansion of the tourist industry, although all the occupations of the pioneer past are still pursued.

Commercial mining has been almost negligible in the SCP area. The iron ore deposits of Iron County and the immediate area are presently being exploited by several companies, and two truck coal mines were in operation on the Kolob Terrace Coal Field as of 1975 (Utah Geological and Mineral Survey 1975:Energy Resources Map of Utah). Kane County saw some gold mining in the Paria and Hite regions during the period around 1900, but production never was significant. Extensive coal deposits of chiefly low grade coal are found in many parts of Kane County, most especially in the vast Kaiparowits Coal Field. However, only three small mines are presently active. The Harmony Coal Field lies in both Iron and Washington Counties, but as the coal has high ash content and a fine texture, no commercial mining has been undertaken. Garfield County has had gold and uranium mining in the Henry Mountains region, but not on a large scale. Part of the Kaiparowits Coal Field lies in Garfield County and awaits development of industry nearby to make commercial mining worthwhile (Utah's Mining Industry 1967).

Chapter 3

REPORT ON THE CLASS I SURVEY (RG-I)

Part A provides a series of site definitions used in the Southern Coal Project research process. Part B, Archival Research, details the activities of Research Group I (Rg-I) during the search for the 1,554 previously recorded cultural resource sites. This segment of the chapter is further subdivided into two general sections, each dealing with a specific aspect of the Class I research process. The first section is a general background on the research describing the tools and methods employed to accurately record the site data. This discussion is followed by a description of the sources utilized.

Part C is a history of archeological research in the Southern Coal Project area. This part of Chapter Three narrates chronologically the development of the archeological fieldwork which constituted the basis for much of the Class I research data.

The results of the Class I survey are provided in Part D. Here various categories of identified sites are explained in terms of inclusion in the report, cultural characteristics, and trends in site types. A general evaluation of site types and culture by planning unit is also discussed.

Chapter Three correlates with Appendix A, A Site Summary Table by Planning Unit, which lists all of the sites recorded by Research Group I. This table coordinates both historic and prehistoric sites with location, site type, and record repository.

PART A: SITE DEFINITIONS AND TYPES

For purposes of this report, a site is defined as any locus of human activity identifiable through either archeological techniques or through documentary research. A prehistoric site located in the field must contain a minimum of four flakes or associated artifact fragments within a five-meter radius. Further, a cultural resource is defined as any physical remains of human activity which was initiated or deposited prior to 1930. The identification of cultural resource sites, then, involves both temporal and spatial judgments as well as efforts to pinpoint the specific cultural originators of the sites through diagnostic artifacts or structures. To aid in the diagnostic and identification processes, it becomes necessary to classify various types of cultural resource sites according to the differing activities which took place at these locations. The following paragraphs will be devoted to an explanation of the differences between cultural resource site categories.

It was determined that all cultural resource sites should first be categorized on a cultural contact basis. Thus, Prehistoric Sites are those sites which indicate an absence of cultural contact with Euro American cultures. Protohistoric Sites include those sites whose artifactual associations include both prehistoric style tools and objects and artifacts acquired through trade with Euro American peoples. Historic Sites are those sites whose artifacts, structures, or documented history indicate they were established after the time of the first Mormon settlement of 1847. It is obvious that there can exist a definite temporal association between the three periods, thus the need arises for careful examination and evaluation of all diagnostic artifacts related to any given site.

The types of cultural resource sites which would be primarily of a prehistoric or protohistoric origin are explained below.

Lithic Scatters are the most numerous type of cultural resource sites encountered during SCP research. They are characterized by the presence of lithic tools, chips, cores, or flakes, and may vary in size from a radius of five meters to an area of several hundred meters. Lithic scatters are, of course, encountered throughout the entire temporal range of man's existence in the area.

Hunting Sites are located along game trails, in saddles, and near watering and grazing areas. They are indicated by the presence of projectile points, point fragments, secondary flakes, or retouched lithic chips exclusive of other cultural remains. They, like lithic scatters, occur throughout all time and cultural ranges.

Kill-Butchering Sites are distinguished from hunting sites by the predominance of butchering tools including knives, choppers, scrapers, utilized flakes, and sometimes the distal ends of broken projectile points which have been extracted from dead game.

Quarry Sites are locations where lithic material was mined for tool manufacture. Such sites show the presence of hammerstones, flakes, cores, core shatter, and sometimes unfinished tools.

Temporary Camps are non-architectural sites which were occupied over short periods of time usually by few individuals. They are characterized by hearths or fire pits, scattered tools, and occasionally small grinding tools and ceramics. Historic camps are typified by discarded historic debris and circular, rock-rimmed fire pits.

Extended Camps are also non-architectural and often indicate extensive occupation during a single period of time or repeated use through time. Extended camps often include rock shelters and can exhibit a great variance in size and complexity.

Single Habitation Sites are generally the locus of a family or small extended family living quarters. They are defined by artifacts and architectural features either on or below the earth's surface. These habitation structures vary from pit houses and kivas to elaborately walled surface structures.

Multiple Habitation Sites exhibit indications of occupation by multiple families either contemporaneously or through a span of time. The primary differences between single and multiple habitation sites lie in size and complexity.

Petroglyph Sites consist of figures that have been pecked or etched into rock faces, while Pictographs are forms of rock art that have been painted or otherwise applied to a common rock surface. Both petroglyph and pictograph sites are common throughout the study area.

Burial Sites range from scattered interments in shallow holes, habitation floors, or rock clefts to extensive cemeteries. Burial sites are often indicated by rock piles, mounds, burial offerings, and exposed human bone.

Rock Shelter Sites vary greatly in size, intensity of use, and function. Their size ranges from a small overhang which provides protection for one person from sun, wind, or rain to giant alcoves providing protection to a number of contemporaneous families. They vary in content from a small lithic scatter to complex architectural structures with walls, doors, and a full spectrum of household artifacts and debris.

Granaries are small storage shelters constructed of stone, branches, and mud. They frequently contain maize remnants and could also be used to store basketry, pottery, and grinding implements.

Cists, another type of storage structure, consist of subterranean storage pits usually lined with sandstone slabs. They may also contain food remnants and artifacts.

Though many types of historic sites are unique from pre and protohistoric sites, historic man engaged in some of the same types of activities as the earlier inhabitants of the Southern Coal Project area. Therefore, it is possible to discover such site types as hunting sites, quarries, temporary camps, extended camps, simple and multiple habitations, and burials in the historical context as well as in the prehistoric and protohistoric periods. The differences between these sites of similar types, but very dissimilar cultures and temporal ranges, lie in the artifact associations. Metal artifacts such as shell casings, metal knives, horseshoes, buttons, and wire, or various glass items are indicative of historic period activity while trade beads and lithic tools indicate a protohistoric context.

Other site types which are generally historic are cataloged below.

Mine and Quarry Sites include many possible evidences of man's attempts to exploit the mineral resources of the area. These include mine portals, mine service areas, mine transportation routes, overburden areas, and habitation areas.

Cabins are usually associated with either agricultural or livestock raising occupations and also occur in association with small-scale mining efforts.

Mills are indicative of ore, wheat, or lumber processing operations. In the Southern Coal Project area, the two most commonly found types of mills are sawmills and grist mills.

Kilns are usually associated either with mining development, i.e., charcoal and coke kilns or with construction, e.g., lime kilns.

Corrals, which were used for containing various kinds of livestock, are generally found in association with water resources and historic single habitation sites.

Wells include agricultural wells and oil, gas, or geothermal wells.

Roads and Trails provide a means of connecting multiple and single habitations with both natural and man-made resources. In certain cases, trails which originated in prehistoric times are presently in use by modern man and have often been upgraded into road and railroad systems having great economic value.

Railroads serve the same purposes as roads and trails, as a conduit for transportation and communication systems. However, because of the tremendous amounts of capital required to build and operate a railway system, their location frequently signals the presence of resources which can be exploited for profit.

Trash Dumps are an extremely useful type of cultural resource site in a diagnostic sense. It is possible to learn a great deal about a prehistoric or historic culture from the materials that man has discarded.

The final type of cultural resource that bears mention is the Isolated Artifact. Isolated artifacts occur throughout all temporal and spatial ranges and have been discarded by all cultures. Isolates are particularly valuable as they often are indicators of the existence of a particular culture at a specific location.

PART B: ARCHIVAL RESEARCH

General Background

The Existing Site Data Compilation for the Southern Coal Project explored many possible sources of information. Some sources yielded hundreds of recordable sites; others did not yield even one. The list of site sources checked includes: the Antiquities Section of the Utah State Historical Society, the Office of Historic Preservation of the Utah State Historical Society, the American West Center of the University of Utah, the Charles Redd Center of Brigham Young University, the State Office of the Bureau of Land Management, the Regional Office of the U. S. Forest Service, the Richfield and Cedar City District Offices of the Bureau of Land Management, the Richfield Zone Office of the Forest Service, the library of the Utah State Historical Society, the Anthropology Departments of the University of Utah and Brigham Young University, and the site files of the Archeological-Environmental Research Corporation.

The bulk of the information on the sites incorporated into the Class I survey was acquired from the card system and site report copies of the Antiquities Section of the Utah State Historical Society, about eighty percent of the sites being generated from this source alone. Other sources of site records which yielded significant numbers of sites were the State Office of the Bureau of Land Management, the Regional Office of the Forest Service, and the University of Utah Anthropology Department. In addition to the above-mentioned sources, short trips to the Richfield and Cedar City District Offices of the Bureau of Land Management and the Richfield Zone Office of the Forest Service enabled over 100 more recorded sites to be added to the compilation of data.

Sources Utilized

Sources which yielded smaller numbers of recorded sites or information of a clarifying or explanatory nature were: the Office of Historic Preservation of the Utah State Historical Society, the library of the Utah State Historical Society, the site files of the Archeological-Environmental Research Corporation, and the Department of Anthropology of Brigham Young University.

The American West Center of the University of Utah and the Charles Redd Center of Brigham Young University did not yield any sites for this project but are potentially useful sources for cultural resource survey work in other areas. These institutions have no ordered system of recording sites; their projected use would seem to lie in the realm of consultative agencies for specific problems encountered in future cultural resource surveys.

The Research Group I (Class I) crew consisted of research group members J. Dykman, H. Roberts, W. Howell, M. Jacklin, D. Lyon, and Research Group I Supervisor L. Drollinger. The crew members were assigned specified tasks within the larger framework of the Class I effort. These specific tasks took into account previous experience or contact with the individual agencies to be consulted and special employment situations as they arose. As a result, J. Dykman, holding an M. A. in Anthropology, consulted the records of the University of Utah and Brigham Young University Anthropology Departments. H. Roberts, a student in anthropology at the University of Utah and L. Drollinger were able to gain access to the Anthropology Department's records. L. Drollinger, through contacts previously established by the RG-I Director, Dr. F. R. Hauck, studied and recorded the information from the other institutions consulted.

Problems Encountered

The problems which RG-I had to deal with were numerous, time-consuming, and principally had to do with inadequate or insufficient information on the original site report forms.

The first problem encountered in the Class I research involved the reproduction of site form data: which method would provide the most efficient, yet effective, means of recording and compiling the great number of sites within the survey area? Because of concerns over logistics, handling, and cost-effectiveness, the best answer appeared to be in reproducing site report data onto site cards. The site cards provided a means of reducing bulky, hard-to-synthesize blocks of data into a concise series of coded numbers and letters. (See sample site card in Appendix B.) These numbers and letters were easily adaptable to tabulation and computation, a necessary function for determining concentrations of cultural resources and providing workable mitigation and planning procedures.

The problem of missing information is especially acute on site reports that were filed before the mid-1960's. For example, the location of sites was poorly reported on many of the older archeological reports. Such descriptions as "3 miles below Nutter's Ranch", made the accurate location of many important sites impossible. The lack of an accurate location caused insurmountable difficulties in determining the elevation of a site, the vegetation zone of the site, or the geological formation upon which the site rested. All these pieces of information are important in understanding the relation of cultural resources to environmental factors, a key in resource use planning.

Another type of valuable information frequently missing from site reports was the recording individual/institution. When both were available, they were recorded;

in the absence of either, the recording individual or institution, whichever piece of information was present, was recorded. In some cases, however, nothing was present for recording purposes.

In addition to the above, other types of information most frequently missing from site reports were designations of land ownership and usable geomorphological descriptions. When the first piece of information was not included, it invalidated some of the statistical uses for the site and necessitated a laborious cross-checking process to attempt to establish land ownership. If the geomorphological information was not present and there was no way to obtain this data from other sources, the possibility of relocating a site in the future will be greatly complicated.

The second major source of difficulty in compiling existing site data was the lack of a universal numbering system for all sites. The existing permanent Smithsonian numbering system has not been utilized by all the various agencies involved. In many instances, site reports exist that have never been given permanent Smithsonian numbers. This problem created a very confusing situation. Duplication of effort became very probable and frequent backtracking became necessary to maintain order in the recording of site data.

Another major problem has to do with the different systems used by contracting agencies to classify site data. Where the Utah State Historical Society uses a county-by-county system, the Forest Service records are organized by each forest unit. The Bureau of Land Management, while maintaining records in a manner similar to that of the Historical Society, actually orients its information on a planning unit basis, making it necessary to reorganize all the collected data into a similar system. This difficulty was relatively easy to correct, though it did consume a good deal of time for reorganization.

It is realized that the various agencies involved in maintaining site records have different functions to perform and, as a result, differing ways that they can use the records in their possession. However, it appears that if the permanent state site records system was employed by all agencies, future work would be much easier and exchange of data between agencies would be facilitated. One possible way of standardizing records consists of organizing all sites according to township and range figures, while assigning each site a permanent state number. Organization of sites by township and range would provide an unexcelled degree of flexibility when using site record information and would exclude no qualified agency or individual from making use of the common stockpile of knowledge.

Cultural Resource Site Record Systems

As was briefly mentioned in the preceding section, the site records systems of the various institutions consulted are organized differently (although the forms themselves are very similar) because of the different uses to which they are put. Some further elaboration on these systems follows.

The Forest Service maintains records of all sites which have been reported on Forest Service lands. Most of the surveys on Forest Service lands have been generated through land exchanges with other government agencies or sales of Forest lands for various uses. The Forest Service site records system is the most difficult to work with for someone who is not thoroughly familiar with the system. The sites are organized by different forests (i.e., Manti-LaSal, Dixie, etc.) and given a Forest Service site number. During the course of this process, permanent Smithsonian site numbers are infrequently assigned.

The Bureau of Land Management has records that are broken down according to counties and further organized on a numerical progression system according to permanent Smithsonian site numbers. Because of this organization system, BLM site records relate well with the site records system employed by the Antiquities Section of the Utah State Historical Society. Recording of site data is no problem here until all information has been gathered; then the dual aspect of the BLM's records system comes into focus. All information gathered under the "county" system must be redirected into Bureau of Land Management planning units which are based on various geographical and physical determinants.

The records system most frequently encountered during the existing site data compilation was the county-by-county permanent Smithsonian site numbering system administered by the Antiquities Section of the Utah State Historical Preservation Office. The permanent Smithsonian site numbering system is available to all individuals qualified to do cultural resource survey work in Utah. It constitutes the only all-inclusive system for the recording and registration of cultural resource sites in the state and is of great importance because of that fact. The major difficulty in utilizing this system lies in its filing of all site reports by numerical sequence rather than by township and range locations which would be easier to utilize during a records search.

All other records systems for compiling site data were adaptations of the system employed by the Historical Society and, therefore, no further mention of those systems is necessary.

PART C: PREVIOUS ARCHEOLOGICAL RESEARCH IN THE PROJECT AREA

A search of the available archeological literature was conducted in order to identify those cultural resource sites within the Southern Coal Project area which have been previously recorded and, in a few cases, excavated. Those reports were also reviewed in order to determine the intensity of survey throughout the project area.

Excavation reports cited include all excavated sites as of the end of the field season, 1977, while published survey reports include most of those projects reported by September, 1977. Several known survey reports, specifically those originating at the Museum of Northern Arizona and from the International Learning and Research Inc. were not available during the preparation of this report, but are referenced in the bibliography.

The history of archeological research in the Southern Coal Project area can be divided into two main phases, with the initial period being concerned with museum collections and site inventory. This period begins with Judd's work in 1915 and extends to the inception of the Glen Canyon Project in 1957. The second phase begins with the survey and archeological work of the Glen Canyon Project and extends to the present. This second phase can be divided into two parts. That work accomplished by the University of Utah primarily in salvage archeology is superseded by a cross cutting current of recent research that reflects the increasingly growing demand for industrial development archeology which negates the control of the area by the University of Utah. Rather, controlling agencies are financing archeological surveys without regard to institutional affiliation resulting in an array of contracting archeologists working in the area, thus the report literature exhibits this diversity.

The initial phase of archeological research in the area, which can be considered explorative, was begun by Neil M. Judd from 1915-1919 (Judd 1926). Judd excavated several of the 50 mounds he noted at the mouth of Red Creek in Iron County uncovering the remains of various house types in addition to lithic and ceramic artifacts. He also reported mounds and rock art of various types at the town of Parowan. Additionally, Pueblo materials were recorded in Cottonwood Canyon, Johnson Canyon, and Kanab Creek in Kane County. Judd's work in the region was continued in behalf of the Bureau of American Ethnology and reported in 1926 under the title, "Archeological Observations North of the Rio Colorado."

Noel Morss followed Judd with his 1928 to 1929 excavations at the Coombs Village Site. Three burials, ceramics, and lithics were recovered. An additional architectural site west of Boulder was also explored and reported to be of PII-PIII or "Proto-Kayenta" affiliation. Nineteen additional sites, including Image Cave, were located in the Dry Bench-Pleasant Creek area, most of them being assigned to the Fremont culture (Morss 1931).

Julian Steward reported 142 sites in the canyons between Kanab and the Paria River, with major densities in Johnson and Johnson Lakes Canyons. The majority of those sites fall within the Vermilion Planning Unit with the remaining portion in the Paria Unit. Rock art sites, rock shelters, and architectural features were reported (Steward 1941). In addition, Steward recorded 28 sites on both banks of the Colorado River, including rock shelters, rock art, and architectural features.

In 1933 and 1934, excavations were carried out in Zion National Park just outside the SCP area by Grater and Wetherill and later reported by Schroeder in a report titled, "Archeology of Zion Park" (1955). Survey and excavation activity occurred also in southwestern Utah and northwestern Arizona.

A brief survey of the Glen Canyon was conducted by Gene Foster (1952) with four sites recorded at the mouth of Rock Creek, two at Halls Creek, and one at the Escalante River. A total of 18 sites was recorded for the Museum of Northern Arizona. Foster also reported on the rock art of the Glen Canyon, giving details of 15 sites (Foster 1954). Four of those fall within the SCP area, two at Rock Creek and two on the Escalante River.

Additional excavation work was performed in the Paragonah area of Iron County by C. W. Meighan (Meighan et al 1956). Two mounds and two burials were excavated with two periods of use postulated on the basis of ceramic typology. Snake Valley Gray, Snake Valley Black on Gray and Snake Valley corrugated types were recovered. In addition, a pit structure was excavated at the Robinson site near Paragonah.

The second phase of archeological research in the SCP area began with the granting of survey and excavation contracts to the University of Utah and the Museum of Northern Arizona in 1957. The period can be characterized as intensive reconnaissance and salvage work. The University of Utah, under the initial guidance of Robert Lister (Fowler et al 1959:5) performed survey and excavation in those parts of the Glen Canyon included in the SCP project area (Jennings 1966). Lister reported on the initial survey of the salvage project of 1957 (Lister 1958) covering an area from the dam location to the Escalante River at Steve's Canyon and along the west bank of the Colorado River. A total of 105 sites were discovered; analysis of the ceramics revealed a strong Pueblo II and Pueblo III occupation, with minor amounts of intrusive Fremont and Kayenta ceramics. Testing and excavation of selected sites were undertaken from July through October, 1957.

With J. D. Jennings as Project Coordinator, Don Fowler and others conducted extensive archeological work from June to September, 1958 (Fowler et al 1959). The main stream survey covered an area from eight miles north of the San Juan River to Lees Ferry. Some 95 sites were recorded, 38 of which fall into the SCP area. A total of 14 rock art sites, five prehistoric trails, four historic mining sites, and one Navajo hogan were identified, the remainder of the sites being lithic scatters (14).

The Glen Canyon Right Bank Survey, completed under Robert Lister in the summer of 1958 (Fowler et al 1959), covered the area from Halls Creek on the south to the Dirty Devil River on the north. Sixteen sites were recorded at Halls Creek and twelve at Bullfrog Creek. Three sites were discovered at Hansen Creek as well as a prehistoric foot trail of hand and toe holds. Smith Fork had one site. The Warm Spring locale contained no sites, as was also the case with Ticaboo Creek, Four Mile Canyon, and Two Mile Canyon. Trachyte Creek revealed 13 sites, with the North Wash and the Dirty Devil confluence each having one site. The 48 sites recorded by Lister indicated a short seasonal occupational pattern of late Pueblo II to Pueblo III Kayenta Anasazi cultural affiliation. Limited Virgin and Fremont influence was again noted.

James Nichols directed an extended survey of the west bank of the Glen Canyon from June to August 1958 (Fowler et al 1959). The area of work was the Escalante Desert and the south side of the Kaiparowits Plateau. Some 179 sites were located, including 98 campsites, a number of which were associated with rock shelters. A total of 16 sites contained architectural features, with six others listed as rock art and two as prehistoric trails. The remaining eight sites were not classified. No Numic or Navajo period sites were recorded despite this being the main purpose of the project. Again, the heaviest cultural influence revealed was of Pueblo II and Pueblo III cultures with limited Fremont influence evident.

During 1958 and 1959, a crew led by Don Fowler surveyed areas between the San Juan River and Hite and recorded eight sites within the present boundaries of the SCP (Fowler et al 1959).

Robert Lister, during another facet of the Glen Canyon Project, began the excavation of Coombs Village near Boulder, in 1958 and completed excavation in 1959 (Lister, Ambler and Lister 1959-1961). A total of 77 surface rooms were discovered including ten pithouses, fourteen burials, and a ramada. Portable artifacts included ceramics, lithics, and basketry. Pottery was predominantly a local Virgin type named Coombs Gray with Kayenta and Fremont ware also being recovered. The site was dated by ceramic cross dating of known types which indicated an occupation growth occurring at 1100 A.D. An additional twenty eight sites were located within a one and one half mile radius of the Coomb site, including five habitations, eight camps, and 15 lithic scatters.

James H. Gunnerson discovered 255 sites on the Kaiparowits Plateau, an area surveyed as part of the Glen Canyon Project (Gunnerson 1959). The main occupation was found to be of Pueblo II and early Pueblo III affiliation and was judged to be agriculturally based with possibly a heavy population density.

In 1958 William Lipe led excavations at twelve sites in the eastern drainages of the Glen Canyon area (Lipe 1960). With the exception of Loper Ruin, which showed a strong Mesa Verde influence, the remainder of the culturally affiliated sites showed a strong Virgin-Kayenta association.

Lipe continued excavations in 1959 in areas outside of the Southern Coal Project area (Lipe et al 1960).

During 1961, sites in the Harris Wash area and parts of the Kaiparowits Plateau were excavated by the University of Utah as part of the Glen Canyon Project. On the Kaiparowits Plateau, 11 sites were tested and excavated. The majority revealed a heavy Kayenta influence with Fremont and Virgin trade sherds (Fowler and Aikens 1963).

During the 1961 field season, Harris Wash of the Escalante River was intensively resurveyed with 16 additional sites recorded. Previous survey work had been done by Suhm (1959) and excavation by Lister (1960). All sites are in Garfield County and within the boundaries of the SCP. Four sites were excavated and one tested out of the 48 recorded sites in lower Harris Wash. Only two of those were determined to be habitation sites, the remainder being rock art, trails, and chipping scatters. Fremont and Anasazi ceramics were both recovered with indications that Fremont activity may have been more intensive, a postulate that is contradictory to the primary relationship between these cultures as demonstrated by previous and subsequent research.

In addition to the survey and salvage reports noted above, a series of related projects were undertaken in conjunction with the Glen Canyon Project. Based primarily on the ceramic remains of the area, Florence Lister (1964) published an interpretation of the nature of Fremont and Virgin/Kayenta interaction in the Kaiparowits region.

C. Melvin Aikens under an NSF Grant excavated eight sites in the Zion and Saint George area (Aikens 1965). Two sites--Bonanza Dune and Sand Hill--fall within the SCP boundaries. All sites reflect a Virgin/Kayenta ceramic association with Pueblo II and Pueblo III affiliation. Limited Fremont intrusive wares as well as Shoshonean ceramics were also recovered.

The ethnographic nature of the Glen Canyon area was supplemented by two publications. Euler and Sweeney reported on their investigations of southern Paiute prehistory in the Glen Canyon salvage area (Euler and Sweeney 1963). A total of 38 sites and three burials were recorded, eleven of which had Shoshonean ceramics present. The University of Utah published Isabel T. Kelley's 1933-34 work, "Southern Paiute Ethnography" in 1964 as part of the Glen Canyon series. The work synthesizes ethnographic collections prior to 1932 and discusses accounts of the Kaibab, Panguitch and Kaiparowits bands, all of which had territorial areas within the SCP. Historical site evaluation was an integral part of the Glen Canyon Project with a noteable contribution being made by Gregory Crampton (1959). He has recorded 118 historic sites between the dam location and the Dirty Devil River and has provided information on the use of Glen Canyon during the Navajo/Numic and Historic periods. Other topics include information regarding Mormon history, early exploration, and gold mining. Crampton also reported on additional historic activity as related to the Glen Canyon Project (see Crampton 1960, 1962, 1964a, 1964b). Concurrent with the University of Utah's work in Glen Canyon, the Museum of Northern Arizona was conducting work in the region. However, the focus of their work was on the east bank of the Colorado River and the tribal lands around the San Juan River and thus outside the SCP boundaries. Twenty three sites that fall on the west bank were given Museum of Northern Arizona numbers and one of these, Wildhorse Alcove (NA2691) was excavated and reported (Long 1966).

Two additional publications from the Museum of Northern Arizona on the Glen Canyon Project are of note. Christy Turner (1963) provides an evaluation of the rock art of the Glen Canyon area and C. Melvin Aikens, in an attempt to specify the relationships between Virgin and Kayenta groups in southern Utah, published a comparison of the two archeological groups based primarily on shared trait lists (Aikens 1966). Aiken's work was found to be useful in dealing with the archeology of the SCP region in the preparation of the present report.

Jennings published his "Glen Canyon: A Summary" in 1966 as a summation and review of the Glen Canyon Salvage Project (included are discussions as to the merits of salvage archeology as opposed to problem archeology). The work provides a good summary of the archeology, geography, geology, and historic aspects of the area.

William J. Adams' publication (1960) entitled, Ninety Years of Archeology in Glen Canyon, provides a brief summary of early explorations and their purpose. Site locations are included and keyed to research projects dating from the time of the Powell Expeditions to the mid-twentieth century.

With the termination of the Glen Canyon Salvage Project, the pace of archeological work in the area slowed and reverted back to traditional problem archeology for a short period. The Nevada State Museum published a progress report at the Evan's Mound Site in Summit, Utah (Alexander and Ruby 1962). The main mound, 280 by 80 feet, was tested in 1959, 1960, and 1962 by the UCLA field school. Architectural features as well as a burial were uncovered. Ceramics were primarily of the Snake Valley type and agriculture was evidenced by the presence of corncobs and permanent habitations.

Evan's Mound received continued attention from the University of Utah. Michael S. Berry published "The Evan's Mound Site: A Special Report" in 1970. As a result of further excavation, Berry emphasized possible models of subsistence for the Fremont and speculated on the abandonment of Utah by the Fremont. In an additional report (Berry 1974), he synthesized the UCLA and SUSC excavations at Evan's Mound. Perry has attempted to derive a model of cultural adaptation in relation to the environmental parameters of the locality. Berry postulates that agriculture gradually became unproductive and the Fremont were forced to compete on a hunting and gathering level with the contemporary Numic groups.

The Median Village Site (42In124) provided the basis for excavation and elaboration of the Fremont problem (Marwitt 1973). Excavation occurred in 1968. An attempt was initiated to clearly define the cultural variants and their attributes. Additionally, the approximate dates for Fremont ceramics were given in order to facilitate cross dating by ceramic types.

A period of industrial development archeology began in the 1970's. An in-depth report of all work done is not possible since many of the reports are not generally available or have not been fully completed.

The year 1974 can be used as the beginning year for industrial development archeology in the project area. James Bradford of the Museum of Northern Arizona (Bradford 1974) reported on 14 sites in the Paradise and Four Mile Bench localities of Kane County. Approximately five of those sites were considered Anasazi with the remaining nine of unknown cultural affiliation. Another contract by the Museum of Northern Arizona in Kane County performed for the Utah International Inc. (Davidson et al 1974) initiated clearance investigation for coal development. A total of 17 sites was recorded including those of Archaic, Fremont, Virgin/Kayenta, and Shoshonean cultural affiliation.

Also in 1974 during a brief survey to provide an archeological clearance for Southern California Edison, Roy Hunt (Hunt 1974) of the Museum of Northern Arizona recorded four sites in the Wahweep Creek and Horse Mountain localities of Washington and Kane Counties. All sites were of unknown cultural affiliation.

The Kaiparowits Limestone Project in John's Valley was surveyed by the Museum of Northern Arizona in the summer of 1974 for the Utah International Inc. (Davidson 1974). Some 18 sites, including lithic scatters, rock shelters, and one habitation site, were recorded. Ceramic and lithic analysis revealed the presence of Fremont, Virgin/Kayenta, and Shoshonean cultural activity.

R. H. Thompson of International Learning and Research Inc. of Cedar City, Utah, conducted an archeological survey on 2,082 acres in the Dry Valley Alvey Wash and Henrieville area of Utah for a BLM seeding project (Thompson 1975). Some three lithic scatters were discovered on the Dry Valley acreage with five sites being located in Alvey Wash. One site was identified as late Archaic based upon a possible Elko point with the remainder being of unknown cultural affiliation.

A cultural resource inventory of the Skutumpah Terrace was conducted by R. H. Thompson of International Learning and Research (Thompson 1977). Two Virgin/Kayenta camps, one historic sweathouse, and eleven unaffiliated lithic scatters were recorded. Possible Archaic occupation was documented by diagnostic projectile points.

AERC conducted a brief surface survey for the Consolidated Coal Company on the Kaiparowits Plateau (Hauck, in preparation). A total of seven prehistoric sites were recorded in the survey, consisting of one multiple habitation, two temporary campsites, and four lithic scatters.

Thompson also recorded additional sites in the SCP area, but as the reports are not available, no discussion of those sites is presently possible (Thompson 1975b, Nielson and Thompson 1977). Similar work done by Ing (1972) and Ing and Boynton (1972) is known, but the location and nature of those sites recorded are not presently available. References to additional work by the Museum of Northern Arizona are known, but those data have not been received from the Museum of Northern Arizona as of publication.

PART D: RESEARCH RESULTS

The total number of previously recorded sites in the project area is 1,554. Included in this total are 295 sites without complete legal descriptions. Many of these sites were located relative to natural landmarks. Using these landmark descriptions AERC was able to tie 237 of these 295 sites into respective planning units. Fifty-eight sites have township locations or were assigned one utilizing the original author's landmark description. Excluded from these total number of previously recorded sites were 53 sites lacking any form of decipherable location description.

In Appendix A sites are tabulated and listed under four categories. Each category corresponds to the degree of completion of each site's location description. Category 1 includes all sites recorded with complete legal description and also all sites with township, range, and sections noted but lacking specification on quarter sections.

Part 2 includes sites with township and range descriptions only while category 3 includes those sites located within specific planning units. The sites listed in category 4 include all those of unknown location which may be in the project area. These four categories correspond to the four divisions noted by planning unit Appendix A.

These categories were created to bypass difficulties associated with locating these sites onto Figures 3-2 through 3-8 and Figures 4-2 through 4-11. Figures 4-2 through 4-11 are separate planning unit maps illustrating both Class I and II sites. It should be pointed out that the squares designating the Class II sample areas are mapped as sections rather than quarter sections due to the spatial limitations on each map. Figures 3-2 through 3-8 are visual repesentations of site locations according to cultural affiliation.

SOUTHERN COAL PLANNING UNITS

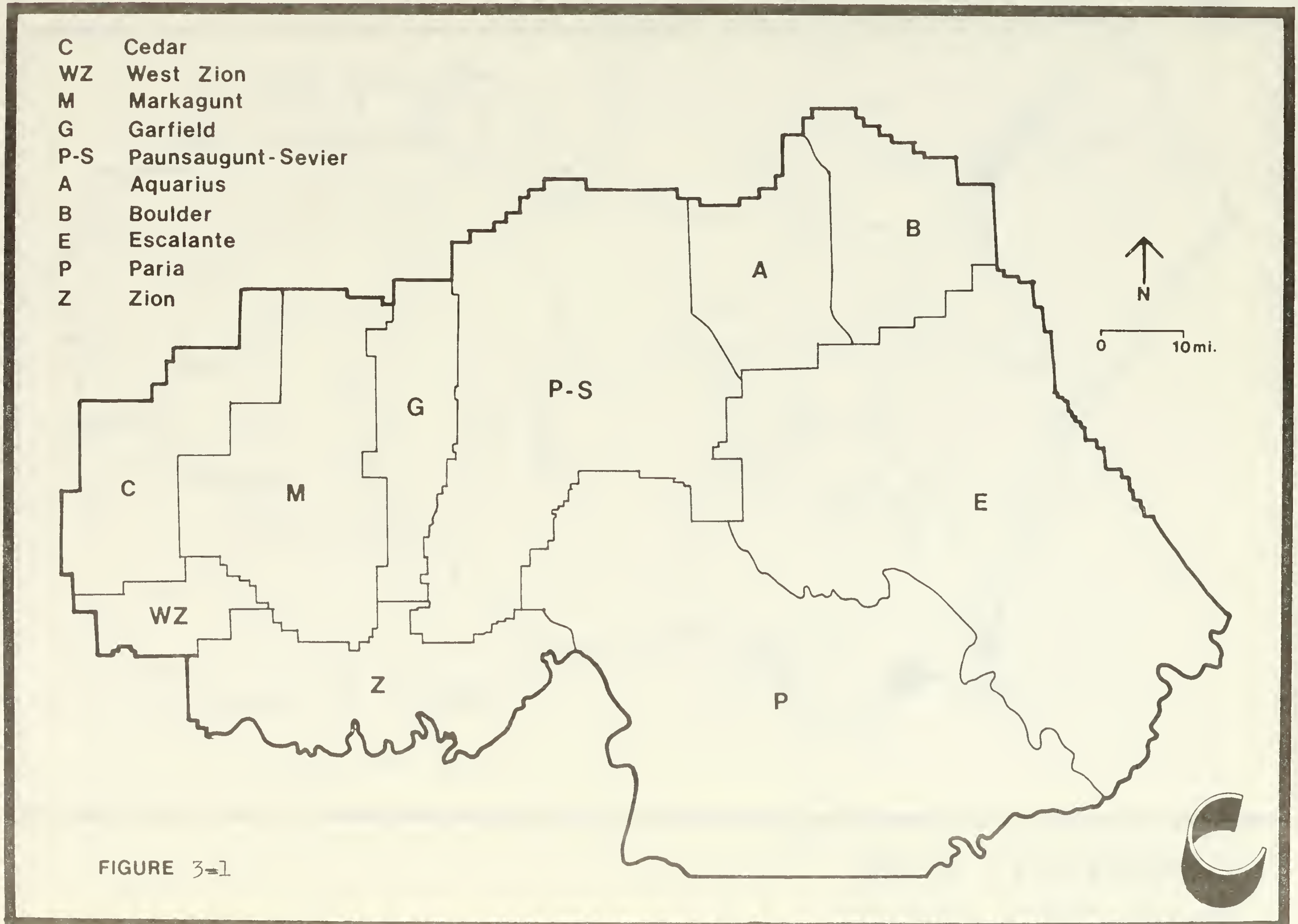


FIGURE 3-1

TOTAL CULTURAL SITE LOCATIONS

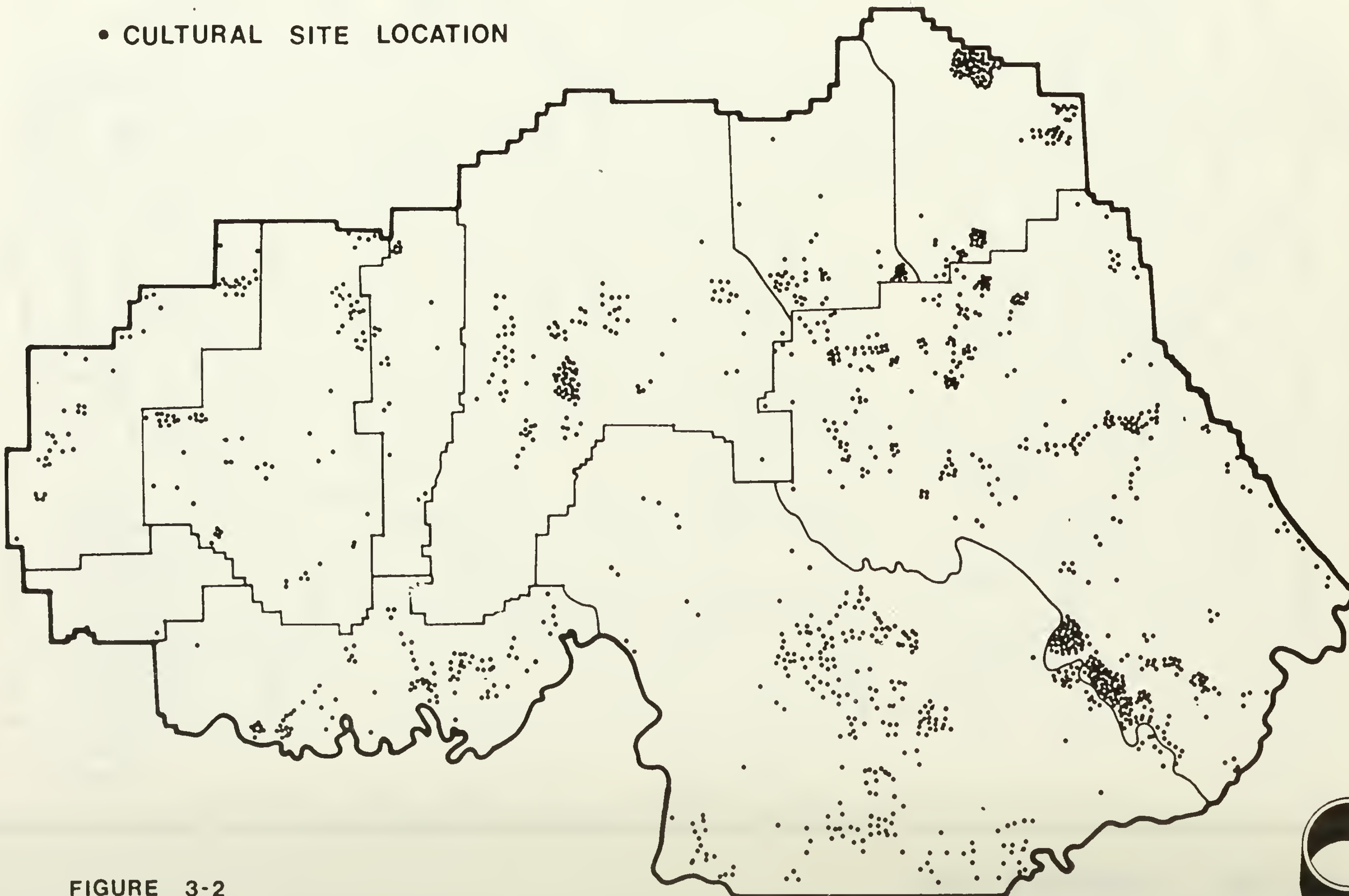


FIGURE 3-2

UNKNOWN-CULTURE SITE LOCATIONS

• CULTURAL SITE LOCATION

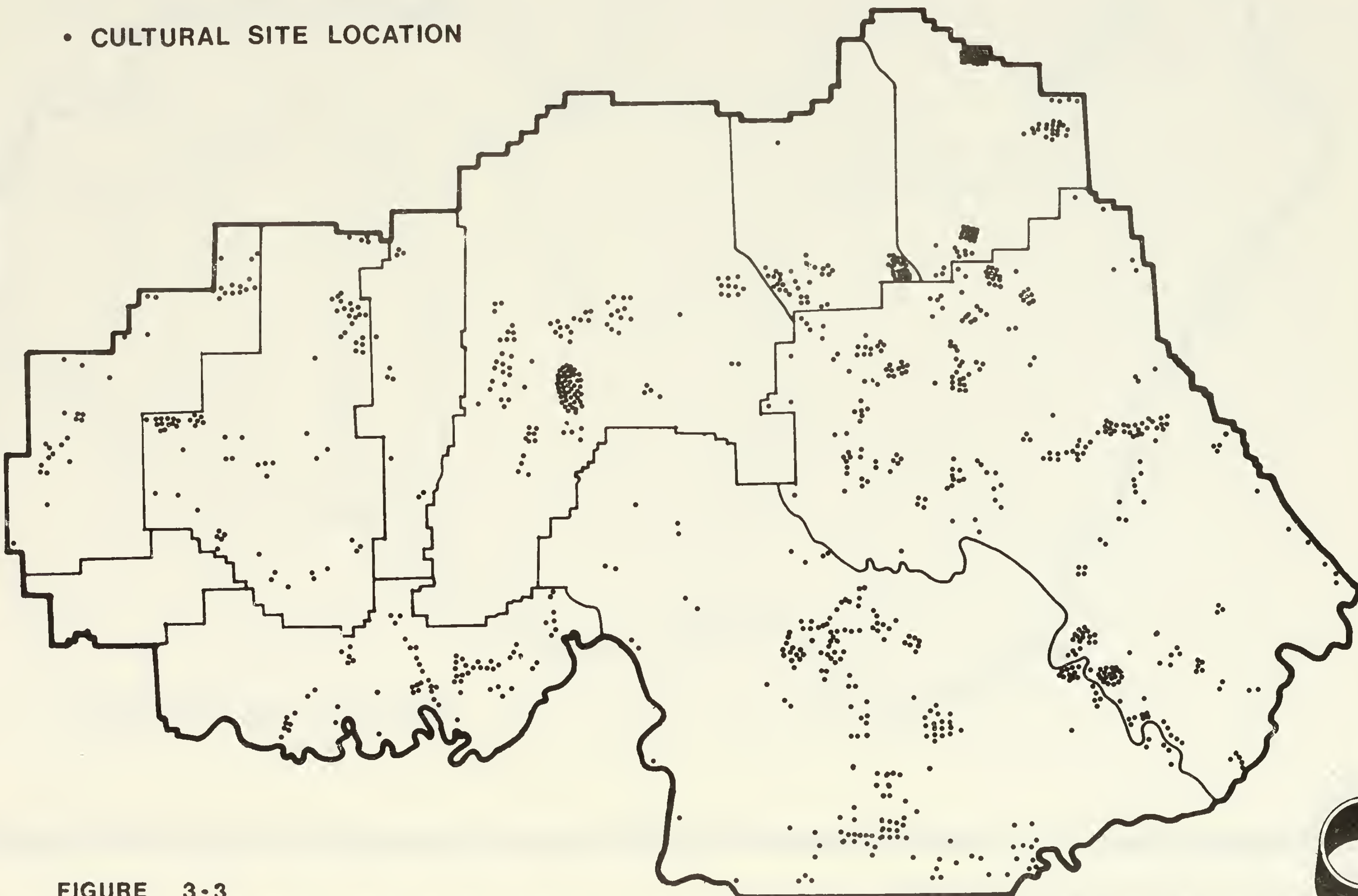


FIGURE 3-3

ARCHAIC SITE LOCATIONS

FIGURE 3-4

FREMONT
SITE LOCATIONS

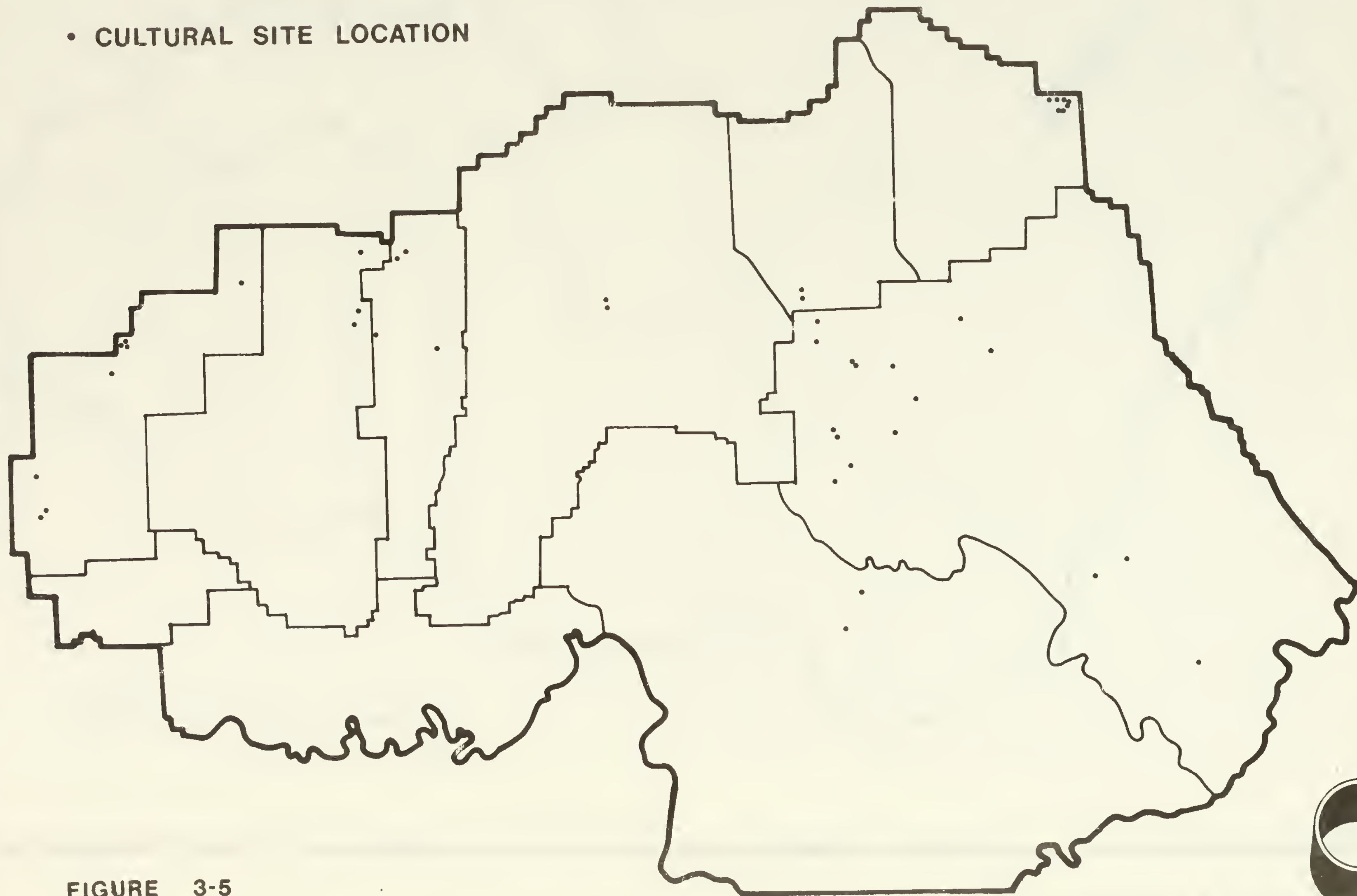


FIGURE 3-5

KAYENTA-ANASAZI SITE LOCATIONS

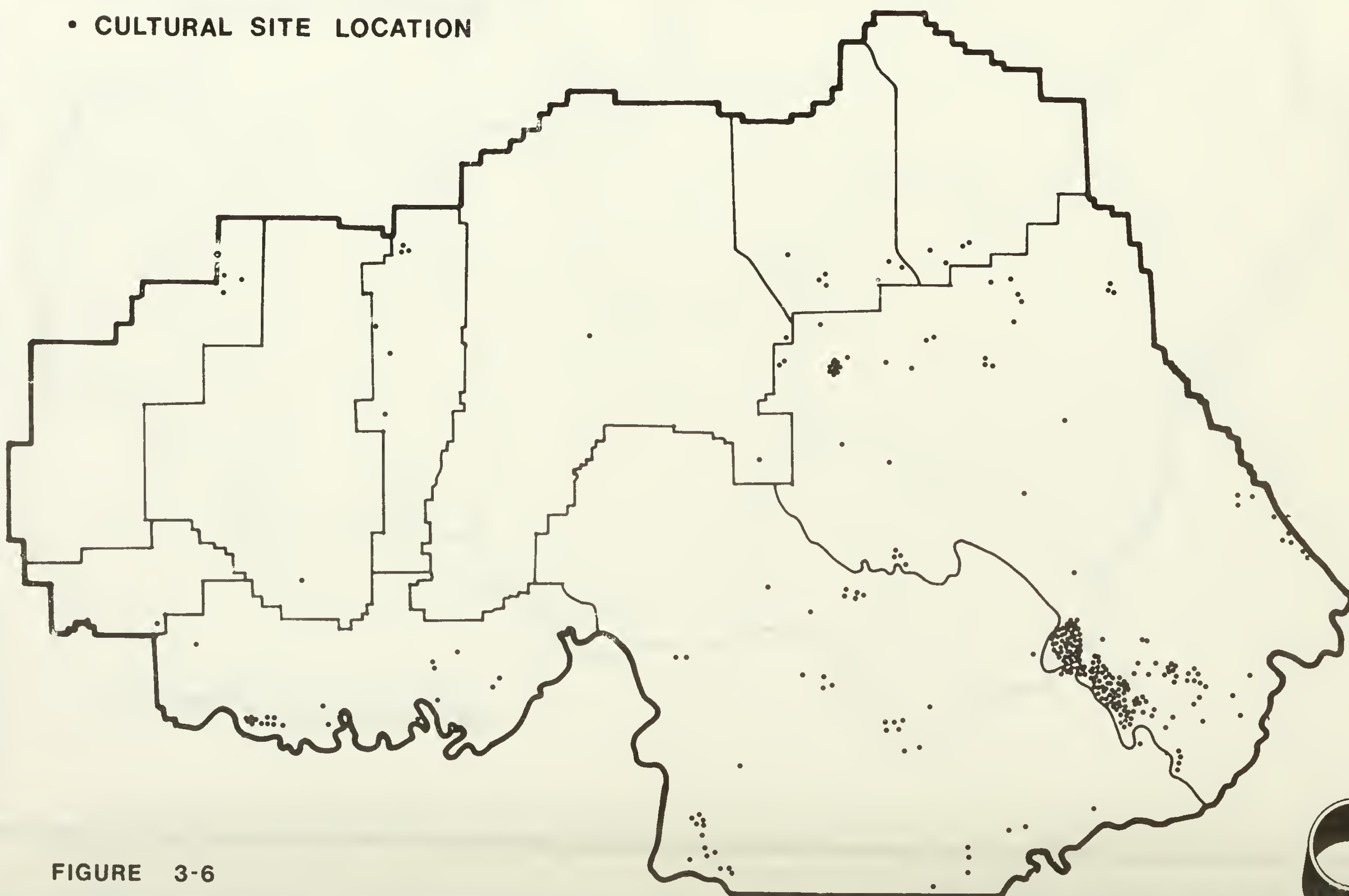


FIGURE 3-6

SHOSHONEAN SITE LOCATIONS

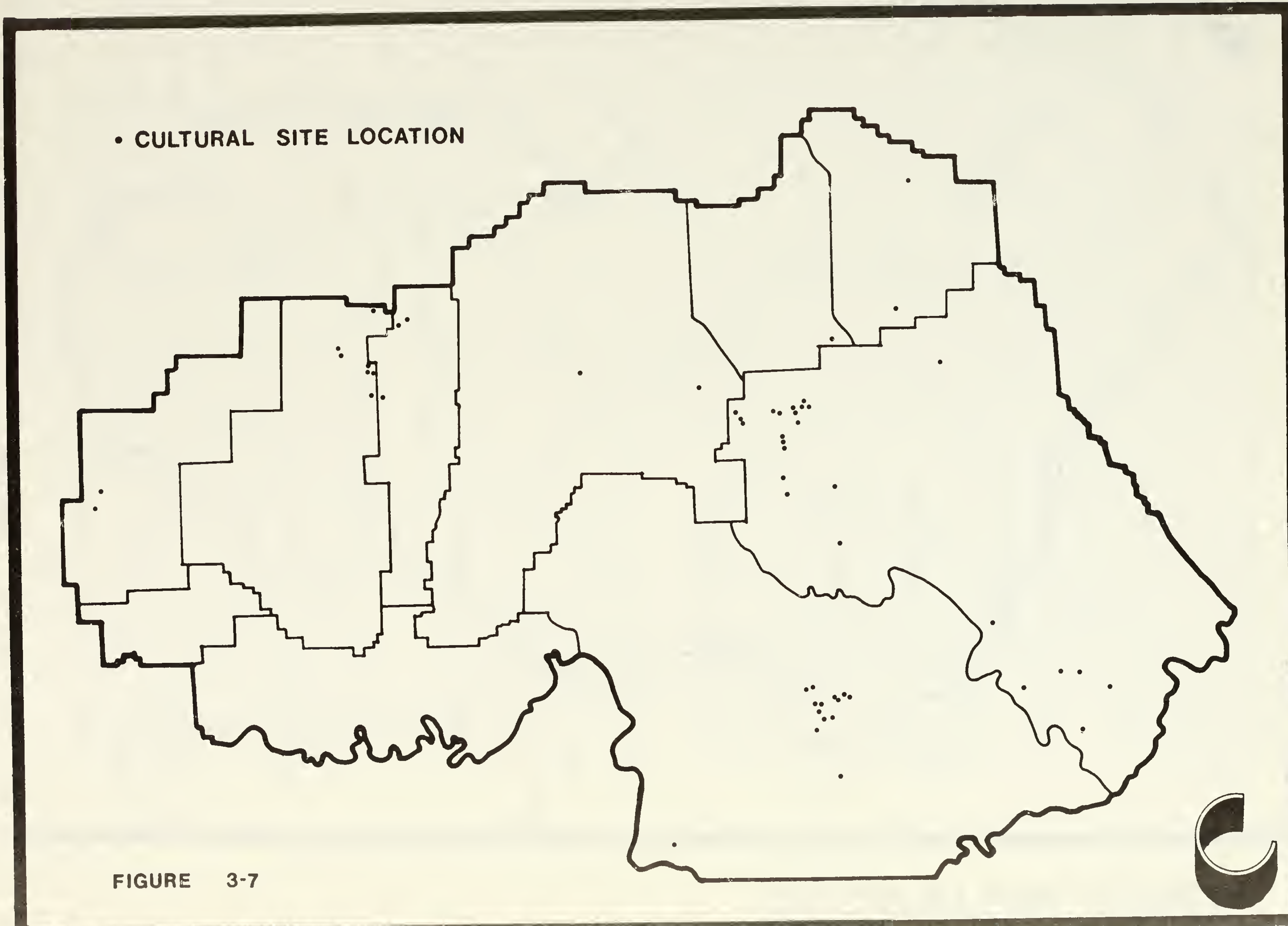


FIGURE 3-7

HISTORIC SITES AND OCCUPATION ZONES

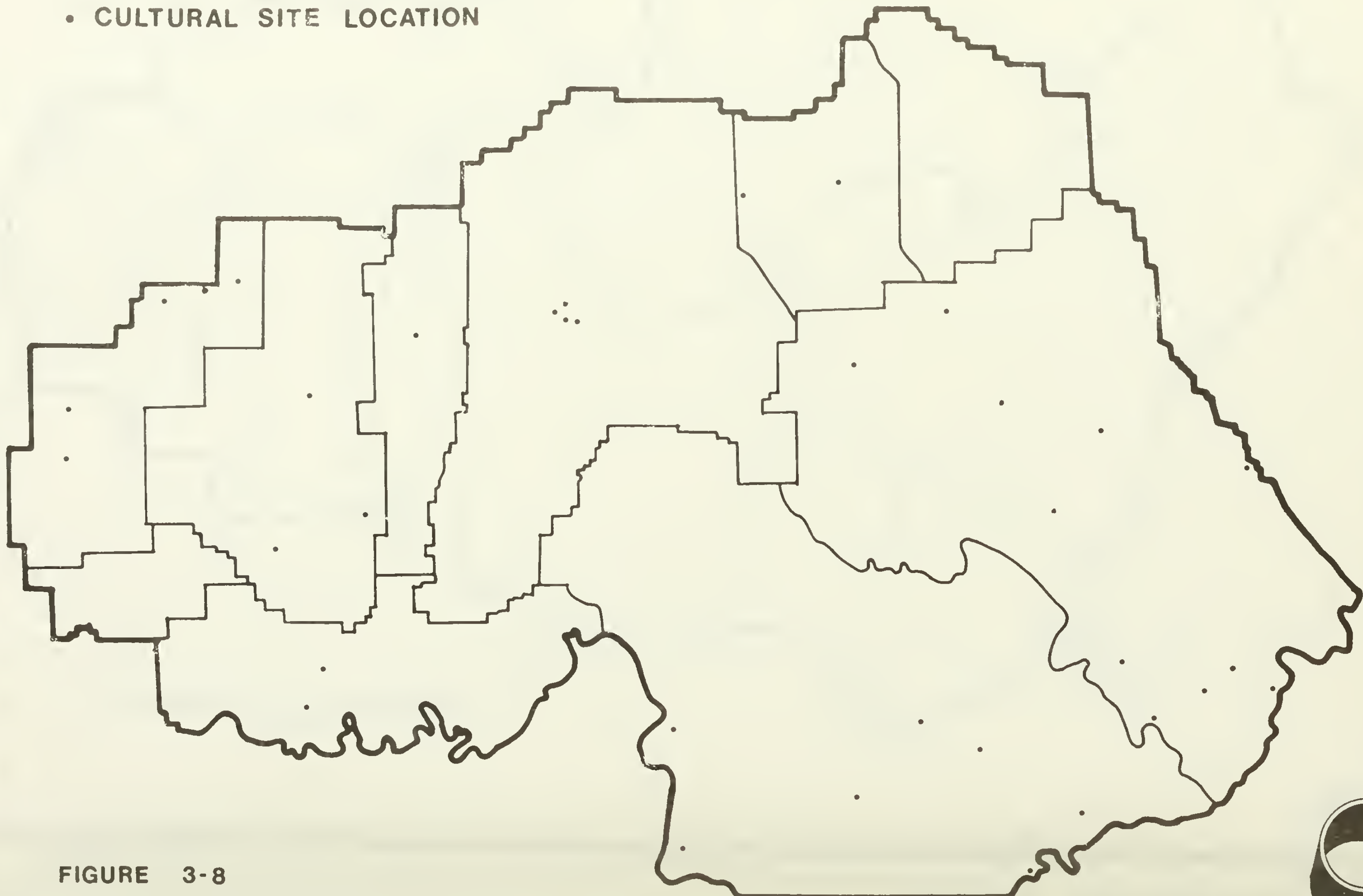


FIGURE 3-8

The difficulties incurred in mapping Class I sites which have incomplete legal descriptions are obvious. Consequently, only sites included in Appendix A category 1 are included in these Class I figures placed on the maps provided in Chapters 3 and 4. A few Glen Canyon sites, which don't have legal descriptions were plotted on Figure 4-3. This was done by referring to site locations shown on the Glen Canyon Series publication maps.

Historic sites are segregated from prehistoric and protohistoric sites to facilitate greater control over these separate temporal divisions. The number of historic sites total 33 and are defined in Table 3-1. Figure 3-8 illustrates the approximate locations of these sites. Five sites are actually trails but were plotted as single points. Also included on Figure 3-8 is a Class II historic site in the Escalante River Planning Unit, discovered during the RG-II survey in sample area #1337. Historic sites are listed as category 5 in Appendix A.

Only one previously recorded site, 42Ka864, was relocated by AERC during the Class II survey. In the Escalante Planning Unit three sample areas (793, 20b, 19b) could contain relocated sites. Incomplete legal descriptions on previously recorded sites, precluded the location of duplications by AERC. Obviously, the 295 Class I sites lacking township and section locations could not be searched for duplication.

In the Escalante Planning Unit one previously located Class I survey site supposedly recorded in sample area 2349 was not found by the AERC crew who surveyed that sample area. Although the survey crew searched six rock shelters in this sample area for cultural evidence, the prerecorded rock shelter was not recorded. The crew chief believes that this earlier recorded rock shelter was actually in an adjacent quarter section where several rock shelters were observed from a distance, but not recorded by AERC.

HISTORIC Total Sites - 33

	Cedar City	Escalante
Site types:	3 Multiple Habitations 1 Historic Trail	1 Wagon Road 3 Multiple Habitations 3 Miscellaneous
Cultural Affiliations:	4 Anglo European	7 Anglo European
	Garfield	Paria
Site types:	1 Multiple Habitation	2 Multiple Habitations 2 Inscriptions 2 Mines 1 Bush Fence
Cultural Affiliations:	1 Anglo European	7 Anglo European
	Zion	Aquarius
Site types:	2 Multiple Habitations	2 Cabins
Cultural Affiliations:	2 Anglo European	2 Anglo European
	Markagunt	Paunsaugunt-Sevier
Site types:	2 Cabins 1 Inscription	1 Cabin 3 Campsites
Cultural Affiliations:	3 Anglo European	4 Anglo European
	More than One Planning Unit	
Site types:	3 Trails	
Cultural Affiliations:	3 Anglo European	

Table 3-1. Total of Reported Historic Sites in the Project Area by Planning Units.

Detailed site correlations revealed no similar discrepancy between RG-I and RG-II sites.

The majority of archeological sites which were previously recorded in the project area are located in the Escalante (698) and Paria (354) Planning Units. The Paunsaugunt-Sevier and Boulder Units had 160 and 110 sites, respectively. The remaining units vary between the calculated 78 sites in Markagunt and Zion and the 1 site demonstrated for the West Zion Unit.

The total numbers of various kinds of sites (not site types which incorporate total units within any given site) distinguished by earlier researchers include 605 lithic scatters, 23 hunting or kill-butchering sites, 10 quarries, 197 temporary camps, 75 extended camps, 165 single habitations, 121 multiple habitations, 32 petroglyphic or pictographic sites, 3 burials, 28 storage cists or granaries, 251 rock shelter sites, 14 miscellaneous sites, and 16 petroglyph sites associated with rock shelters. A total of 13 sites were unclassified.

The total number of culturally identified sites recorded during the records search include 10 Archaic, 35 Fremont, 372 Kayenta Anasazi, 51 Shoshonean, and 1 Navajo site. A total of 1,066, or 69% of the 1,554 sites were culturally unidentified by the earlier researchers.

The total number of various site types distinguished by previous recorders are listed in Tables 3-2 - 3-12 which are provided as a total for the entire project area and by each planning unit. The numbers of culturally identifiable and unidentifiable previously recorded sites are also listed. Included in these totals are sites with complete legal descriptions, those containing township only, and those where just the planning unit is known. The 53 sites of completely unknown location are not included on these tables, since they may not be in the project area.

Class I

TOTAL ALL PLANNING UNITS 1554 Total Sites

Unknown:	1085
Archaic:	10
Fremont:	35
Pueblo:	372
Ute, Shoshone, and Piute:	51
Navajo:	1

Lithic Scatter:	605
Hunting:	18
Kill-Butchering:	5
Quarry:	10
Temporary Camp:	197
Extended Camp:	75
Single Habitation:	165
Multiple Habitation:	121
Petroglyphs and Pictographs:	33
Rock Shelters:	251
Rock Shelters and Petroglyphs:	16
Burials:	3
Storage Cists (Granary):	28
Miscellaneous:	14
Unknown:	13

Table 3-2. Class I Survey Results of All Planning Units

Class I

CEDAR PLANNING UNIT - 47 Total Sites

Unknown: 32	Lithic Scatter: 9
Archaic: 0	Hunting: 0
Fremont: 9	Kill-Butchering: 0
Pueblo: 3	Quarry: 1
Ute, Shoshone, and Piute: 3	Temporary Camp: 7
Navajo: 0	Extended Camp: 1
	Single Habitation: 3
	Multiple Habitation: 6
	Petroglyphs and Pictographs: 6
	Rock Shelters: 5
	Rock Shelters and Petroglyphs: 7
	Burials: 0
	Storage Cists (granary): 0
	Miscellaneous: 1
	Unknown: 1

Table 3-3. Class I Survey Results of the Cedar Planning Unit

Class I

ESCALANTE RIVER PLANNING UNIT - 698 Total Sites

Unknown:	368
Archaic:	0
Fremont:	9
Pueblo:	298
Ute, Shoshone, and Piute:	23
Navajo:	0

Lithic Scatter:	99
Hunting:	0
Kill-Butchering:	0
Quarry:	4
Temporary Camp:	90
Extended Camp:	52
Single Habitation:	144
Multiple Habitation:	89
Petroglyphs and Pictographs:	12
Rock Shelters:	156
Rock Shelters and Petroglyphs:	16
Burials:	3
Storage Cists (granary):	14
Miscellaneous:	11
Unknown:	8

Table 3-4. Class I Survey Results of the Escalante River Planning Unit

GARFIELD PLANNING UNIT - 2 Total Sites

Unknown:	1
Archaic:	1
Fremont:	0
Pueblo:	0
Ute, Shoshone, and Piute:	0
Navajo:	0

Lithic Scatter:	1
Hunting:	0
Kill-Butchering:	0
Quarry:	0
Temporary Camp:	1
Extended Camp:	0
Single Habitation:	0
Multiple Habitation:	0
Petroglyphs and Pictographs:	0
Rock Shelters:	0
Rock Shelters and Petroglyphs:	0
Burials:	0
Storage Cists (granary):	0
Miscellaneous:	0
Unknown:	0

Table 3-5. Class I Survey Results of the Garfield Planning Unit

Class I

PARIA PLANNING UNIT - 354 Total Sites

Unknown:	270
Archaic:	6
Fremont:	2
Pueblo:	61
Ute, Shoshone, and Piute:	15
Navajo:	0

Lithic Scatter:	161
Hunting:	2
Kill-Butchering:	0
Quarry:	2
Temporary Camp:	54
Extended Camp:	18
Single Habitation:	6
Multiple Habitation:	10
Petroglyphs and Pictographs:	15
Rock Shelters:	71
Rock Shelters and Petroglyphs:	0
Burials:	0
Storage Cists (granary):	13
Miscellaneous:	0
Unknown:	2

Table 3-6. Class I Survey Results of the Paria Planning Unit

Class I

WEST ZION PLANNING UNIT - 1 Total Site

Unknown:	0
Archaic:	0
Fremont:	0
Pueblo:	1
Ute, Shoshone, and Piute:	0
Navajo:	0

Lithic Scatter:	0
Hunting:	0
Kill-Butchering:	0
Quarry:	0
Temporary Camp:	0
Extended Camp:	0
Single Habitation:	0
Multiple Habitation:	0
Petroglyphs and Pictographs:	0
Rock Shelters:	1
Rock Shelters and Petroglyphs:	0
Burials:	0
Storage Cists (granary):	0
Miscellaneous:	0
Unknown:	0

Table 3-7. Class I Survey Results of the West Zion Planning Unit

Class I

ZION PLANNING UNIT - 76 Total Sites

Unknown:	68	Lithic Scatter:	41
Archaic:	0	Hunting:	4
Fremont:	0	Kill-Butchering:	0
Pueblo:	7	Quarry:	0
Ute, Shoshone, and Piute:	0	Temporary Camp:	22
Navajo:	1	Extended Camp:	1
		Single Habitation:	4
		Multiple Habitation:	3
		Petroglyphs and Pictographs:	0
		Rock Shelters:	0
		Rock Shelters and Petroglyphs:	0
		Burials:	0
		Storage Cists (granary):	0
		Miscellaneous:	1
		Unknown:	0

Table 3-8. Class I Survey Results of the Zion Planning Unit

Class I

AQUARIUS PLANNING UNIT - 28 Total Sites

Unknown:	24	Lithic Scatter:	14
Archaic:	1	Hunting:	6
Fremont:	3	Kill-Butchering:	0
Pueblo:	0	Quarry:	0
Ute, Shoshone, and Piute:	0	Temporary Camp:	2
Navajo:	0	Extended Camp:	0
		Single Habitation:	2
		Multiple Habitation:	0
		Petroglyphs and Pictographs:	0
		Rock Shelters:	4
		Rock Shelters and Petroglyphs:	0
		Burials:	0
		Storage Cists (granary):	0
		Miscellaneous:	0
		Unknown:	0

Table 3-9 . Class I Survey Results of the Aquarius Planning Unit

Class I

BOULDER PLANNING UNIT - 110 Total Sites

Unknown:	101
Archaic:	0
Fremont:	7
Pueblo:	1
Ute, Shoshone, and Piute:	1
Navajo:	0

Lithic Scatter:	78
Hunting:	0
Kill-Butchering:	0
Quarry:	0
Temporary Camp:	12
Extended Camp:	1
Single Habitation:	3
Multiple Habitation:	5
Petroglyphs and Pictographs:	0
Rock Shelters:	9
Rock Shelters and Petroglyphs:	0
Burials:	0
Storage Cists (granary):	1
Miscellaneous:	0
Unknown:	1

Table 3-10. Class I Survey Results of the Boulder Planning Unit

Class I

MARKAGUNT PLANNING UNIT - 78 Total Sites

Unknown: 68	Lithic Scatter: 65
Archaic: 0	Hunting: 0
Fremont: 3	Kill-Butchering: 1
Pueblo: 0	Quarry: 2
Ute, Shoshone, and Piute: 7	Temporary Camp: 2
Navajo: 0	Extended Camp: 1
	Single Habitation: 2
	Multiple Habitation: 1
	Petroglyphs and Pictographs: 0
	Rock Shelters: 4
	Rock Shelters and Petroglyphs: 0
	Burials: 0
	Storage Cists (granary): 0
	Miscellaneous: 0
	Unknown: 0

Table 3-11. Class I Survey Results of the Markagunt Planning Unit

Class I

PAUNSAUGUNT-SEVIER PLANNING UNIT - 16C Total Sites

Unknown:	153
Archaic:	2
Fremont:	2
Pueblo:	1
Ute, Shoshone, and Piute:	2
Navajo:	0

Lithic Scatter:	137
Hunting:	6
Kill-Butchering:	4
Quarry:	1
Temporary Camp:	7
Extended Camp:	1
Single Habitation:	1
Multiple Habitation:	0
Petroglyphs and Pictographs:	0
Rock Shelters:	1
Rock Shelters and Petroglyphs:	0
Burials:	0
Storage Cists (granary):	0
Miscellaneous:	1
Unknown:	1

Table 3-12. Class I Survey Results of the Paunsaugunt-Sevier Planning Unit

Chapter 4

REPORT ON THE CLASS II SURVEY (RG-II)

This chapter provides in four parts the archeological information gathered during the surface reconnaissance of about 27,680 acres in nine planning units of the Southern Coal Project in southern Utah. The survey was carried out between September 1977 and early January 1978.

Research methods and field techniques are described in Part A. AERC's research approach, personnel, and operational details are defined. The final segment addresses the problems of site significance and provides evaluation of both the BLM and AERC's Forest site rating systems.

Part B is an evaluation and correlation of the research results obtained from the field work. Site densities within each planning unit and by sample area are provided. The newly found cultural resources in each of the nine planning units are described in conjunction with the specific environmental factors appertaining to each historic and prehistoric site.

The artifacts collected during the project are the focus of Part C. Here, general inventories are made of the lithic and ceramic artifacts associated with 190 of the 348 newly documented archeological sites.

The chapter ends with a discussion of cultural factors discerned from the Class II (RG-II) research effort.

PART A: RESEARCH METHODOLOGY

The Class II (RG-II) inventory methodology utilized during the Southern Coal Project recorded 348 newly discovered historic and prehistoric cultural sites. The research consisted of four sequential phases. Phase I included the preliminary research preparatory to entering the field and began with AERC's reception of sample area designations and working maps from the federal agencies. Weekly assignments of sample areas to each crew were based on coordination of crew and vehicle capabilities with sample areas. Certain crews and their vehicles were best able to survey samples located in the more difficult terrain. Crew assignments were made not only to facilitate the surveys but to headquarter each crew within a reasonable distance to each week's assigned areas in order to minimize travel time. Assignments for each week were made on the preceding Saturday by the RG-II Director, F. R. Hauck and by Asa Nielson, the Team Leader.

The second phase involved actual field work. AERC crews, upon receiving their assigned sample areas, would travel to the research locality and use topographic maps and compass bearings as a means of locating each sample area. Available section markers were recorded when found, and the crews would then set about surveying the assigned units by walking transects with each crew member spaced between five and twenty meters apart, depending on the terrain and vegetation. In open terrain having limited vegetation, crews would walk wider transects running parallel to the known section lines. Parallel transects along contours were utilized in more complex terrain. Limited access terrain presented special problems. Steep colluvial slopes were walked in transect whenever the terrain permitted while on the steepest, most dangerous slopes, crew members conducted spot checks of the alcoves and terraces that could be reached. Canyon walls were climbed only on talus slopes. In the few sample areas where vertical canyon walls precluded an intensive survey of the higher elevations, the canyon floors were carefully examined for cultural remains.

Upon the discovery of a historic or prehistoric cultural site in a sample area, the crew chief conducted an evaluation to determine the site's periphery and loci of activity. During this evaluation, the crew chiefs and their assistants recorded pertinent data on the site form, the site card, and on the topographic map while members of the crews took photographs and marked the location of diagnostic artifacts as directed. Only valuable or diagnostic artifacts were collected* during the survey period. The archeological collection will be deposited at BYU. At the conclusion of the site evaluation, a check was conducted to insure that no flagging or refuse was left on the site which would indicate its location to vandals.

Phase III of AERC's Class II methodology consisted of the laboratory evaluation period. During this phase, site forms, site cards, and maps related to the 348 newly discovered sites were edited, photographs and artifacts processed, and both cultural and environmental data were extrapolated from the record and placed into a system most conducive to computation and cross reference card retrieval. Environmental site cards (see Appendix B for copies of each recording system) was carefully edited and transferred to previously prepared tables and charts for control and coordination. Cross tabulations and Chi-square statistical evaluations were conducted utilizing these comprehensive tabular data packages which originated during the preparation of the earlier Central Coal Project which AERC completed in 1977 (cf Hauck et al 1977). In addition to the compilation of tabular information, staff members prepared special matrices, tables, and charts on all facets of the project as a means of

*The limited amount of artifacts collected precluded the development of frequency distribution tables.

maximizing an understanding of the data within the time and budget constraints presented by the contract.

The final phase of the project was the report preparation period in which the complex array of information was correlated, edited, and prepared for publication. For guidance toward an inclusive and viable product, AERC utilized the Central Coal Project Report format prepared during the summer of 1977. Each report updated the data base and aided the planning and compilation of the final reports. This Preliminary Summary Report, upon acceptance, will be transferred into the final investigative report. The final evaluation of the project's results which appear in Volumes II and III has been used to further clarify and enhance the project's Summary Report provided in Volume I.

PERSONNEL

RG-II field operations began on September 6, 1977. Three crews of four personnel each began the survey. The total team strength varied between one and three crews throughout the fall until January 6, 1978 when the field work was concluded.

Field personnel included Asa Nielson, Team Leader, with Casey Shumway, Alan Spencer, Samuel Kennette, Marian Jacklin, Michael Benson, Dean Schliesman, Justin Brydson, and Stephen Hayes as crew chiefs. Assistant crew chiefs included Casey Shumway, Marian Jacklin, Kayla Benson, David Lyon, Jeffrey Bentley, and Wes Carpenter.

OPERATIONAL DETAILS

Crew research efficiency was evaluated each weekend by F. R. Hauck and Asa Nielson through checking each crew's weekly summary reports, site reports, artifacts, and sample area data sheets. The RG-II director and the team leader also periodically worked with the crews in the field during the fall in order to insure quality control and to handle any logistic or administrative needs. RG-II logistics were handled by John Elwell, an employee of the Van Wagoner firm.

Every week, each crew completed between one and seven sample areas of 160 acres for a mean of four sample areas per crew per week over a fourteen-week period. Major factors which occasionally reduced the number of sample areas inventoried by any one crew in a given week included extremely difficult terrain, heavy site densities, vehicle breakdowns, and access problems across private lands.

SITE SIGNIFICANCE

Two evaluation systems were used as basic aids by the crew chiefs in assigning significance ratings to RG-II sites. On BLM administered lands, the Cultural Resource Evaluation System (CRES) was employed. This system is explained below. Sites discovered on National Forest lands were assigned an S-I through S-III rating depending on their quality of artifacts and cultural remains. AERC's Forest Service S-I rating is similar to the BLM S-1, while the S-II encompasses both the BLM S-2 and S-3 ratings. The lower, or least significant, AERC Forest rating of S-III is similar to the CRES S-4 rating.

Cultural Resource Evaluation System

S-1 "In general, S-1 sites show a clear potential for yielded, or have yielded, highly significant scientific/educational information, and are clearly important in terms of national, state, and local known use. Normally, the S-1 rating will be assigned to those sites that are in relatively good condition and are unique or representative, and/or have important associations, and display some of the qualities expressed in other criteria."

S-2 "S-2 sites are usually not particularly unique, representative, nor do they have important associations. The condition of the site usually is only fair. Such sites are commonly large, but do not have great antiquity and have only limited depth potential. Many abandoned aboriginal camps and villages, abandoned homesteads, small mining campsites, cemeteries, railbed roads, and trails will be S-2. Contemporary sites may become highly significant from standpoints of national, state, and local history and culture, but they cannot be clearly and immediately assessed as such. More historical perspective is needed."

S-3 "The S-3 rating indicates that the main worth of the site is its potential for contributing data toward solving larger problems, such as reconstruction of paleo-environments and human use patterns. Such sites commonly show little (if any) depth and very few features; they may have great antiquity but be very small, or they may be very large but show no great concentration of materials. Many seasonal aboriginal camps, hunting and gathering activity areas, isolated finds, etc. will be S-3. Dumps, isolated domestic and non-domestic buildings and materials, and small mining operations will often fall here."

S-4 "The S-4 rating is assigned only to properties that have minimal information-retrieval possibilities." (BLM Memorandum issued in 1977).

	General Sample Area Totals		Sites by Planning Unit			Sample Area Comparisons				
Column	1	2	3	4	5	6	7	8	9	10
PLANNING UNITS	Totals	Without Site	Previously Recorded Class I	Newly Recorded Class II	Totals	Site Density[1] Class II	With Sites Class II	Site Density[2] Class II	% of Planning Unit Area[3] Class II	Density Ranking[4] Class II
BLM										
Cedar	4	1	47	10	57	2.50	3	3.33	75.00%	ML
Escalante River	72	23	698	199	897	2.76	49	4.06	68.10%	M
Garfield	6	0	2	23	25	3.83	6	3.83	100.00%	ML
Paria	0	0	354	0	354	0	0	0	0	-
West Zion	1	1	1	0	1	0	0	0	0	L
Zion	10	2	76	21	97	2.10	8	2.63	80.00%	ML
U.S.F.S.										
Aquarius	17	5	28	53	81	3.12	12	4.42	70.60%	M
Boulder	3	0	110	24	134	8.00	3	8.00	100.00%	MH
Markagunt	15	11	78	8	86	0.53	4	2.00	26.70%	L
Paunsaugunt-S.	40	32	160	10	170	0.25	8	1.25	20.00%	L
Total	168	75	1554	348	1902	-	93	-	-	-
Overall Density (from totals)	-	-	-	-	-	2.07	-	3.74	-	ML
Percentage of Sample Areas with sites (from totals)	-	-	-	-	-	-	-	-	55.40%	-

Note: Class I = the existing site records of the entire planning unit

Class II = AERC survey selected quarter sections of a one percent sample area

[1] Average number of Class II sites per sample area by planning unit. (Column 4 divided by Column 1)

[2] Average number of Class II sites per sample area with sites. (Column 4 divided by Column 7)

[3] This figure represents the percentage of quarter sections that probably contain at least one site in each planning unit. (Column 7 divided by Column 1)

[4] This figure is a ranking based upon the density ratings in Column 8.

Key:
- L = 0 to 2 (Low)
- ML = 2.01 to 4 (Moderately Low)
- M = 4.01 to 6 (Medium)
- MH = 6.01 to 8 (Moderately High)
- H = 8.01 to 10 (High)

Table 4-1. Comparison of Class I and Class II site totals and densities between planning units

PART B: RESEARCH RESULTS

Introduction

A total of 348 historic and prehistoric cultural sites were discovered during the Class II (RG-II) survey of the Southern Coal Project of central Utah. Site counts by planning unit are presented in Table 4-1. The location of all quarter-section survey areas in the general region of the Southern Coal Project is shown in Figure 4-1.

Evidence from the RG-II survey, as shown in Column 8 of Table 4-1, indicates that the Boulder Planning Unit has the highest average density of eight sites per sample area. Aquarius and Escalante River Planning Units are of moderate density, having four to 4.42 sites per quarter section. Cultural resources in Garfield, Cedar, and Zion Units are moderately low, while the West Zion, Markagunt, and Paunsaugunt-Sevier Units have the lowest density. The Paria Unit cannot be assessed since no Class II survey was conducted in that planning unit.

The Escalante River RG-II survey shows an overall moderate site density, but there is a high site density in the Fifty Mile Mountain area and in certain canyons on the Escalante River drainage, as revealed in the RG-I and RG-II surveys.

Comparison of RG-I and RG-II planning unit site totals in Table 4-1 reflectsthe extent of prior surveys in the different units. For instance, the Garfield RG-II survey results show a moderately high site density in contrast to only two previously known sites found in the existing records (RG-I). This and comparable figures in Table 4-1 indicate where the greatest need lies for further research in the relatively unknown areas showing greatest site density potential. These are also the areas that present

SAMPLE AREA LOCATIONS

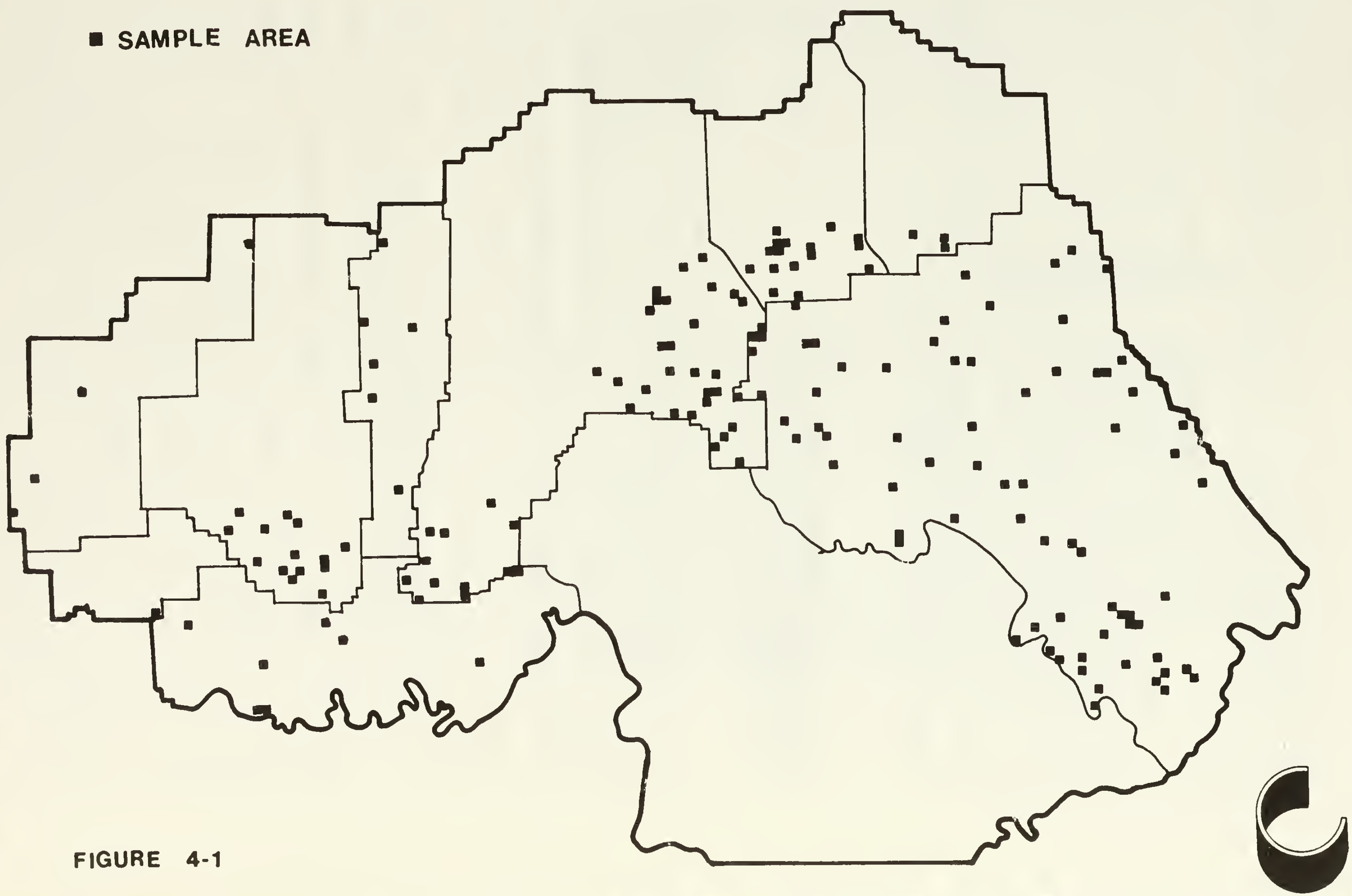


FIGURE 4-1

the greatest concern for preservation of cultural resources in considering potential land use projects (see Chapters 3 and 4 of Volume III).

Part B is presented in three parts. The first, "Correlation Between Cultures, Site Types, and Environments", is self explanatory. Following the general correlations, an evaluation of site types and environmental settings will be discussed with reference to specific planning units. This unit will conclude with a general discussion of site density or its lack correlated to specific environmental variables and sample area localities.

CORRELATIONS BETWEEN CULTURES, SITE TYPES, AND ENVIRONMENTS

Throughout the cultural resources survey for the Southern Coal Project,attempts have been made to relate sites with their natural environment as well as with cultural groups. An important part of the results of these attempts is summarized in Tables 4-2 through 4-7. A detailed discussion of the data of these tables is presented below. Before beginning this section, however, a summary discussion of the highlights is helpful.

Almost 78% of all sites discovered in the survey are associated with pinyon-juniper ecozone(s), zones, or habitats (see Table 4-2). The consideration of just occupation sites, ranging from temporary camps through multiple habitations and rock shelters, provides emphasis to this relationship. Some 65% of the occupation sites are in this ecozone, as are 82.5% of all lithic scatters. The next most important ecozone is the arid-transitional, characterized by various subzones and habitats. This ecozone had almost 15% of the total sites, and 67% of those are camps and habitation sites. The higher elevation vegetation zones were predominantly of non-intensive, short duration use during prehistoric times.

PLANNING UNITS / VEGETATION ZONES	Arid	Arid-transitional	Pinyon-juniper	Mountain Brush	Montane	TOTALS
Cedar	0	0	10	0	0	10
Escalante River	2	54	143	0	0	199
Garfield	3	0	20	0	0	23
Paria	-	-	-	-	-	-
West Zion	0	0	0	0	0	0
Zion	0	1	20	0	0	21
Aquarius	0	0	48	5	0	53
Boulder	0	0	24	0	0	24
Markagunt	0	0	0	0	8	8
Paunsaugunt-Sevier	0	0	6	0	4	10
TOTALS	5	55	271	5	12	348

Table 4-2. Correlation between number of sites and vegetation zones by planning unit

The relationship between sites and geomorphic features is also fairly strong (see Table 4-3). There is a high association between sites and prominent terrain locations. About 66% of the sites are either on ridges, benches, plateau or mesa tops, terraces, saddles, hills, rims, or faces. This relationship is further strengthened by the fact that 69% of the camp and habitation sites are in those geomorphic locations. Increased site numbers on these features may be partially influenced by factors of preservation.

The relationships between cultural sites and elevation are also strong (see Table 4-4). Some 81% of the sites are located between 5,000 and 8,000 feet (1,524-2,438 m.) and they include 73% of the camp and habitation sites. The elevation distribution of sites is somewhat a factor of the elevations given in sample areas chosen by the original sampling process, but seems to indicate a cultural preference for middle elevations within the available range. This range in preferred elevation corresponds to the pinyon-juniper region as mentioned above.

In observing the relationship between sites and the geological formations on which they are found (see Table 4-5), it is difficult to find such strong associations. The bulk of the camp and habitation sites occur in four formations: miscellaneous Quaternary alluvial deposits, the Cretaceous Straight Cliffs Formation, the Jurassic Morrison, and the Navajo Formations. In the middle two formations mentioned here, the number of camp and habitation sites outnumbers the lithic scatters. Overall, the Navajo Formation is most productive of sites of all types and its large number of lithic scatters, as well as other site types, marks this formation as highly preferred for human activity.

Table 4-6 gives a distribution of site types by planning unit. The Escalante River Unit with its large number of sites (57% of the survey total) has the greatest variety of site types. The West Zion Planning Unit, on the

PLANNING UNITS / GEOMORPHOLOGY	Rim	Face	Drainage	Seep	Mesa	Ridge	Bench	Saddle	Terrace	Alcove	Hill	Slope	Valley	Sand Dune	Rock Outcrop	Totals
Cedar City	0	0	1	0	0	3	1	4	1	0	0	0	0	0	0	10
Escalante River	13	2	28	0	8	57	50	7	15	13	3	2	0	1	0	199
Garfield	0	0	3	0	4	13	2	0	0	0	0	1	0	0	0	23
Paria	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
West Zion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zion	0	0	3	0	0	13	1	1	1	0	2	0	0	0	0	21
Aquarius	0	1	17	0	4	6	11	3	0	0	0	1	9	0	1	53
Boulder	0	0	4	0	4	6	5	2	0	0	1	0	0	0	2	24
Markagunt	1	0	6	0	0	1	0	0	0	0	0	0	0	0	0	8
Paunsaugunt-Sevier	0	0	3	0	1	4	0	0	2	0	0	0	0	0	0	10
Totals	14	3	65	0	21	103	70	17	19	13	6	4	9	1	3	348

Table 4-3. Correlation between compounded site numbers and geomorphic feature by planning unit

PLANNING UNITS / ELEVATION ZONES	3,000 - 4,000 (914 - 1,219 m.)	4,000 - 5,000 (1,219 - 1,524 m.)	5,000 - 6,000 (1,524 - 1,829 m.)	6,000 - 7,000 (1,829 - 2,134 m.)	7,000 - 8,000 (2,134 - 2,438 m.)	8,000 - 9,000 (2,438 - 2,743 m.)	9,000 - 10,000 (2,743 - 3,048 m.)	above 10,000 (3,048 -	Totals
Cedar City	0	0	0	9	1	0	0	0	10
Escalante River	6	45	75	47	26	0	0	0	199
Garfield	0	0	0	11	12	0	0	0	23
Paria	-	-	-	-	-	-	-	-	-
West Zion	0	0	0	0	0	0	0	0	0
Zion	0	0	11	5	4	1	0	0	21
Aquarius	0	0	0	32	15	5	1	0	53
Boulder	0	0	1	22	1	0	0	0	24
Markagunt	0	0	0	0	4	3	1	0	8
Paunsaugunt-Sevier	0	0	0	0	5	4	0	1	10
Totals	6	45	87	126	68	13	2	1	348

Table 4-4. Correlation between number of sites and elevation by planning unit

PLANNING UNITS / GEOLOGY	Quaternary	Tertiary & Wasatch	Cretaceous	Kaiparowits	Wahweap	Straight Cliffs	Tropic	Dakota	Jurrasic	Morrison	Windsor	Bluff	Entrada	Carmel	Navajo	Kayenta	Moenkopi	Totals
Cedar City	2	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4	10
Escalante River	27	0	0	0	3	30	1	4	0	19	0	3	5	9	87	3	8	199
Garfield	6	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23
Paria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Zion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zion	0	0	0	0	1	1	3	0	5	0	9	0	0	3	0	0	0	21
Aquarius	37	0	0	0	4	4	0	0	0	0	-	0	0	0	12	0	0	53
Boulder	2	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	24
Markagunt	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Paunsaugunt-Sevier	0	4	0	5	1	1	0	0	0	0	0	0	0	0	0	0	0	10
Totals	74	29	4	5	3	36	4	4	5	19	9	3	5	12	121	3	12	348

Table 4-5. Correlation between number of sites and geological features by planning unit

PLANNING UNITS / SITE TYPE	Lithic Scatter	Hunting	Kill-butchering	Quarry	Temporary Camp	Extended Camp	Single Habitation	Multiple Habitation	Petroglyph	Rock Shelter	Granary	Miscellaneous	TOTALS
Cedar	9	0	0	0	1	0	0	0	0	0	0	0	10
Escalante River	103	3	0	3	37	16	18	9	1	4	3	2	199
Garfield	20	0	0	0	3	0	0	0	0	0	0	0	23
Paria	--	-	-	-	-	-	-	-	-	-	-	-	--
West Zion	0	0	0	0	0	0	0	0	0	0	0	0	0
Zion	9	0	0	0	5	6	0	0	0	0	1	0	21
Aquarius	34	1	0	12	4	0	0	1	0	1	0	0	53
Boulder	14	1	1	1	4	1	1	0	0	1	0	0	24
Markagunt	7	0	0	0	1	0	0	0	0	0	0	0	8
Paunsaugunt-Sevier	10	0	0	0	0	0	0	0	0	0	0	0	10
TOTALS	206	5	1	16	55	23	19	10	1	6	4	2	348

Table 4-6. Correlation between number of sites and site type by planning unit

PLANNING UNITS / PRECIPITATION ZONE	6 - 8 inches (150 - 200 mm.)	8 - 10 inches (200 - 250 mm.)	10 - 12 inches (250 - 300 mm.)	12 - 16 inches (300 - 410 mm.)	16 - 20 inches (410 - 510 mm.)	20 - 25 inches (510 - 640 mm.)	25 - 30 inches (640 - 760 mm.)	30 - 40 inches (760 - 1,020 mm.)	Totals
Cedar City	0	0	0	8	0	2	0	0	10
Escalante River	23	36	100	39	1	0	0	0	199
Garfield	0	0	1	22	0	0	0	0	23
Paria	-	-	-	-	-	-	-	-	-
West Zion	0	0	0	0	0	0	0	0	0
Zion	0	0	0	20	0	1	0	0	21
Aquarius	0	0	0	2	47	4	0	0	53
Boulder	0	0	0	24	0	0	0	0	24
Markagunt	0	0	0	0	6	0	1	1	8
Paunsaugunt-Sevier	0	0	0	6	4	0	0	0	10
Totals	23	36	101	121	58	7	1	1	348

Table 4-7. Correlation between number of sites and precipitation zones by site type

other extreme, had no new sites recorded at all. The same variety exists in the cultures represented by the sites within each planning unit. The Escalante Unit has the greatest range with other units having more restricted variety. Due to lack of diagnostic artifacts, only about 39% of the sites discovered in the survey can be culturally identified. It is probable, however, that many other sites, especially the camp and habitation sites, could be culturally identified at some future date through testing and excavation. Of those sites identified, about 74.5% are Kayenta Anasazi (29% of the total survey results), and the remainder are divided among cultures from Archaic, Fremont, and Shoshonean to Early Historic.

There are several trends in the kinds and distribution of Class II archeological sites in the area of the Southern Coal Project. For example, lithic scatters predominate among site types, and ridges are generally favored over other land forms for settlement. Also, in those planning units where site elevation is largely between 6,000 and 7,000 feet (1,829-2,134 m.) and most sites are in the pinyon-juniper ecozone, site density per sample area is relatively high, while in those planning units where the overall site elevation is higher and more sites are in the montane ecozone, site density per sample area is relatively low. Moreover, in this latter case, the percentage of lithic scatters, which is relatively high everywhere in the survey area, is even higher. Sites featuring lithic scatters generally lack evidence of horticultural technology, and the fact that the upper limits of prehistoric agriculture were between the 7,000 and 8,000 foot elevations (2,134-2,438 m.) may be important. Planning units in the lower elevation range are Cedar, Escalante River, Garfield, West Zion, Zion, Aquarius, and Boulder. Those generally having a higher elevation are Markagunt and Paunsaugunt-Sevier.

Planning Unit Summaries

This section summarizes by planning unit the environmental variables related to the archeological sites recorded during the Class II survey. Variables being considered are site distribution and type, site relation to different categories of vegetation, geology, geomorphology, elevation, and rainfall, and site significance according to either the BLM or the AERC Forest rating system.

A number of illustrations supplement the discussion. The location of the sample areas and archeological sites are shown in the map series, Figures 4-1 through 4-11. Table 4-1 presents a collection of planning unit statistics for Class I (RG-I) and Class II (RG-II) sites, and a series of tables show a breakdown of the archeological sites of each planning unit by site type (Table 4-6), vegetation (Table 4-2), geology (Table 4-5), geomorphology (Table 4-3), elevation (Table 4-4), and rainfall (Table 4-7).

CEDAR PLANNING UNIT (BLM)

In the Cedar Planning Unit, a one percent sample stratified according to vegetation type by the BLM was intensively surveyed by AERC in the fall of 1977.

A total of ten archeological sites was located among the four sample areas of the Cedar Planning Unit (see Tables 4-1, 8, 9, 10, and 11). These sample areas are distributed diagonally from southwest to northeast across the planning unit as are the archeological sites of the Class II survey (see Figure 4-2). No archeological sites were found in sample area #1 in the southwest corner, but in sample area #2, only a short distance to the northeast, four archeological sites were found. Farther northeast, four other archeological sites were located in area #3, and in the northeastern corner of sample area #4, two more archeological sites were found.

Tables 4-6 and 4-11 show that these newly recorded archeological sites were predominantly lithic scatters.

CEDAR PLANNING UNIT

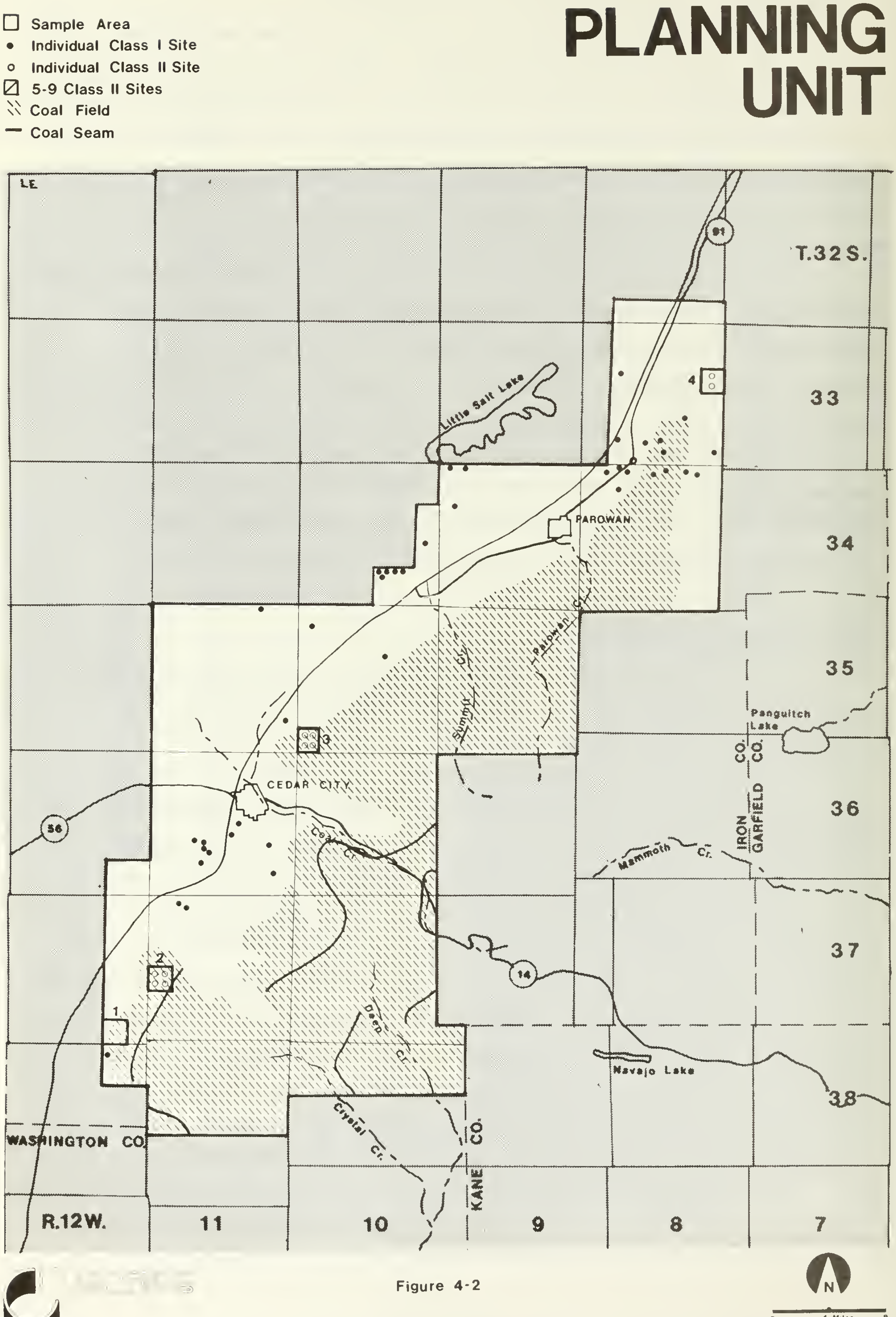


Figure 4-2

The single exception was a temporary camp included among the four archeological sites of sample area #2.

All of the Class II survey archeological sites in the Cedar Planning Unit are within the pinyon-juniper ecozone (see Table 4-8). This ecozone is common in the Cedar Planning Unit especially on the high plateau section of the Colorado Plateau Physiographic Province just east of the valley area along the unit's western edge.

The breakdown of the unit's archeological sites by geology (Table 4-9) is more varied. Two sites were found in deposits of the Quaternary period, four were in Cretaceous period deposits, and four (those in sample area #2) lay on the Moenkopi Formation.

Similarly varied is the range of surface features associated with the Class II archeological sites of the Cedar Planning Unit (see Table 4-10). One archeological site was in a drainage, three were on ridges, one was on a bench, four were in saddles, and one was on a terrace.

Nine of the ten Class II archeological sites in the Cedar Planning Unit were in the elevation range (Table 4-11) between 6,000 and 7,000 feet (1,829-2,134 m.). The other site was in the 7,000 to 8,000 foot range (2,134-2,438 m.).

Rainfall (Table 4-7) at eight of the archeological sites varies currently between twelve and sixteen inches (305-407 mm.). At the other two sites, it is now in the twenty to twenty-five inch range (510-640 mm.).

The Class II archeological site of greatest significance in the Cedar Planning Unit is the lone temporary camp (42In439) which was located in sample area #2 (Table 4-11). It has been given the highest significance rating of CRES: S-1. (For a discussion of the rating system, see the preceding chapter.) Also in sample area #2, one lithic scatter (42In442) has been rated S-2 and another (42In440) rated S-3. All other Class II archeological sites in the Cedar Planning Unit have been given the lowest CRES rating of S-4 in survey areas #2, #3, and #4.

TABLE 4-8

CEDAR PLANNING UNIT

Sample Area	AERC Vegetation Zone	BLM Vegetation Type	Legal Description	No. of Sites Located
1	Pinyon-juniper	Brush/scrub	T37S, R12W, Sec 35, SE¼	0
2	Pinyon-juniper	Pinyon-juniper	T37S, R11W, Sec 19, SW¼	4
3	Pinyon-juniper	Pinyon-juniper	T35S, R10W, Sec 31, SW¼	4
4	Pinyon-juniper	Conifer	T33S, R8W, Sec 13, SE¼	2

TABLE 4-9

GEOLOGIC/SITE RELATIONSHIPS

CEDAR PLANNING UNIT

		TERTIARY		CRETACEOUS							JURRASIC									
Permanent Site Number	QUATERNARY	Wasatch Formation	Tertiary Undivided	Cretaceous Undivided	Kaiparowits	~~Straight Cliffs Wahweap Sandstone~~	Wahweap Sandstone	~~Straight Cliffs~~	Tropic Shale	Dakota Sandstone	Jurrassic Undivided	~~Morrison Formation~~	Windsor Formation	~~Bluff Sandstone~~	~~Entrada Sandstone~~	~~Carmel Formation~~	~~Navajo Formation~~	~~Kayenta Formation~~	Moenkopi Formation	~~TRIASSIC~~
2In439																			X	
440																			X	
441																			X	
442																			X	
443				X																
444				X																
445				X																
446				X																
447	X																			
448	X																			

TABLE 4-10

GEOMORPHOLOGIC/SITE RELATIONSHIPS

CEDAR PLANNING UNIT

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42In439											Rs						
440											Rs						
441									Cl								
442								Cl									
443								Rs									
444			Al														
445								Rs									
446											Rs						
447											Rs						
448										Rs							
Sub totals 10			1					3	1	1	4						

Al = alluvial
Ae = aeolian
Bd = bedrock

Cl = colluvial
Rs = residual

TABLE 4-11

CEDAR TABULAR DESCRIPTION

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
Lithic Scatter							
42In440	2	6350	yes	S-3	Archaic	ca. BC. 2500	40 X 25m.
42In441	2	6400	no	S-4	Unknown	-	20 X 25m.
42In442	2	6120	yes	S-2	Fremont	ca. AD. 800	40 X 30m.
42In443	3	6440	no	S-4	Unknown	-	30m. diameter
42In444	3	6480	no	S-4	Unknown	-	5m. diameter
42In445	3	6640	no	S-4	Unknown	-	20m. diameter
42In446	3	6240	no	S-4	Unknown	-	30m. diameter
42In447	4	7240	no	S-4	Unknown	-	50m. diameter
42In448	4	6960	no	S-4	Unknown	-	50 X 10m.
Temporary Camp							
42In439	2	6280	yes	S-1	Unknown	-	30 X 40m. 30 X 20m. } 2 units

Limited data makes it difficult to generalize concerning the influence of the various environmental factors discussed above on human settlement. It may be significant, however, that the only survey area associated with the Jurassic Moenkopi Formation (area #2) is where human occupation was most significant.

ESCALANTE RIVER PLANNING UNIT (BLM)

As specified by the BLM, a one percent sample stratified according to vegetation type was intensively surveyed in the Escalante River Planning Unit (Figure 4-3). This sample amounted to 72 quarter-section sample areas which were surveyed by AERC during the fall and winter of 1977 and 1978. (This tally of sample areas includes thirteen substitute sample areas--see Table 4-12--which were utilized when inaccessibility and snow cover precluded a survey of the originally assigned units.)

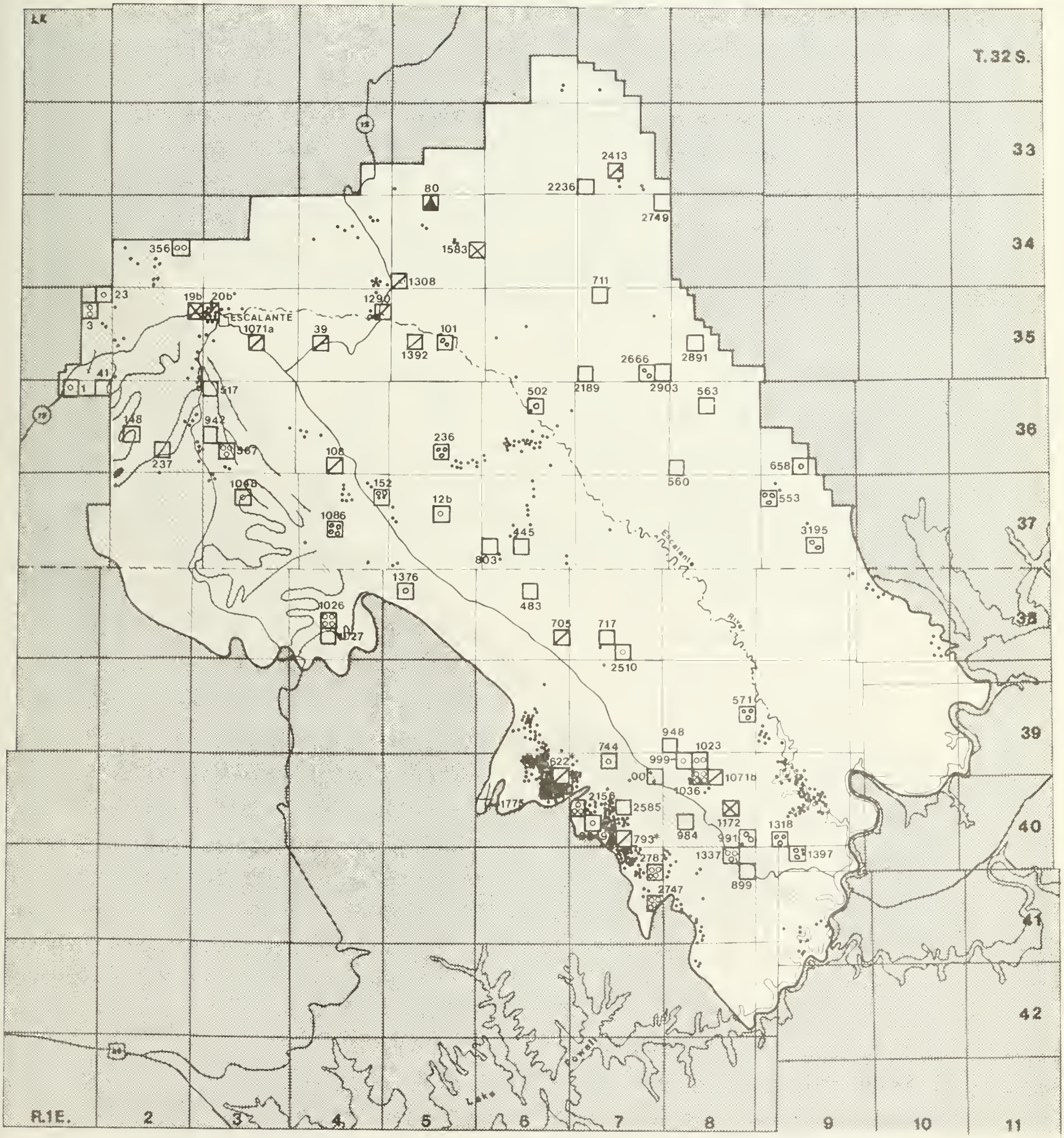
A total of 199 archeological sites was located among the 72 sample areas (see Table 4-12), and since most sample areas have archeological sites (only 23 have none), the distribution of archeological sites in the Escalante River Planning Unit roughly parallels that of the sample areas. There is, however, a slight trend toward fewer sites among the northeastern sample areas.

Among the 199 newly recorded sites, most (103) are lithic scatters (see Table 4-15). Next in importance numerically are temporary camps (37), followed by single habitations (18), and then extended camps (16). Rounding out the list are multiple habitations (9), rock shelters (4), hunting sites (3), quarries (3), granaries (3), and petroglyph sites (1).

There are three vegetation zones in the Escalante River Planning Unit in which the Class II archeological sites were found (see Table 4-12). The bulk of the sites (143) were in the pinyon-juniper ecozone or pinyon-juniper habitat. A much smaller but still significant number (54) were in the arid transitional ecozone. Only two were in the

ESCALANTE PLANNING UNIT

- □ Sample Area
- • Individual Class I Site
- ○ Individual Class II Site
- 5-9 Class II Sites
- 10-14 Class II Sites
- 15-19 Class II Sites
- Coal Field
- — Coal Seam



*sample unit 622 class I 16
class II 5
793 class I 11
class II 8

Figure 4-3

third arid ecozone. (Vegetation type correlations in Table 4-12 and the subsequent tables for other planning units are based upon general ecozone correlations for the sample areas and will not always correspond to individual habitats where sites are located.)

The distribution of the Class II archeological sites of the Escalante River Planning Unit in relation to the geology is quite diverse (see Table 4-13). Some 27 sites are on Quaternary period deposits, and another 38, divided among various formations, are on Cretaceous deposits. The remaining 134 sites are on a variety of Jurassic period formations but are mainly associated with the Navajo Formation where 87 archeological sites were found.

Class II archeological sites of the Escalante River Planning Unit were found on a variety of land features (see Table 4-14), including ridges (57 sites), benches (50 sites), and drainages (28), while the remaining 64 sites were found over a wide range of land features.

This trend toward varied environmental associations among the Class II archeological sites of the Escalante River Planning Unit also holds for elevation (see Table 4-15). Seventy-five of the unit's archeological sites are in the 5,000 to 6,000 foot (1,829-2,134 m.) range.

Rainfall (see Figure 4-7) among the Class II archeological sites of the Escalante River Planning Unit is equally varied. About 23 of the unit's archeological sites receive between six and eight inches (152-203 mm.); 36 receive between eight and ten inches (203-254 mm.); and 39 receive twelve to sixteen inches (305-407 mm.) annual precipitation.

A total of 35 of the 199 Class II archeological sites of the Escalante River Planning Unit was rated above S-4 in the CRES rating system (see Table 4-15). Of these, 25 were assigned a CRES rating of S-3 and 9 received a rating of S-2. One archeological site, 42Ga1585, a multiple habitation, was given a CRES rating of S-1 and should be

TABLE 4-12

ESCALANTE PLANNING UNIT

Sample Area	AERC Vegetation Zone	BLM Vegetation Type	Legal Description	No. of Sites Located
1	Pinyon-juniper	Pinyon-juniper	T36S, R1E, Sec 3, NE$\frac{1}{4}$	1
3	Pinyon-juniper	Pinyon-juniper	T35S, R1E, Sec 11, NW$\frac{1}{4}$	2
12b*	Arid-Transitional	Brush	T37S, R5E, Sec 15, SE$\frac{1}{4}$	1
19b*	Pinyon-juniper	Brush/scrub	T35S, R2E, Sec 12, SE$\frac{1}{4}$	13
23	Pinyon-juniper	Pinyon-juniper	T35S, R1E, Sec 1, NW$\frac{1}{4}$	1
39	Pinyon-juniper	Barren	T35S, R4E, Sec 20, NE$\frac{1}{4}$	7
41	Pinyon-juniper	Pinyon-juniper	T36S, R1E, Sec 1, NE$\frac{1}{4}$	0
80	Pinyon-juniper	Barren	T34S, R5E, Sec 4, NE$\frac{1}{4}$	16
101	Pinyon-juniper	Barren	T35S, R5E, Sec 22, SE$\frac{1}{4}$	2
108	Pinyon-juniper	Grass	T36S, R4E, Sec 33, SE$\frac{1}{4}$	5
148	Pinyon-juniper	Pinyon-juniper	T36S, R2E, Sec 20, SE$\frac{1}{4}$	0
152	Pinyon-juniper	Grass	T37S, R4E, Sec 12, SE$\frac{1}{4}$	2
236	Pinyon-juniper	Brush/scrub	T36S, R5E, Sec 27, NE$\frac{1}{4}$	3
237	Pinyon-juniper	Pinyon-juniper	T36S, R2E, Sec 27, SE$\frac{1}{4}$	0
356	Pinyon-juniper	Pinyon-juniper	T34S, R2E, Sec 23, NW$\frac{1}{4}$	2
445	Arid-Transitional	Brush/scrub	T37S, R6E, Sec 28, SW$\frac{1}{4}$	0
483	Arid-Transitional	Brush/scrub	T38S, R6E, Sec 10, NW$\frac{1}{4}$	0
502	Pinyon-juniper	Brush/scrub	T36S, R6E, Sec 10, SW$\frac{1}{4}$	1
517	Pinyon-juniper	Pinyon-juniper	T36S, R3E, Sec 6, NE$\frac{1}{4}$	0
553	Pinyon-juniper	Barren	T37S, R9E, Sec 7, NE$\frac{1}{4}$	3
560 (10b)*	Arid-Transitional	Barren	T36S, R8E, Sec 31, NW$\frac{1}{4}$	0

*Substituted sample areas

TABLE 4-12

ESCALANTE PLANNING UNIT (Continued)

Sample Area	AERC Vegetation Zone	BLM Vegetation Type	Legal Description	No. of Sites Located
563	Pinyon-juniper	Barren	T36S, R8E, Sec 9, SW$\frac{1}{4}$	0
567	Pinyon-juniper	Pinyon-juniper	T36S, R3E, Sec 29, NW$\frac{1}{4}$	3
571 (6b)*	Arid	Barren	T39S, R8E, Sec 24, SE$\frac{1}{4}$	3
622	Pinyon-juniper	Brush/scrub	T40S, R6E, Sec 12, SE$\frac{1}{4}$	5
658	Pinyon-juniper	Barren	T36S, R9E, Sec 33, SW$\frac{1}{4}$	1
705 (7b)*	Pinyon-juniper	Barren	T38S, R6E, Sec 25, NW$\frac{1}{4}$	5
711	Pinyon-juniper	Brush/scrub	T35S, R7E, Sec 5, NW$\frac{1}{4}$	0
717	Pinyon-juniper	Brush/scrub	T38S, R7E, Sec 28, SW$\frac{1}{4}$	0
744	Arid-Transitional	Brush/scrub	T40S, R7E, Sec 4, NE$\frac{1}{4}$	1
793	Arid-Transitional	Brush/scrub	T40S, R7E, Sec 34, NE$\frac{1}{4}$	8
803 (8b)*	Pinyon-juniper	Barren	T37S, R6E, Sec 30, NE$\frac{1}{4}$	0
899	Arid-Transitional	Barren	T41S, R8E, Sec 12, NE$\frac{1}{4}$	0
942	Pinyon-juniper	Pinyon-juniper	T36S, R3E, Sec 19, SE$\frac{1}{4}$	0
948	Arid-Transitional	Brush/scrub	T39S, R8E, Sec 31, SE$\frac{1}{4}$	0
984	Arid-Transitional	Brush/scrub	T40S, R8E, Sec 29, SW$\frac{1}{4}$	0
991 (2b)*	Arid	Barren	T40S, R8E, Sec 36, SW$\frac{1}{4}$	4
999	Arid-Transitional	Brush/scrub	T40S, R8E, Sec 5, SE$\frac{1}{4}$, NE$\frac{1}{4}$	1
1023	Arid-Transitional	Brush/scrub	T40S, R8E, Sec 4, NW$\frac{1}{4}$	2
1026	Pinyon-juniper	Pinyon-juniper	T38S, R4E, Sec 21, SW$\frac{1}{4}$	4
1027	Pinyon-juniper	Pinyon-juniper	T38S, R4E, Sec 28, NW$\frac{1}{4}$	0
1036	Arid-Transitional	Brush/scrub	T40S, R8E, Sec 9, SW$\frac{1}{4}$	4

*Substituted sample areas

TABLE 4-12

ESCALANTE PLANNING UNIT (Continued)

Sample Area	AERC Vegetation Zone	BLM Vegetation Type	Legal Description	No. of Sites Located
1048 (13b)*	Pinyon-juniper	Pinyon-juniper	T37S, R8E, Sec 9, SW$\frac{1}{4}$	1
1071a	Pinyon-juniper	Pinyon-juniper	T35S, R3E, Sec 22, NW$\frac{1}{4}$	8
1071b	Arid-Transitional	Brush/scrub	T40S, R8E, Sec 10, SW$\frac{1}{4}$	6
1086	Pinyon-juniper	Pinyon-juniper	T37S, R4E, Sec 21, SE$\frac{1}{4}$	4
1172 (4b)*	Arid-Transitional	Brush/scrub	T40S, R8E, Sec 23, NW$\frac{1}{4}$	11
1290	Pinyon-juniper	Pinyon-juniper	T35S, R4E, Sec 12, NW$\frac{1}{4}$	5
1308	Pinyon-juniper	Pinyon-juniper	T34S, R5E, Sec 31, NW$\frac{1}{4}$	8
1318	Arid	Brush/scrub	T40S, R9E, Sec 32, NE$\frac{1}{4}$	3
1337 (5b)*	Arid-Transitional	Brush/scrub	T41S, R8E, Sec 2, NW$\frac{1}{4}$	3
1376	Pinyon-juniper	Pinyon-juniper	T38S, R5E, Sec 8, NE$\frac{1}{4}$	1
1392	Pinyon-juniper	Pinyon-juniper	T35S, R5E, Sec 20, SE$\frac{1}{4}$	7
1397	Arid-Transitional	Brush/scrub	T40$\frac{1}{2}$S, R9E, Sec 29, SE$\frac{1}{4}$	2
1583	Pinyon-juniper	Pinyon-juniper	T34S, R5E, Sec 24, SW$\frac{1}{4}$	10
1775	Pinyon-juniper	Pinyon-juniper	T40S, R6E, Sec 19, NE$\frac{1}{4}$	0
2156	Pinyon-juniper	Pinyon-juniper	T40S, R7E, Sec 19, NW$\frac{1}{4}$	3
2189	Pinyon-juniper	Pinyon-juniper	T35S, R7E, Sec 31, SW$\frac{1}{4}$	0
2236	Pinyon-juniper	Pinyon-juniper	T33S, R7E, Sec 31, SE$\frac{1}{4}$	0
2349	Pinyon-juniper	Pinyon-juniper	T40S, R7E, Sec 29, SE$\frac{1}{4}$	1
2413	Pinyon-juniper	Pinyon-juniper	T33S, R7E, Sec 28, SW$\frac{1}{4}$	6
2510	Pinyon-juniper	Pinyon-juniper	T38S, R7E, Sec 34, NW$\frac{1}{4}$	1
2585	Pinyon-juniper	Pinyon-juniper	T40S, R7E, Sec 22, NE$\frac{1}{4}$	0
2666	Pinyon-juniper	Pinyon-juniper	T35S, R7E, Sec 35, NW$\frac{1}{4}$	2

*Substituted sample areas

TABLE 4-12

ESCALANTE PLANNING UNIT (Continued)

Sample Area	AERC Vegetation Zone	BLM Vegetation Type	Legal Description	No. of Sites Located
2747	Arid-Transitional	Pinyon-juniper	T41S, R7E, Sec 24, NE$\frac{1}{4}$	4
2749	Pinyon-juniper	Pinyon-juniper	T34S, R7E, Sec 1, SW$\frac{1}{4}$	0
2787	Pinyon-juniper	Pinyon-juniper	T41S, R7E, Sec 12, NE$\frac{1}{4}$	4
2891	Pinyon-juniper	Pinyon-juniper	T35S, R8E, Sec 20, NW$\frac{1}{4}$	0
2903 (11b)*	Pinyon-juniper	Pinyon-juniper	T35S, R7E, Sec 36, NW$\frac{1}{4}$	0
3195	Pinyon-juniper	Pinyon-juniper	T37S, R9E, Sec 27, NW$\frac{1}{4}$	2
00 *	Arid-Transitional	Brush/scrub	T40S, R7E, Sec 12, SE$\frac{1}{4}$	1
20b*	Pinyon-juniper	Pinyon-juniper	T35S, R3E, Sec 7, SW$\frac{1}{4}$	6

*Substituted sample areas

TABLE 4-13

GEOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT

Permanent Site Number	QUATERNARY	TERTIARY		CRETACEOUS							JURRASIC									TRIASSIC
		~~Wasatch Formation~~	~~Tertiary Undivided~~	~~Cretaceous Undivided~~	~~Kaiparowits~~	~~Straight Cliffs Wahweap Sandstone~~	Wahweap Sandstone	Straight Cliffs	Tropic Shale	Dakota Sandstone	~~Jurrassic Undivided~~	Morrison Formation	~~Windsor Formation~~	Bluff Sandstone	Entrada Sandstone	Carmel Formation	Navajo Formation	Kayenta Formation	Moenkopi Formation	
42Ga1614																X				
1615															X					
1616															X					
1617															X					
1618															X					
1619															X					
1620								X												
1621														X						
1622														X						
1623	X																			
1624	X																			
1625														X						
1626	X																			
1627	X																			
1628	X																			
1631																X				
1632																X				
1633																X				
1634																	X			
1635																X				
1636																			X	
1637																			X	
1638								X									X			
1639								X												
1640								X												
1641																		X		
1642																		X		
1643																		X		
1644																	X			
1645																	X			
1646										X										
1647										X										
1648										X										
1649									X											
1650	X																			

TABLE 4-13

GEOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT (Continued)

Permanent Site Number	QUATERNARY	TERTIARY: ~~Wasatch Formation~~	TERTIARY: ~~Tertiary Undivided~~	CRETACEOUS: Cretaceous Undivided	CRETACEOUS: ~~Kaiparowits~~	CRETACEOUS: Straight Cliffs ~~Wahweap Sandstone~~	CRETACEOUS: Wahweap Sandstone	CRETACEOUS: Straight Cliffs	CRETACEOUS: Tropic Shale	CRETACEOUS: Dakota Sandstone	JURRASIC: ~~Jurrassic Undivided~~	JURRASIC: Morrison Formation	JURRASIC: ~~Windsor Formation~~	JURRASIC: Bluff Sandstone	JURRASIC: Entrada Sandstone	JURRASIC: Carmel Formation	JURRASIC: Navajo Formation	JURRASIC: Kayenta Formation	JURRASIC: Moenkopi Formation	TRIASSIC
42Ga1651	X																			
1652								X												
1653								X												
1654							X													
1655							X													
1656							X													
1657								X												
1658								X												
1659								X												
1660								X												
1661																	X			
1662																	X			
1663																	X			
1664																	X			
1665																	X			
1666																	X			
1667																	X			
1668																	X			
1669																	X			
1670																	X			
1671																	X			
1672																	X			
1673																	X			
1674																	X			
1675																	X			
1676																	X			
1677																	X			
1678																	X			
1679																	X			
1680																	X			
1681																	X			
1682																	X			
1683																	X			
1684																	X			
1685																	X			

TABLE 4-13

GEOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT (Continued)

		TERTIARY		CRETACEOUS							JURRASIC									
Permanent Site Number	QUATERNARY	~~Wasatch Formation~~	~~Tertiary Undivided~~	~~Cretaceous Undivided~~	~~Kaiparowits~~	~~Straight Cliffs~~ Wahweap Sandstone	Wahweap Sandstone	Straight Cliffs	Tropic Shale	Dakota Sandstone	~~Jurrassic Undivided~~	Morrison Formation	~~Windsor Formation~~	Bluff Sandstone	Entrada Sandstone	Carmel Formation	Navajo Formation	Kayenta Formation	Moenkopi Formation	TRIASSIC
42Ga1686																	X			
1687																	X			
1688																	X			
1689																	X			
1690																	X			
1691																	X			
1692																	X			
1693																	X			
1694																	X			
1695																	X			
1696																	X			
1697																	X			
1818												X								
1819												X								
1820												X								
1821												X								
1822												X								
1823												X								
42Ka1839																	X			
1840																	X			
1841																	X			
1842																	X			
1843																	X			
1844																	X			
1845																	X			
1846																	X			
1847																	X			
1848										X										
1849																X				
1850																X				
1851																X				
1852																X				
1853																	X			
1854																	X			
1855	X																			
1856	X																			

TABLE 4-13

GEOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT (Continued)

		TERTIARY		CRETACEOUS							JURRASIC									
Permanent Site Number	QUATERNARY	~~Wasatch Formation~~	~~Tertiary Undivided~~	~~Cretaceous Undivided~~	~~Kaiparowits~~	~~Straight Cliffs Wahweap Sandstone~~	Wahweap Sandstone	Straight Cliffs	Tropic Shale	Dakota Sandstone	~~Jurrassic Undivided~~	Morrison Formation	~~Windsor Formation~~	Bluff Sandstone	Entrada Sandstone	Carmel Formation	Navajo Formation	Kayenta Formation	Moenkopi Formation	TRIASSIC
42Ka1857	X																			
1858	X																			
1859																	X			
1860																	X			
1861																	X			
1862	X																			
1863	X																			
1864	X																			
1865																	X			
1866	X																			
1867																	X			
1868	X																			
1869	X																			
1871	X																			
1872	X																			
1873	X																			
1874	X																			
1875																	X			
1876																	X			
1877	X																			
1878																	X			
1879	X																			
1880																	X			
1881								X												
1882								X												
1883								X												
1884	X																			
1885								X												
1886								X												
1887								X												
1888								X												
1889								X												
1890								X												
1891								X												
1892								X												
1893								X												

TABLE 4-13

GEOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT (Continued)

		TERTIARY		CRETACEOUS							JURRASIC									
Permanent Site Number	QUATERNARY	~~Wasatch Formation~~	~~Tertiary Undivided~~	~~Cretaceous Undivided~~	~~Kaiparowits~~	~~Straight Cliffs Wahweap Sandstone~~	Wahweap Sandstone	Straight Cliffs	Tropic Shale	Dakota Sandstone	~~Jurrassic Undivided~~	Morrison Formation	~~Windsor Formation~~	Bluff Sandstone	Entrada Sandstone	Carmel Formation	Navajo Formation	Kayenta Formation	Moenkopi Formation	TRIASSIC
42Ka1894								X												
1895								X												
1896								X												
1897								X												
1898								X												
1899								X												
1900								X												
1901								X												
1902																	X			
1903																	X			
1904																	X			
1905																	X			
1906																	X			
1907																	X			
1908																	X			
1910																	X			
1918																	X			
1919																	X			

TABLE 4-14

GEOMORPHOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ga1576								Rs									
1577																Rs	
1578								Rs									
1579										Rs							
1580										Rs							
1581									Rs								
1582			Rs														
1583										Rs							
1584								Rs									
1585					Rs												
1586									Rs								
1587									Rs								
1588									Rs								
1589									Rs								
1590									Rs								
1591									Rs								
1592								Rs									
1593			Rs														
1594			Rs														
1595			Rs														
1596									Rs								
1597									Rs								
1598								Rs									
1599								Rs									
1600								Rs									
1601								Rs									
1602								Rs									
1603								Rs									
Sub totals 28			4		1			10	9	3						1	

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-14

GEOMORPHOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT (Continued)

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ga1604			Rs														
1605																Rs	
1606								Rs									
1607								Rs									
1608	Rs																
1609																Rs	
1610								Rs									
1611								Rs									
1612									Rs								
1613									Rs								
1614			Al														
1615														Rs			
1616								Rs									
1617								Rs									
1618								Rs									
1619								Rs									
1620								Rs									
1621															Bd		
1622									Rs								
1623										Al							
1624										Rs							
1625		Rs															
1626			Cl														
1627										Rs							
1628												Bd					
1631								Ae									
1632									Ae								
Sub totals 27	1	1	3					10	4	3		1		1	1	2	

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-14

GEOMORPHOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT (Continued)

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ga1633								Ae									
1634					Rs												
1635									Rs								
1636									Rs								
1637			Rs														
1638			Ae														
1639											Al						
1640										Rs							
1641								Ae									
1642									Rs								
1643			Rs														
1644									Rs								
1645									Ae								
1646									Rs								
1647									Rs								
1648									Ae								
1649									Rs								
1650								Ae									
1651								Ae									
1652								Rs									
1653					Rs												
1654														Cl			
1655								Rs									
1656									Rs								
1657			Al														
1658										Al							
1659											Bd						
1660										Al							
Sub totals 28			4		2			6	10	3	2			1			

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-14

GEOMORPHOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT (Continued)

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ga1661								Rs									
1662					Rs												
1663					Rs												
1664								Bd									
1665									Ae								
1666								Bd									
1667												Rs					
1668								Al									
1669								Ae									
1670								Ae									
1671										Rs							
1672									Al								
1673										Ae							
1674	Rs																
1675								Rs									
1676					Ae												
1677								Rs									
1678									Rs								
1679									Rs								
1680								Rs									
1681								Ae									
1682											Rs						
1683								Rs									
1684								Cl									
1685								Rs									
1686								Rs									
1687								Rs									
Sub totals 27	1				3			15	4	2	1	1					

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-14

GEOMORPHOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT (Continued)

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ga1688									Rs								
1689										Rs							
1690										Rs							
1691												Cl					
1692											Rs						
1693									Rs								
1694									Rs								
1695									Cl								
1696									Ae								
1697									Ae								
1818	Bd																
1819	Bd																
1820								Rs									
1821			Ae														
1822					Ae												
1823			Ae														
42Ka 864									Al								
1839															Bd		
1840												Al					
1841			Al														
1842			Al														
1843			Al														
1844		Rs															
1845											Rs						
1846											Cl						
1847												Bd					
1848									Bd								
1849								Rs									
Sub totals 27	2	1	5		1			2	7	2	3	3			1		

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-14

GEOMORPHOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT (Continued)

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ka1850			Rs														
1851			Rs														
1852			Rs														
1853									Ae								
1854									Ae								
1855								Ae									
1856									Ae								
1857												Bd					
1858												Bd					
1859			Al														
1860								Al									
1861											Al						
1862												Al					
1863												Al					
1864			Al														
1865												Ae					
1866										Ae							
1867	Ae																
1868									Ae								
1869									Ae								
1871									Rs								
1872								Ae									
1873								Bd									
1874								Bd									
1875									Ae								
1876			Ae														
1877												Bd					
1878			Al														
Sub totals 28	1		7					5	7	1	1	6					

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-14

GEOMORPHOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT (Continued)

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ka1879									Rs								
1880	Bd																
1881								Rs									
1882					Rs												
1883								Rs									
1884								Rs									
1885									Ae								
1886									Ae								
1887									Ae								
1888									Rs								
1889	Rs																
1890	Rs																
1891	Rs																
1892			Rs														
1893								Rs									
1894	Rs																
1895	Rs																
1896	Rs																
1897								Rs									
1898									Rs								
1899								Rs									
1900										Rs							
1901													Rs				
1902								Ae									
1903			Ae														
1904								Ae									
1905								Ae									
1906			Ae														
Sub totals 28	7		3		1			9	6	1			1				

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-14

GEOMORPHOLOGIC/SITE RELATIONSHIPS

ESCALANTE PLANNING UNIT (Continued)

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ka1907									Bd								
1908			Bd														
1910		Bd															
1918			Ae														
1919									Ae								
Sub totals 5		1	2						2								

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-15

ESCALANTE TABULAR DESCRIPTION

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
<u>Lithic Scatter</u>							
42Ga1576	23	6950	no	S-4	Unknown	-	100 X 20m.
42Ga1577	356	7080	no	S-4	Unknonw	-	45 X 45m.
42Ga1578	356	7010	yes	S-4	Unknown	-	25 X 25m.
42Ga1592	2413	6600	yes	S-4	Kayenta	ca. AD. 1050	30 X 200m.
42Ga1593	2413	6700	yes	S-4	Kayenta	ca. AD. 1050	30 X 50m.
42Ga1594	2413	6540	yes	S-4	Archaic	ca. BC. 2500	30 X 30m.
42Ga1595	2413	6560	yes	S-4	Archaic	ca. BC. 2500	10 X 75m.
42Ga1596	2413	6500	yes	S-4	Unknown	-	10 X 10m.
42Ga1597	2413	6540	yes	S-4	Kayenta	ca. AD. 1050	40 X 75m.
42Ga1598	80	6100	no	S-4	Unknown	-	100 X 30m.
42Ga1599	80	6140	no	S-4	Unknown	-	10 X 70m.
42Ga1600	80	6100	no	S-4	Unknown	-	10 X 150m.
42Ga1601	80	6100	yes	S-4	Unknown	-	40 X 20m.
42Ga1603	80	6040	yes	S-4	Archaic	ca. BC. 2500	8 X 20m.
42Ga1604	80	6020	no	S-4	Unknown	-	30 X 20m.
42Ga1605	80	5980	yes	S-3	Unknown	-	10 X 10m.
42Ga1606	80	6040	no	S-4	Unknown	-	50 X 70m.
42Ga1608	80	6160	no	S-4	Unknown	-	80 X 20m.
42Ga1609	80	6100	no	S-4	Unknown	-	20 X 10m.
42Ga1610	80	6120	no	S-4	Unknown	-	50 X 20m.
42Ga1611	80	5980	no	S-4	Unknown	-	30 X 20m.
42Ga1612	80	6080	no	S-4	Unknown	-	30 X 30m.
42Ga1613	80	6040	no	S-4	Unknown	-	20 X 10m.
42Ga1615	108	5500	no	S-4	Unknown	-	20 X 20m.
42Ga1616	108	5440	no	S-4	Unknown	-	5 X 10m.

TABLE 4-15

ESCALANTE TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
Lithic Scatter (Continued)							
42Ga1619	108	5500	yes	S-4	Unknown	-	20 X 20m.
42Ga1620	1	7500	yes	S-4	Unknown	-	75 X 75m.
42Ga1624	1071a	5920	no	S-4	Unknown	-	8 X 8m.
42Ga1625	1071a	5800	no	S-4	Unknown	-	5 X 50m.
42Ga1631	236	5140	no	S-4	Unknown	-	30 X 10m.
42Ga1632	236	5160	no	S-4	Unknown	-	20 X 20m.
42Ga1633	236	5200	no	S-4	Unknown	-	10 X 10m.
42Ga1634	101	5960	yes	S-4	Unknown	-	60 X 40m.
42Ga1636	2666	5880	no	S-4	Unknown	-	10 X 10m.
42Ga1637	2666	5800	no	S-4	Unknown	-	3 X 3m.
42Ga1638	502	5240	no	S-4	Unknown	-	10 X 10m.
42Ga1642	553	6320	yes	S-4	Unknown	-	80 X 40m.
42Ga1643	553	6300	no	S-4	Unknown	-	30 X 30m.
42Ga1644	3195	6200-6600	no	S-4	Kayenta	ca. AD. 1050	900 X 400m.
42Ga1645	3195	6592	yes	S-4	Kayenta	ca. AD. 1050	50 X 50m.
42Ga1650	152	5330	no	S-4	Unknown	-	30 X 15m.
42Ga1651	152	5400	no	S-4	Unknown	-	10 X 10m.
42Ga1654	567	6680	no	S-4	Unknown	-	10 X 10m.
42Ga1655	567	6780	no	S-4	Unknown	-	5 X 5m.
42Ga1660	1026	5750	no	S-4	Unknown	-	10 X 10m.
42Ga1661	1290	5580	no	S-4	Unknown	-	5 X 15m.
42Ga1662	1290	5860	yes	S-4	Kayenta	ca. AD. 1050	100 X 30m.
42Ga1663	1290	5840	yes	S-4	Unknown	-	10 X 30m.
42Ga1664	1290	5840	yes	S-4	Kayenta	ca. AD. 1050	200 X 40m.
42Ga1665	1290	5600	yes	S-4	Unknown	-	10 X 20m.
42Ga1666	39	5920	yes	S-4	Unknown	-	30 X 100m.

TABLE 4-15

ESCALANTE TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
Lithic Scatter (Continued)							
42Ga1668	39	5880	yes	S-4	Unknown	-	10 X 30m.
42Ga1669	39	6080	yes	S-4	Unknown	-	10 X 30m.
42Ga1670	39	6040	yes	S-4	Kayenta	ca. AD. 1050	40 X 200m.
42Ga1671	39	5980	yes	S-4	Unknown	-	20 X 10m.
42Ga1672	39	5940	no	S-4	Unknown	-	40 X 20m.
42Ga1673	1308	5880	no	S-4	Unknown	-	20 X 30m.
42Ga1674	1308	6160	no	S-4	Unknown	-	10 X 10m.
42Ga1675	1308	5980	yes	S-4	Unknown	-	10 X 20m.
42Ga1676	1308	5880	no	S-3	Unknown	-	85 X 100m.
42Ga1677	1308	5980	yes	S-4	Unknown	-	20 X 20m.
42Ga1678	1308	5780	yes	S-4	Unknown	-	20 X 20m.
42Ga1679	1308	5740	no	S-4	Unknown	-	100 X 100m.
42Ga1680	1308	5820	yes	S-4	Unknown	-	50 X 50m.
42Ga1681	1392	5680	yes	S-4	Fremont	ca. AD. 800	30 X 150m.
42Ga1682	1392	5780	yes	S-4	Kayenta	ca. AD. 1050	200 X 40m.
42Ga1683	1392	5800	no	S-4	Unknown	-	100 X 100m.
42Ga1684	1392	5720	yes	S-4	Unknown	-	60 X 60m.
42Ga1686	1392	5780	yes	S-4	Unknown	-	100 X 60m.
42Ga1687	1392	5720	yes	S-4	Kayenta	ca. AD. 1050	80 X 350m.
42Ga1688	1583	6490	no	S-4	Unknown	-	25 X 126m.
42Ga1689	1583	6520	no	S-4	Unknown	-	3 X 3m.
42Ga1690	1583	6540	yes	S-3	Unknown	-	100 X 100m.
42Ga1692	1583	5320	no	S-4	Unknown	-	35 X 15m.
42Ga1693	1583	5800	yes	S-3	Kayenta	ca. AD. 1050	200 X 400m.
42Ga1694	1583	5800	yes	S-2	Kayenta	ca. AD. 1050	20 X 20m.
42Ga1695	1583	5800	yes	S-3	Unknown	-	10 X 10m.

TABLE 4-15

ESCALANTE TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
42Ga1696	1583	5800	no	S-3	Unknown	-	50 X 200m.
42Ka 842	991-2b	4150	yes	S-4	Shoshonen	ca. AD. 1500	50 X 50m.
42Ka1849	2787	7200	yes	S-4	Kayenta	ca. AD. 1050	15 X 25m.
42Ka1850	2787	7100	no	S-4	Unknown	-	8 X 4m.
42Ka1852	2787	7200	yess	S-4	Kayenta	ca. AD. 1050	40 X 40m.
42Ka1864	991-2b	4150	yes	S-4	Unknown	-	50 X 50m.
42Ka1869	1071b	4200	no	S-4	Unknown	-	10 X 10m.
42Ka1872	571-6b	4410	no	S-4	Unknown	-	3 X 3m.
42Ka1873	571-6b	4440	yes	S-4	Unknown	-	10 X 10m.
42Ka1874	571-6b	4440	yes	S-4	Unknown	-	15 X 15m.
42Ka1875	1318	4080	no	S-4	Unknown	-	15 X 15m.
42Ka1876	1318	4160	yes	S-4	Kayenta	ca. AD. 1050	20 X 30m.
42Ka1877	1318	4320	no	S-4	Unknown	-	1 X 1m.
42Ka1878	658	5440	no	S-4	Unknown	-	30 X 100m.
42Ka1879	1376	5440	yes	S-4	Unknown	-	100 X 50m.
42Ka1882	2156	7180	no	S-4	Unknown	-	10 X 10m.
42Ka1884	744	4820	no	S-4	Kayenta	ca. AD. 1050	30 X 30m.
42Ka1885	2747	4160	no	S-4	Unknown	-	50 X 100m.
42Ka1886	2747	4160	no	S-4	Unknown	-	30 X 30m.
42Ka1887	2747	4170	no	S-4	Unknown	-	20 X 20m.
42Ka1888	2747	4240	no	S-4	Unknown	-	75 X 75m.
42Ka1902	705-7b	4780	no	S-4	Unknown	-	15 X 15m.
42Ka1903	705-7b	4720	no	S-4	Unknown	-	30 X 30m.
42Ka1905	705-7b	4780	no	S-4	Unknown	-	40 X 40m.
42Ka1906	705-7b	4760	yes	S-4	Unknown	-	30 X 30m.
42Ka1907	1172	4040	yes	S-4	Kayenta	ca. AD. 1050	

TABLE 4-15

ESCALANTE TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
Lithic Scatter (Continued)							
42Ka1908	1172	4040	no	S-4	Unknown	-	
Temporary Camp							
42Ga1586	19b	6040	yes	S-4	Kayenta	ca. AD. 1050	50 X 50m.
42Ga1587	19b	6000	yes	S-4	Kayenta/Fremont	ca. 1050; 800	30 X 30m.
42Ga1589	19b	6080	yes	S-4	Kayenta	ca. AD. 1050	40 X 15m.
42Ga1590	19b	6000	yes	S-4	Unknown	-	100 X 75m.
42Ga1591	19b	6020	yes	S-4	Kayenta	ca. AD. 1050	10 X 10m.
42Ga1607	80	6020	no	S-3	Unknown	-	30 X 20m.
42Ga1617	108	5440	yes	S-4	Kayenta	ca. AD. 1050	30 X 10m.
42Ga1618	108	5460	yes	S-3	Unknown	-	10 X 10m.
42Ga1622	1071a	5900	no	S-4	Unknown	-	15 X 15m.
42Ga1623	1071a	5920	no	S-4	Unknown	-	30 X 30m.
42Ga1639	3	7080	no	S-4	Anasazi	ca. AD. 650	20 X 20m.
42Ga1641	553	6500	yes	S-4	Unknown	-	50 X 50m.
42Ga1649	1086	5600	yes	S-4	Unknown	-	50 X 50m.
42Ga1656	567	6700	yes	S-4	Kayenta	ca. AD. 1050	60 X 30m.
42Ga1657	1026	5660	yes	S-4	Kayenta	ca. AD. 1050	10 X 10m.
42Ga1685	1392	5780	yes	S-4	Kayenta	ca. AD. 1050	160 X 50m.
42Ga1821	20b	5880	yes	S-4	Unknown	-	5 X 5m.
42Ga1822	20b	5800	yes	S-3	Unknown	-	20 X 30m.
42Ga1823	20b	5900	yes	S-3	Fremont	ca. AD. 800	20 X 20m.

TABLE 4-15

ESCALANTE TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
Temporary Camp (Continued)							
42Ka1842	1172-4b	3900	yes	S-4	Fremont	ca. AD. 800	60 X 20m.
42Ka1845	1172-4b	4000	no	S-4	Unknown	-	50 X 100m.
42Ka1846	1172-4b	4040	no	S-4	Unknown	-	30 X 30m.
42Ka1848	00	4600	yes	S-4	Kayenta	ca. AD. 1050	10 X 10m.
42Ka1853	1023	4400	yes	S-4	Kayenta	ca. AD. 1050	10 X 20m.
42Ka1854	1023	4400	yes	S-4	Kayenta	ca. AD. 1050	200 X 100m.
42Ka1855	1036	4200	yes	S-4	Shoshonen	ca. AD. 1500	150 X 150m.
42Ka1856	1036	4200	no	S-4	Unknown	-	30 X 30m.
42Ka1859	1337-5b	4360	yes	S-4	Kayenta	ca. AD. 1050	30 X 30m.
42Ka1867	1071b	4120	yes	S-4	Piute	ca. AD. 1500	50 X 60m.
42Ka1871	991-2b	4160	yes	S-4	Kayenta	ca. AD. 1050	10 X 10m.
42Ka1883	2156	7200	yes	S-4	Kayenta	ca. AD. 1050	50 X 30m.
42Ka1897	622	7360	yes	S-4	Kayenta	ca. AD. 1050	40 X 100m.
42Ka1898	622	7250	yes	S-4	Kayenta	ca. AD. 1050	20 X 20m.
42Ka1899	622	7300	yes	S-4	Kayenta	ca. AD. 1050	20 X 80m.
42Ka1900	622	7370	yes	S-4	Kayenta	ca. AD. 1050	100 X 50m.
42Ka1901	622	7280	yes	S-4	Kayenta	ca. AD. 1050	30 X 30m.
Single Habitation							
42Ga1579	19b	5940	yes	S-4	Kayenta	ca. AD. 1050	30 X 30m.
42Ga1582	19b	5950	yes	S-4	Kayenta	ca. AD. 1050	5 X 5m.
42Ga1583	19b	5920	yes	S-4	Kayenta/Fremont	ca. 1050; 800	5 X 5m.
42Ga1588	19b	6000	no	S-4	Unknown	-	1.5m.^{2}

TABLE 4-15

ESCALANTE TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
Single <u>Habitation (Continued)</u>							
42Ga1621	1071a	5900	yes	S-4	Fremont	ca. AD. 800	7 X 7m.
42Ga1626	1071a	5820	no	S-4	Unknown	-	20 X 20m.
42Ga1627	1071a	5820	yes	S-4	Unknown	-	45 X 45m.
42Ga1628	1071a	5820	yes	S-3	Kayenta	ca. AD. 1050	20 X 20m.
42Ga1640	3	6820	yes	S-4	Kayenta	ca. AD. 1050	15 X 40m.
42Ka1847	1172-4b	4020	no	S-3	Kayenta	ca. AD. 1050	12 X 15m.
42Ka1864	991-2b	4150	yes	S-4	Unknown	-	50 X 50m.
42Ka1889	793	7490	yes	S-4	Kayenta	ca. AD. 1050	40 X 40m.
42Ka1890	793	7480	yes	S-4	Kayenta	ca. AD. 1050	30 X 10m.
42Ka1892	793	7480	yes	S-4	Kayenta	ca. AD. 1050	60 X 30m.
42Ka1893	793	7480	no	S-3	Kayenta	ca. AD. 1050	60 X 60m.
42Ka1894	793	7480	yes	S-4	Kayenta	ca. AD. 1050	45 X 20m.
42Ka1895	793	7470	yes	S-3	Kayenta	ca. AD. 1050	35 X 50m.
42Ka1896	793	7470	yes	S-4	Kayenta	ca. AD. 1050	40 X 10m.
Extended <u>Camp</u>							
42Ga1602	80	6080	yes	S-4	Kayenta	ca. AD. 1050	100 X 30m.
42Ga1614	12b	5040	yes	S-4	Kayenta	ca. AD. 1050	25 X 30m.
42Ga1648	1086	5560	no	S-2	Unknown	-	75 X 75m.
42Ga1658	1026	5700-5746	yes	S-3	Kayenta	ca. AD. 1050	75 X 50m.
42Ga1697	1583	5680-5893	yes	S-2	Shoshonen	ca. AD. 1500	300 X 600m.
42Ga1820	20b	5800	yes	S-4	Fremont	ca. AD. 800	5 X 5m.

TABLE 4-15

ESCALANTE TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
<u>Extended Camp (Continued)</u>							
42Ka1841	1172-4b	3900	yes	S-4	Kayenta	ca. AD. 1050	70 X 50m.
42Ka1857	1036	4280	yes	S-2	Unknown	-	20 X 10m.
42Ka1860	1337-5b	4340	yes	S-3	Kayenta	ca. AD. 1050	30 X 30m.
42Ka1862	1071b	4150	yes	S-3	Kayenta	ca. AD. 1050	50 X 50m.
42Ka1863	1071b	4050	yes	S-2	Kayenta	ca. AD. 1050	30 X 30m.
42Ka1865	1071b	4000	yes	S-4	Kayenta	ca. AD. 1050	120 X 50m.
42Ka1881	2156	7330	yes	S-4	Kayenta	ca. AD. 1050	150 X 50m.
42Ka1904	705-7b	4770	yes	S-3	Kayenta	ca. AD. 1050	30 X 20m.
42Ka1918	1397	4260	yes	S-3	Kayenta	ca. AD. 1050	150 X 30m.
42Ka1919	1397	4080	no	S-4	Unknown	-	200 X 100m.
<u>Multiple Habitations</u>							
42Ga1580	19b	5980	yes	S-4	Kayenta	ca. AD. 1050	20 X 20m.
42Ga1584	19b	6020	yes	S-2	Kayenta/Fremont	ca. 1050; 800	25 X 15m.
42Ga1585	19b	6120	yes	S-1	Kayenta	ca. AD. 1050	175 X 75m.
42Ga1652	2349	7430	yes	S-2	Kayenta	ca. AD. 1050	125 X 300m.
42Ka1840	1172-4b	3920	yes	S-3	Kayenta	ca. AD. 1050	40 X 250m.
42Ka1843	1172-4b	3900	yes	S-4	Kayenta	ca. AD. 1050	60 X 20m.
42Ka1844	1172-4b	3900	no	S-4	Kayenta	ca. AD. 1050	20 X 70m.
42Ka1866	1071b	4120	yes	S-3	Kayenta	ca. AD. 1050	10 X 30m.
42Ka1891	793	7470	yes	S-2	Kayenta	ca. AD. 1050	50 X 50m.

TABLE 4-15

ESCALANTE TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
Rock Shelter							
42Ga1667	39	5920	no	S-3	Unknown	-	30 X 30m.
42Ga1691	1583	6560	yes	S-3	Unknown	-	5 X 15m.
42Ka1839	999	4400	no	S-4	Unknown	-	5 X 5m.
42Ka1880	2510	4800	yes	S-4	Fremont	ca. AD. 800	10 X 100m.
Quarry							
42Ga1581	19b	6000	no	S-4	Unknown	-	800 X 150m.
42Ga1635	101	5260	no	S-4	Unknown	-	100 X 30m.
42Ga1647	1086	5520	no	S-4	Unknown	-	300 X 300m.
Hunting							
42Ga1646	1086	5600	yes	S-3	Unknown	-	800 X 500m.
42Ga1653	1048-13b	7000	yes	S-4	Unknown	-	200 X 750m.
42Ka1851	2787	7240	yes	S-4	Kayenta	ca. AD. 1050	20 X 30m.
Granary							
42Ga1659	1026	5780	yes	S-2	Kayenta	ca. AD. 1050	10 X 5m.
42Ga1818	20b	6200	no	S-4	Unknown	-	2 X 2.5m.
42Ga1819	20b	6200	no	S-4	Unknown	-	15 X 3m.

TABLE 4-15

ESCALANTE TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
<u>Historical Trail</u>							
42Ka1861	1337-5b	4360	yes	S-4	Historic	19th century	30 X 30m.
<u>Oven</u>							
42Ka1858	1036	4280	no	S-4	Unknown	-	5 X 5m.
<u>Petroglyph</u>							
42Ka1910	1172	3900	no	S-3	Kayenta	ca. AD. 1050	

considered for nomination to the National Register of Historic Sites.

Summing up for the Escalante River Planning Unit, lithic scatters were the predominant site type among the Class II archeological sites and the pinyon-juniper ecozone was most frequently occupied. Most Class II archeological sites were on the Jurassic, Navajo Formation, and ridges and benches were favored localities for settlement. Class II archeological sites were distributed throughout various elevation ranges and rainfall zones, but more than in any other case, they were in the 5,000 to 6,000 foot (1,524-1,829 m.) elevation range and the ten to twelve inch (254-305 mm.) annual precipitation zone.

GARFIELD PLANNING UNIT (BLM)

A one percent sample, stratified according to vegetation type, was the survey procedure specified by the BLM for the Garfield Planning Unit. The result was six quarter-section sample areas in the unit which were intensively surveyed by the AERC in the fall of 1977.

Archeological sites, 23 in all, were located in all six of the sample areas (see Figure 4-4, Table 4-16). These sample areas are rather evenly distributed throughout the planning unit; but since ten of the unit's 23 archeological sites are in the sample area (Ga299) situated farthest to the north, there is a strong northern bias in the distribution.

Lithic scatters predominate among the 23 Class II archeological sites of the Garfield Planning Unit (see Table 4-19). Only three are not lithic scatters. These three are temporary camps.

The breakdown of Class II archeological sites by vegetation is the same. Twenty of these sites were in the pinyon-juniper ecozone or habitat, while three were in the arid ecozone. This breakdown, however, does not correspond with that for sample areas as shown in Figure 4-16; the three temporary camps were in the pinyon-juniper ecozone.

GARFIELD PLANNING UNIT

- Sample Area
- Individual Class I Site
- Individual Class II Site
- 5-9 Class II Sites
- 10-14 Class II Sites
- 15-19 Class II Sites
- Coal Field

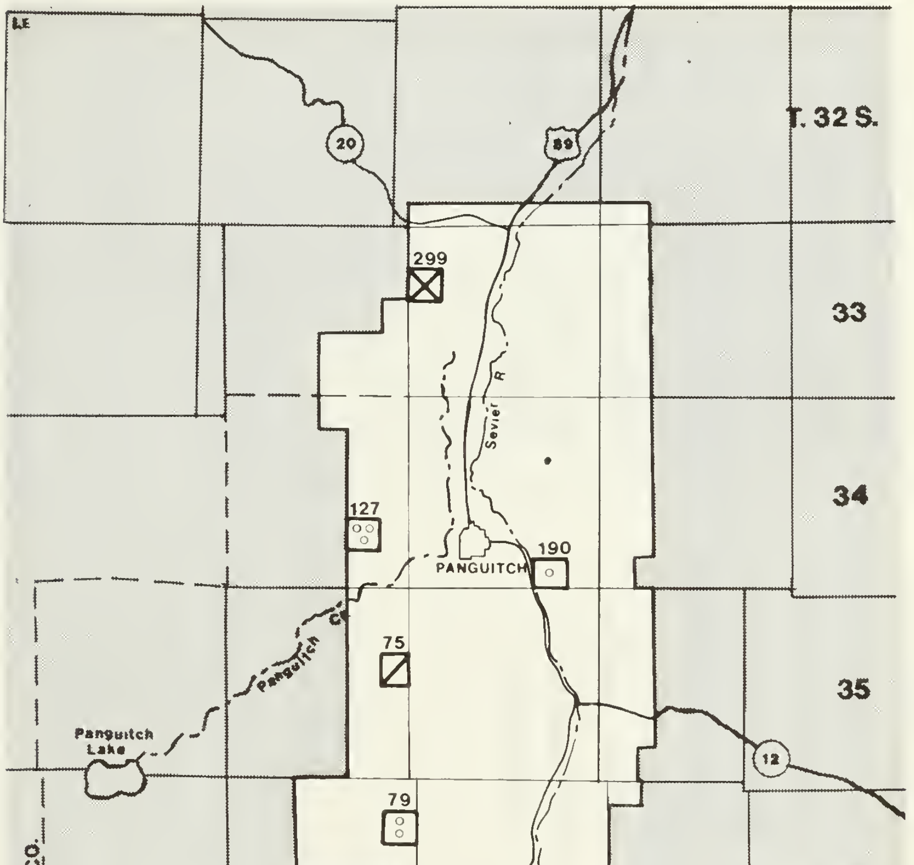


Figure 4-4

N

0 4 Miles 8

TABLE 4-16

GARFIELD PLANNING UNIT

Sample Area	AERC Vegetation Zone	BLM Vegetation Type	Legal Description	No. of Sites Located
24	Pinyon-juniper	Brush/scrub	T37S, R5W, Sec 22, NE¼	2
75	Pinyon-juniper	Pinyon-juniper	T35S, R6W, Sec 13, NE¼	5
79	Arid-Transitional	Brush/scrub	T36S, R6W, Sec 12, NE¼	2
127	Pinyon-juniper	Pinyon-juniper	T34S, R6W, Sec 26, SW¼	3
190	Pinyon-juniper	Brush/scrub	T34S, R5W, Sec 22, NE¼	1
299	Arid-Transitional	Brush/scrub	T33S, R5W, Sec 18, SE¼	10

TABLE 4-17

GEOLOGIC/SITE RELATIONSHIPS

GARFIELD PLANNING UNIT

		TERTIARY		CRETACEOUS							JURASSIC									
Permanent Site Number	QUATERNARY	Wasatch Formation	Tertiary Undivided	~~Cretaceous Undivided~~	~~Kaiparowits~~	~~Straight Cliffs Wahweap Sandstone~~	~~Wahweap Sandstone~~	~~Straight Cliffs~~	~~Tropic Shale~~	~~Dakota Sandstone~~	~~Jurassic Undivided~~	~~Morrison Formation~~	~~Windsor Formation~~	~~Bluff Sandstone~~	~~Entrada Sandstone~~	~~Carmel Formation~~	~~Navajo Formation~~	~~Kayenta Formation~~	~~Moenkopi Formation~~	~~TRIASSIC~~
42Ga1765			X																	
1766			X																	
1767			X																	
1768			X																	
1769			X																	
1770			X																	
1771			X																	
1772			X																	
1773			X																	
1774			X																	
1775	X																			
1776	X																			
1777	X																			
1778	X																			
1779	X																			
1780	X																			
1781			X																	
1782			X																	
1783			X																	
1784		X																		
1785		X																		
1786			X																	
1787			X																	

TABLE 4-18

GEOMORPHOLOGIC/SITE RELATIONSHIPS

GARFIELD PLANNING UNIT

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ga1765								Rs									
1766			Al														
1767								Rs									
1768									Rs								
1769								Rs									
1770								Rs									
1771								Rs									
1772								Rs									
1773								Rs									
1774								Rs									
1775					Rs												
1776			Al														
1777					Rs												
1778					Rs												
1779					Rs												
1780								Al									
1781								Rs									
1782								Rs									
1783			Al														
1784									Rs								
1785																	Rs
1786								Rs									
1787								Rs									
Sub totals 23			3		4			13	2								1

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-19

GARFIELD TABULAR DESCRIPTION

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
Lithic Scatter							
42Ga1765	299	6760	yes	S-3	Kayenta/Shoshonen	ca. 1050;1500	100 X 100m.
42Ga1766	299	6680	yes	S-4	Unknown	-	20 X 50m.
42Ga1767	299	6800	yes	S-4	Kayenta	ca. AD. 1050	100 X 30m.
42Ga1768	299	6780	yes	S-4	Late Archaic	ca. AD. 1	20 X 40m.
42Ga1769	299	6820	yes	S-4	Kayenta	ca. AD. 1050	100 X 100m.
42Ga1770	299	6780	yes	S-4	Unknown	-	20 X 20m.
42Ga1772	299	6790	yes	S-4	Unknown	-	30 X 40m.
42Ga1773	299	6740	yes	S-3	Fremont	ca. AD. 800	60 X 80m
42Ga1774	299	6740	yes	S-4	Fremont	ca. AD. 800	50 X 40m.
42Ga1775	75	7580	no	S-4	Unknown	-	10 X 30m.
42Ga1776	75	7500	no	S-4	Unknown	-	25 X 25m.
42Ga1778	75	7630	yes	S-3	Kayenta	ca. AD. 1050	15 X 40m.
42Ga1779	75	7630	yes	S-4	Archaic	ca. BC. 2500	60 X 60m.
42Ga1781	127	7320	yes	S-4	Kayenta	ca. AD. 1050	400 X 600m.
42Ga1782	127	7360	yes	S-3	Fremont/Shoshonen	ca. 800; 1500	100 X 600m.
42Ga1783	127	7100	yes	S-4	Unknown	-	60 X 400m.
42Ga1784	24	7770	no	S-4	Unknown	-	5 X 5m.
42Ga1785	24	7480	yes	S-4	Unknown		50 X 50m.
42Ga1786	79	7880	yes	S-4	Late Archaic	ca. AD. 1	50 X 50m.
42Ga1787	79	7820	yes	S-4	Kayenta	ca. AD. 1050	40 X 800m.
Temporary Camp							
42Ga1771	299	6790	yes	S-4	Shoshonen	ca. AD. 1500	30 X 40m.
42Ga1780	190	6850	yes	S-4	Archaic/Fremont	ca. AD. 1; 800	800 X 800m.
42Ga1782	127	7360	yes	S-3	Fremont/Shoshonen	ca. 800; 1500	100 X 600m.

Sample area vegetation types reflect general ecozones but not the more limited habitats where sites are generally reported.

Another two-fold division among archeological sites of this unit relates to geology (see Table 4-17). In this case, six sites were on Quaternary deposits and seventeen were on the Wasatch Formation of the Tertiary period.

Geomorphological associations among these sites are more varied (see Table 4-18). Ridges (13 sites), mesas (4 sites), drainages (3 sites), benches (2 sites), and slopes (1 site) were all land forms occupied by the Class II archeological sites.

Concerning elevation, eleven of the archeological sites are in the 6,000 to 7,000 foot (1,829-2,134 m.) range and twelve are in the 7,000 to 8,000 foot (2,134-2,438 m.) range (see Table 4-19).

About 22 of the unit's 23 Class II sites are in the twelve to sixteen inch (305-407 mm.) rainfall zone. The single exception is in the ten to twelve inch (254-305 mm.) rainfall zone (see Table 4-7).

Five of these 23 sites received a CRES rating above S-4 and these were all rated S-3 (see Table 4-19). (For a discussion of the rating system, see the preceding chapter.)

Generalizations concerning significant correlations between archeological sites and environmental features are difficult from the Garfield sampling alone. As in other planning units, however, ridges and the pinyon-juniper ecozone figure prominently in site location.

PARIA PLANNING UNIT (BLM)

No sample areas were selected by the BLM in the Paria Planning Unit. However, numerous sites are known for that region from previous archeological surveys (see Figure 4-1 and Figure 4-5).

PARIA PLANNING UNIT

- Individual Class I Site
- Coal Field
- — Coal Seam

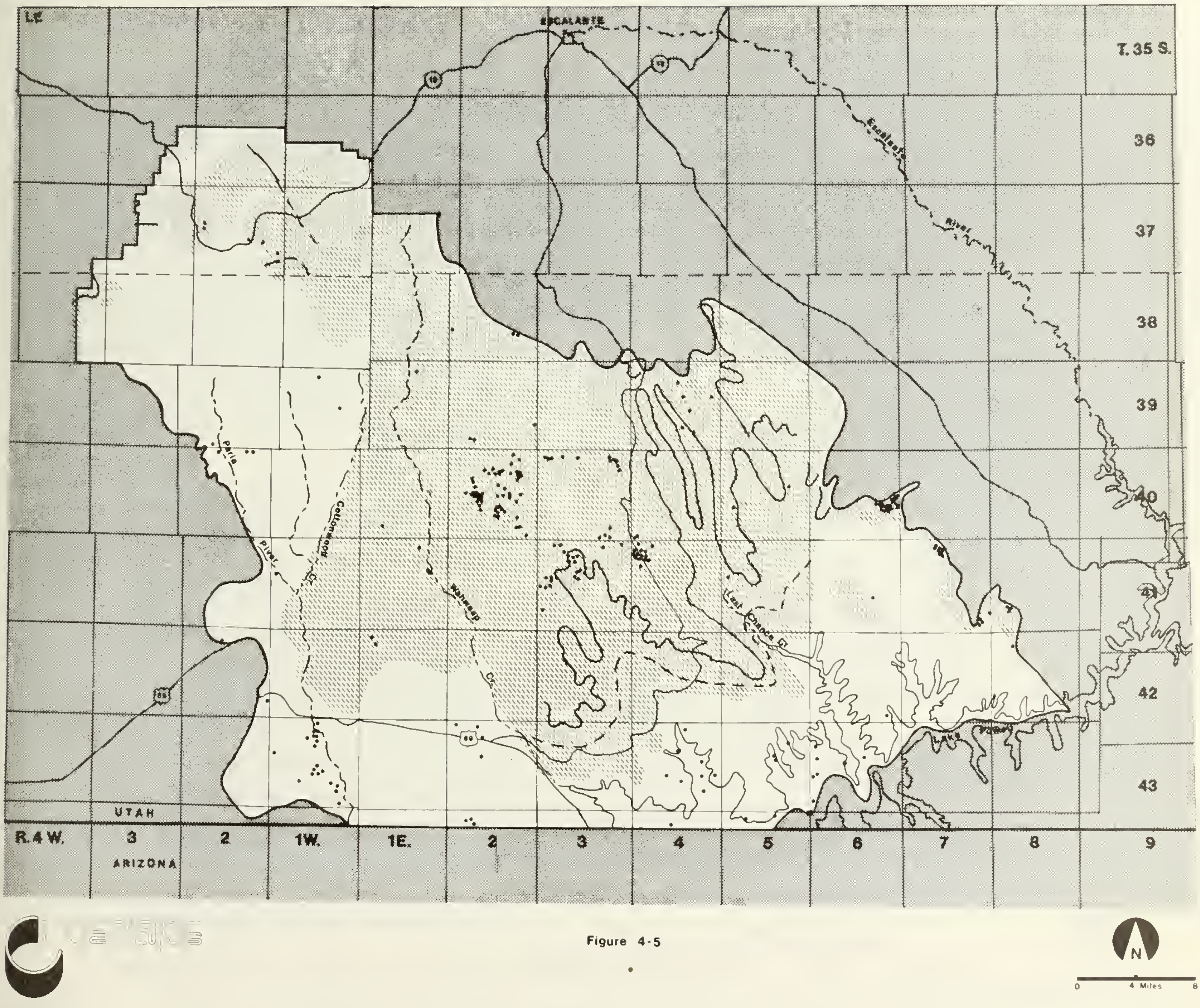


Figure 4-5

WEST ZION PLANNING UNIT (BLM)

A one percent sample, stratified by vegetation type by the BLM for the Zion Planning Unit, resulted in only one sample area being assigned to the West Zion Planning Unit. This unit was surveyed by AERC in the fall of 1977 and no archeological sites were found (see Figure 4-6 and Table 4-20).

ZION PLANNING UNIT (BLM)

From a one percent sample, stratified by vegetation type, the BLM assigned AERC ten quarter-section sample areas for archeological survey. Eight of the ten sample areas were subsequently surveyed by AERC in the fall of 1977. (Snow cover on two of the sample areas necessitated a substitution of similar sample areas #1a and #2a).

A total of 21 archeological sites was found among eight of the ten sample areas of the Zion unit (see Table 4-21). Seven of the sample areas and sixteen of the archeological sites are in the western half of the planning unit; three sample areas and five sites are in the eastern half.

The 21 archeological sites in the Zion Planning Unit include nine lithic scatters, five temporary camps, six extended camps, and one granary (see Table 4-24). Of the five sites in the eastern half of the planning unit, one is a temporary camp and the other four are lithic scatters. All other temporary camps, all extended camps, and the one granary are westward in the planning unit.

Only one archeological site in the planning unit is outside the pinyon-juniper ecozone. It was recorded in the arid-transitional ecozone.

Geologically, there is variation among the sites (see Table 4-22). Class II archeological sites in the unit are on the Straight Cliffs (1 site) and Tropic (3 sites) Formations of the Cretaceous period, and on the Winsor (9 sites) and Carmel (3 sites) Formations of the Jurassic period. Five other sites are on unidentified formations created within the Jurassic period.

- ☐ Sample Area
- • Individual Class I Site
- ∘ Individual Class II Site
- ⧄ 5-9 Class II Sites
- ⊠ 10-14 Class II Sites
- Coal Field
- — Coal Seam

WEST ZION PLANNING UNIT

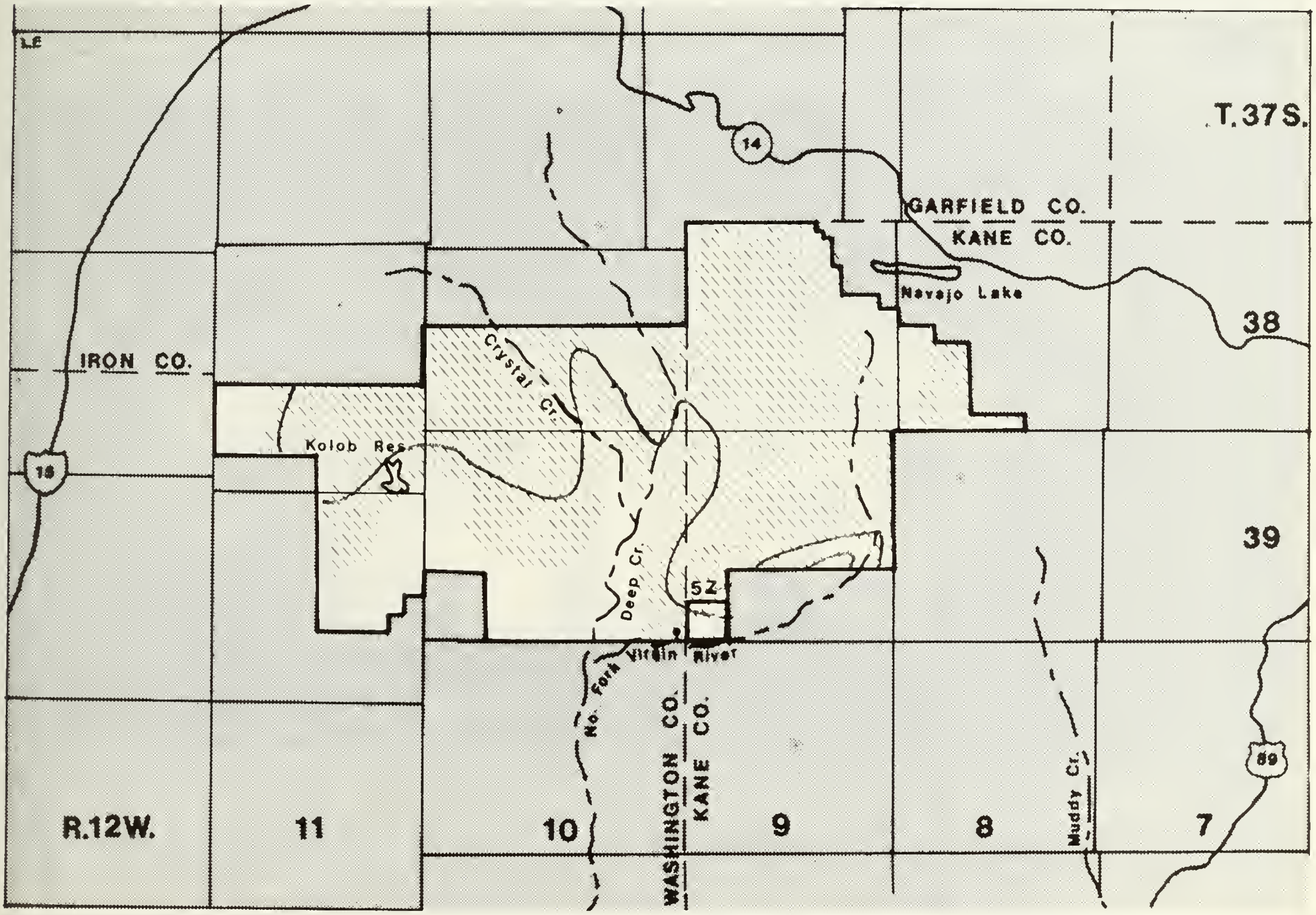


Figure 4-6

TABLE 4-20

WEST ZION PLANNING UNIT

Sample Area	AERC Vegetation Zone	BLM Vegetation Type	Legal Description	No. of Sites Located
5z*	Montane-Transitional	Pinyon-juniper	T39S, R9W, Sec 31, NE$\frac{1}{4}$	0

*Originally issued with Zion Planning Unit Sample Areas.

ZION PLANNING UNIT

- Sample Area
- Individual Class I Site
- Individual Class II Site
- 5-9 Class II Sites
- Coal Field
- Coal Seam

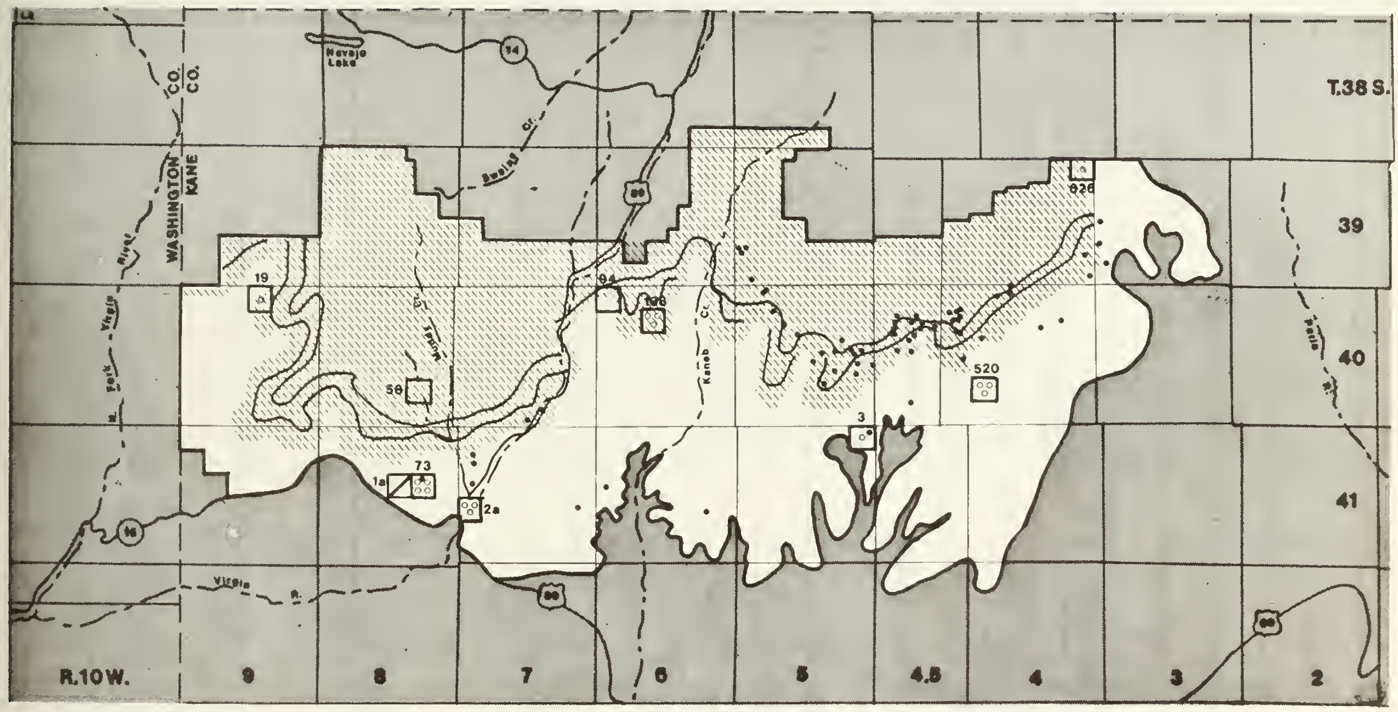


Figure 4-7

TABLE 4-21

ZION PLANNING UNIT

Sample Area	AERC Vegetation Zone	BLM Vegetation Type	Legal Description	No. of Sites Located
3	Arid Transitional	Sage	T41S, R5W, Sec 1, SW$\frac{1}{4}$	1
19	Pinyon-juniper	Mountain Scrub	T40S, R9W, Sec 3, SE$\frac{1}{4}$	1
58	Pinyon-juniper	Pinyon-juniper	T40S, R8W, Sec 26, NW$\frac{1}{4}$	0
73	Pinyon-juniper	Pinyon-juniper	T41S, R8W, Sec 14, SE$\frac{1}{4}$	4
94	Montane-Transitional	Mountain Scrub	T40S, R6W, Sec 6, SE$\frac{1}{4}$	0
138	Pinyon-juniper	Pinyon-juniper	T40S, R6W, Sec 9, NW$\frac{1}{4}$	3
520	Pinyon-juniper	Pinyon-juniper	T40S, R4W, Sec 29, SE$\frac{1}{4}$	3
626	Pinyon-juniper	Pinyon-juniper	T39S, R4W, Sec 1, SE$\frac{1}{4}$	1
1a*	Pinyon-juniper	Pinyon-juniper	T41S, R8W, Sec 15, SW$\frac{1}{4}$	5
2a*	Pinyon-juniper	Pinyon-juniper	T41S, R7W, Sec 19, SW$\frac{1}{4}$	3

*Substitued sample areas

TABLE 4-22

GEOLOGIC/SITE RELATIONSHIPS

ZION PLANNING UNIT

Permanent Site Number	QUATERNARY	TERTIARY	CRETACEOUS							JURASSIC									~~TRIASSIC~~
		Wasatch Formation	~~Cretaceous Undivided~~	Kaiparowits	~~Straight Cliffs Wahweap Sandstone~~	Wahweap Sandstone	Straight Cliffs	Tropic Shale	Dakota Sandstone	Jurrassic Undivided	~~Morrison Formation~~	Windsor Formation	~~Bluff Sandstone~~	~~Entrada Sandstone~~	Carmel Formation	Navajo Formation	~~Kayenta Formation~~	~~Moenkopi Formation~~	
42Ka1920												X							
1921												X							
1922												X							
1923												X							
1924							X												
1925								X											
1926								X											
1927								X											
1928												X							
1929										X									
1930										X									
1931										X									
1932										X									
1950										X									
1951												X							
1952												X							
1953												X							
1954												X							
1955															X				
1956															X				
1957															X				

TABLE 4-23

GEOMORPHOLOGIC/SITE RELATIONSHIPS

ZION PLANNING UNIT

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ka1920								Rs									
1921			Rs														
1922								Rs									
1923										Rs							
1924									Rs								
1925											Rs						
1926			Al														
1927								Rs									
1928								Rs									
1929								Al									
1930								Rs									
1931								Rs									
1932								Rs									
1950			Al														
1951								Rs									
1952								Al									
1953								Al									
1954								Rs									
1955														Al			
1956								Al									
1957														Rs			
Sub totals 21			3					13	1	1	1			2			

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-24

ZION TABULAR DESCRIPTION

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	
Lithic Scatter							
42Ka1920	73	5800	yes	S-2	Kayenta	ca. AD. 1050	250 X 50m.
42Ka1926	138	7120	yes	S-4	Unknown	-	40 X 20m.
42Ka1927	138	7000	yes	S-4	Unknown	-	200 X 75m.
42Ka1929	520	6340	no	S-4	Unknown	-	30 X 30m.
42Ka1930	520	6350	yes	S-4	Kayenta	ca. AD. 1050	30 X 30m.
42Ka1931	520	6325	yes	S-4	Kayenta	ca. AD. 1050	30 X 30m.
42Ka1932	3	6100	yes	S-4	Kayenta	ca. AD. 1050	10 X 10m.
42Ka1956	2a	5360	yes	S-4	Unknown	-	100 X 70m.
42Ka1957	2a	5400	yes	S-4	Unknown	-	20 X 20m.
Extended Camp							
42Ka1921	73	5820	yes	S-3	Kayenta	ca. AD. 1050	30 X 5m.
42Ka1923	73	5680	yes	S-3	Kayenta	ca. AD. 1050	100 X 75m.
42Ka1951	1a	5720	yes	S-4	Kayenta	ca. AD. 1050	400 X 300m.
42Ka1953	1a	5650	yes	S-4	Kayenta	ca. AD. 1050	100 X 200m.
42Ka1954	1a	5700	yes	S-4	Kayenta	ca. AD. 1050	100 X 60m.
42Ka1955	2a	5400	yes	S-4	Kayenta	ca. AD. 1050	100 X 70m.
Temporary Camp							
42Ka1924	19	6800	yes	S-4	Kayenta	ca. AD. 1050	30 X 30m.
42Ka1925	138	7132	no	S-4	Unknown	-	10 X 5m.
42Ka1928	626	7040	no	S-4	Unknown	-	30 X 30m.

TABLE 4-24

ZION TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
<u>Temporary Camp (Continued)</u>							
42Ka1950	1a	5640	yes	S-4	Kayenta	ca. AD. 1050	10 X 20m.
42Ka1952	1a	5660	no	S-4	Kayenta	ca. AD. 1050	10 X 10m.
<u>Cist</u>							
42Ka1922	73	8520	yes	S-4	Kayenta	ca. AD. 1050	10 X 10m.

Land features on which Class II archeological sites are situated in the Zion Planning Unit include ridges (13 sites), drainages (3 sites), hills (2 sites), benches (1 site), saddles (1 site), and terraces (1 site). See Table 4-23.

Most of the Class II archeological sites in this unit (11) are between 5,000 and 6,000 feet (1,524-1,829 m.) in elevation (see Table 4-24). The others are higher with five in the 6,000 to 7,000 foot (1,829-2,134 m.) range, four between 7,000 and 8,000 feet (2,134-2,438 m.), and one in the 8,000 to 9,000 foot (2,438-2,743 m.) range.

All but one of the unit's Class II archeological sites are in the twelve to sixteen inch (305-407 mm.) rainfall zone (see Table 4-7), the sole exception receiving between 20 and 25 inches (508-635 mm.) of annual precipitation.

Concerning site significance, three of the Class II archeological sites are rated above S-4 in the CRES system (see Table 4-24). All three are in sample area #73 in the western part of the unit and two were classified as S-3, with the third assigned an S-2.

AQUARIUS SAMPLING STRATUM (Forest Service)

The Aquarius Planning Unit is on land administered by the Forest Service. The sampling technique utilized to define the seventeen sample areas consisted of a one percent sample stratified in the coal resource zone by the Forest Service Regional Office in Ogden, Utah. These seventeen sample areas were intensively surveyed by AERC in the early fall of 1977.

All of the sample areas are clustered in the southern part of the planning unit (see Figure 4-8). A total of 53 archeological sites was located in twelve of the seventeen areas (see Table 4-25).

Of the 53 Class II sites in the unit, 34 are lithic scatters, 1 is a hunting site, 12 are quarries, 4 are temporary camps, 1 is a multiple habitation, and 1 is a burial site (see Table 4-28).

AQUARIUS PLANNING UNIT

- Sample Area
- Individual Class I Site
- Individual Class II Site
- 5-9 Class II Sites
- 10-14 Class II Sites
- 15-19 Class II Sites
- Coal Field

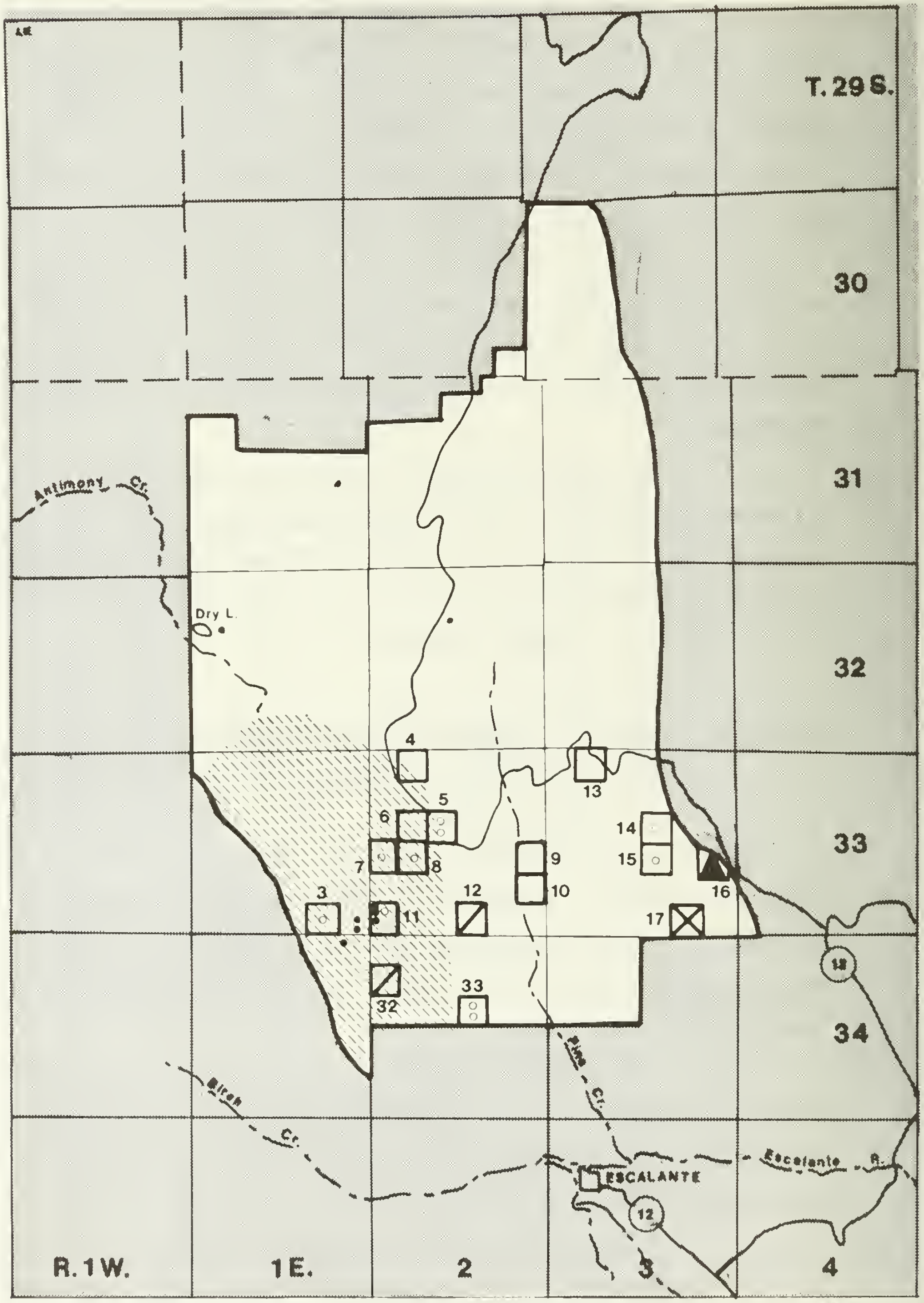


Figure 4-8

Concerning vegetation type (see Table 4-25), 48 sites are in the pinyon-juniper ecozone and five are in the mountain brush ecozone.

As for the geological associations of the unit's Class II sites (see Table 4-26), 37 sites are on Quaternary deposits, 4 are on the Cretaceous Straight Cliffs Formation, and 12 are on the Navajo Formation of the Jurassic period.

Noting the association of the unit's sites with different land features (see Table 4-27), 17 are in drainages, 11 are on benches, 9 are in valleys, and 6 are on ridges.

There are 32 sites in the 6,000 to 7,000 foot (1,829-2,134 m.) elevation range (see Table 4-28). Higher up, 15 sites are between 7,000 and 8,000 feet (2,134-2,438 m.), 5 sites are between 8,000 and 9,000 feet (2,438-2,743 m.), and 1 site is slightly over 9,000 feet (2,743+ m.).

Rainfall (see Table 4-7) is between twelve and sixteen inches (305-407 mm.) at two sites, between sixteen and twenty inches (407-508 mm.) at 47 sites, and between twenty and twenty-five inches (508-635 mm.) at four sites.

A total of eleven Class II archeological sites was given a significance rating above S-III in AERC's Forest rating system (see the preceding chapter for a definition of significance). Among those sites within the Forest boundaries, ten were rated S-II and one, 42Ga1719, a multiple habitation, was rated S-I. (Table 4-28).

While the number of newly recorded sites that are lithic scatters and the number that fall within the pinyon-juniper ecozone lead their respective categories (as in other planning units), the relative number of quarries in the Aquarius Unit is unusually high. Likewise, there is an unusually high percentage of sites in association with Quaternary deposits and situated in drainages--rather than on ridges as is usually the case. This correlation between quarries and sites in association with Quaternary deposits and drainages (where quarry materials are being exposed through natural erosion processes) is culturally significant.

TABLE 4-25

AQUARIUS PLANNING UNIT

Sample Area	AERC Vegetation Zone	Legal Description	No. of Sites Located
3	Montane	T33S, R1E, Sec 35, SW$\frac{1}{4}$	1
4	Montane	T33S, R2E, Sec 5, SE$\frac{1}{4}$	0
5	Montane	T33S, R2E, Sec 16, NE$\frac{1}{4}$	2
6	Montane	T33S, R2E, Sec 17, NW$\frac{1}{4}$	0
7	Montane	T33S, R2E, Sec 29, SW$\frac{1}{4}$	1
8	Montane	T33S, R2E, Sec 20, SE$\frac{1}{4}$	1
9	Montane	T33S, R2E, Sec 24, NE$\frac{1}{4}$	0
10	Montane	T33S, R2E, Sec 25, NW$\frac{1}{4}$	0
11	Pinyon-juniper	T33S, R2E, Sec 31, SW$\frac{1}{4}$	1
12	Pinyon-juniper	T33S, R2E, Sec 34, SE$\frac{1}{4}$	8
13	Montane	T33S, R3E, Sec 5, NE$\frac{1}{4}$	0
14	Pinyon-juniper	T33S, R3E, Sec 25, NW$\frac{1}{4}$	1
15	Pinyon-juniper	T33S, R3E, Sec 22, SW$\frac{1}{4}$	1
16	Pinyon-juniper	T33S, R3E, Sec 24, SE$\frac{1}{4}$	15
17	Pinyon-juniper	T33S, R3E, Sec 35, NE$\frac{1}{4}$	14
32	Pinyon-juniper	T34S, R2E, Sec 7, SE$\frac{1}{4}$	6
33	Pinyon-juniper	T34S, R2E, Sec 25, SE$\frac{1}{4}$	2

TABLE 4-26

GEOLOGIC/SITE RELATIONSHIPS

AQUARIUS PLANNING UNIT

	QUATERNARY	TERTIARY	CRETACEOUS							JURASSIC									~~TRIASSIC~~
Permanent Site Number		Wasatch Formation	~~Cretaceous Undivided~~	~~Kaiparowits~~	~~Straight Cliffs Wahweap Sandstone~~	Wahweap Sandstone	Straight Cliffs	~~Tropic Shale~~	~~Dakota Sandstone~~	~~Jurrassic Undivided~~	~~Morrison Formation~~	~~Windsor Formation~~	Bluff Sandstone	Entrada Sandstone	Carmel Formation	Navajo Formation	~~Kayenta Formation~~	~~Moenkopi Formation~~	
42Ga1698	X																		
1699	X																		
1700	X																		
1701	X																		
1702	X																		
1703	X																		
1704	X																		
1705	X																		
1706	X																		
1707	X																		
1708	X																		
1709	X																		
1710	X																		
1711	X																		
1712	X																		
1713	X																		
1714	X																		
1715	X																		
1716	X																		
1717	X																		
1718	X																		
1719							X												
1720							X												
1721							X												
1722							X												
1723	X																		
1724	X																		
1725																X			
1726																X			
1727																X			
1728																X			
1729																X			
1730																X			
1731	X																		
1732																X			
1733																X			
1734																X			
1735																X			

TABLE 4-26

GEOLOGIC/SITE RELATIONSHIPS

AQUARIUS PLANNING UNIT (Continued)

Permanent Site Number	QUATERNARY	TERTIARY	CRETACEOUS							JURASSIC									~~TRIASSIC~~
		Wasatch Formation	~~Cretaceous Undivided~~	~~Kaiparowits~~	~~Straight Cliffs Wahweap Sandstone~~	Wahweap Sandstone	~~Straight Cliffs~~	~~Tropic Shale~~	~~Dakota Sandstone~~	~~Jurassic Undivided~~	~~Morrison Formation~~	~~Windsor Formation~~	Bluff Sandstone	Entrada Sandstone	Carmel Formation	Navajo Formation	~~Kayenta Formation~~	~~Moenkopi Formation~~	
42Ga1736																X			
1736																X			
1737																X			
1738	X																		
1739	X																		
1740	X																		
42Ka1796	X																		
1797	X																		
1798	X																		
1799	X																		
1800	X																		
1801	X																		
1802	X																		
1803	X																		
1804	X																		
1805	X																		

TABLE 4-27

GEOMORPHOLOGIC/SITE RELATIONSHIPS

AQUARIUS PLANNING UNIT

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ga1698								Rs									
1699			Al														
1700			Al														
1701								Rs									
1702			Al														
1703								Cl									
1704									Rs								
1705									Rs								
1706									Rs								
1707					Rs												
1708			Cl														
1709									Rs								
1710									Rs								
1711			Rs														
1712			Rs														
1713									Rs								
1714									Rs								
1715									Rs								
1716									Rs								
1717					Rs												
1718					Rs												
1719												Bd					
1720		Bd															
1721								Rs									
1722								Ae									
1723																Rs	
1724					Rs												
1725									Rs								
Sub totals 28		1	6		4			5	10			1				1	

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-27

GEOMORPHOLOGIC/SITE RELATIONSHIPS

AQUARIUS PLANNING UNIT (Continued)

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ga1726									Rs								
1727																	Rs
1728																	Rs
1729																	Rs
1730																	Rs
1731																	Rs
1732																	Rs
1733			Rs														
1734																	Rs
1735																	Rs
1736											Rs						
1737											Rs						
1738											Rs						
1739																	Rs
1740										Rs							
42Ka1796			Cl														
1797								Al									
1798			Al														
1799			Al														
1800			Al														
1801			Al														
1802			Al														
1803			Al														
1804			Al														
1805			Rs														
Sub totals 25			10					1	1	1	3						9

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-28

AQUARIUS TABULAR DESCRIPTION

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
Lithic <u>Scatter</u>							
42Ga1699	16	6800	no	III*	Unknown	-	50 X 50m.
42Ga1700	16	6800	no	III*	Unknown	-	205 X 75m.
42Ga1702	16	6760	yes	II*	Unknown	-	25 X 15m.
42Ga1704	17	6790	yes	II*	Unknown	-	75 X 100m.
42Ga1706	17	6760	yes	III*	Unknown	-	10 X 10m.
42Ga1707	17	6800	no	II*	Unknown	-	200 X 30m.
42Ga1708	17	6520	no	III*	Unknown	-	7 X 7m.
42Ga1717	32	7450	no	III*	Unknown	-	60 X 30m.
42Ga1718	32	7480	yes	III*	Unknown	-	150 X 120m.
42Ga1721	32	7340	no	III*	Unknown	-	30 X 40m.
42Ga1722	32	7380	no	III*	Unknown	-	100 X 120m.
42Ga1723	33	7360	no	III*	Unknown	-	$10m.^2$ } 2 units
42Ga1724	33	7480	no	III*	Unknown	-	$20m.^2$ }
42Ga1726	15	7720	yes	III*	Kayenta	ca. AD. 1050	50 X 20m.
42Ga1727	12	7020	yes	II*	Unknown	-	30m. diameter
42Ga1728	12	6976	yes	III*	Unknown	-	15m. diameter
42Ga1729	12	6920	yes	III*	Kayenta	ca. AD. 1050	70 X 30m.
42Ga1730	12	6920	yes	III*	Kayenta	ca. AD. 1050	30m. diameter
42Ga1731	12	7020	yes	III*	Kayenta	ca. AD. 1050	15m. diameter
42Ga1732	12	7080	no	III*	Unknown	-	15m. diameter
42Ga1733	12	7040	no	III*	Unknown	-	10m. diameter
42Ga1734	12	6090	no	III*	Unknown	-	15m. diameter
42Ga1735	11	8360	no	III*	Unknown	-	10m. diameter

TABLE 4-28

AQUARIUS TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
42Ga1736	8	8680	no	III*	Unknown	-	25m. diameter
42Ga1737	7	9680	yes	III*	Kayenta	ca. AD. 1000	20m. diameter
42Ga1739	5	8360	no	III*	Late Archaic	ca. AD. 1	5m. diameter
42Ga1740	3	8240	no	III*	Unknown	-	7 X 3m.
42Ka1796	16	6840	no	II*	Unknown	-	40 X 60m.
42Ka1798	16	6760	no	III*	Unknown	-	10 X 10m.
42Ka1800	16	6760	no	III*	Unknown	-	5 X 5m.
42Ka1801	16	6790	no	III*	Unknown	-	250 X 60m.
42Ka1802	16	6800	no	III*	Unknown	-	10 X 20m.
42Ka1804	16	6840	no	III*	Unknown	-	15 X 10m.
42Ka1805	16	6845	no	III*	Unknown	-	30 X 30m.
<u>Quarry</u>							
42Ga1698	16	6900	no	III*	Unknown	-	40 X 75m.
42Ga1701	16	6840	no	II*	Unknown	-	600 X 150m.
42Ga1703	17	6880	no	II*	Unknown	-	150 X 150m.
42Ga1710	17	6900	no	III*	Unknown	-	200 X 100m.
42Ga1711	17	6920	no	III*	Unknown	-	25 X 75m.
42Ga1712	17	6880	no	III*	Unknown	-	20 X 50m.
42Ga1713	17	6850	no	III*	Unknown	-	15 X 15m.
42Ga1714	17	6920	no	III*	Unknown	-	20 X 20m.
42Ga1715	17	6900	no	III*	Unknown	-	200 X 40m.
42Ga1716	17	7000	no	III*	Unknown	-	250 X 170m.
42Ga1725	14	7920	yes	III*	Unknown	-	$800m.^2$
42Ka1797	16	6940	no	II*	Unknown	-	500 X 150m.

TABLE 4-28

AQUARIUS TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
<u>Temporary Camp</u>							
42Ga1705	17	6770	yes	II*	Shoshonean	ca. AD. 1500	20 X 40m.
42Ga1709	17	6720	no	III*	Unknown	-	8 X 8m.
42Ka1799	16	6760	yes	II*	Kayenta	ca. AD. 1050	15 X 15m.
42Ka1803	16	6800	no	III*	Unknown	-	75 X 75m.
<u>Multiple Habitations</u>							
42Ga1719	32	7320	yes	I*	Fremont	ca. AD. 800	30 X 15m.
<u>Rock Shelter</u>							
42Ga1720	32	7340	yes	III*	Fremont	ca. AD. 800	10 X 10m.
<u>Hunting</u>							
42Ga1738	5	8490	yes	III*	Late Archaic	ca. AD. 1	10m. diameter

BOULDER SAMPLING STRATUM (Forest Service)

Based on a one percent sample, five quarter section sample areas in the southern end of the planning unit were specified for intensive survey by the Forest Service Regional Office in Ogden, Utah. An intensive survey of the three accessible sample areas was conducted by AERC in the fall of 1977. (The Forest Service permitted the deletion of two inaccessible units.)

The three sample areas are situated near the southern boundary of the Boulder Unit (see Figure 4-9). A total of 24 archeological sites was found divided among all three areas (see Table 4-29).

A variety of types is included among the unit's 24 newly recorded archeological sites (see Table 4-32). Fourteen are lithic scatters, four are temporary camps, and one each is a hunting site, a kill/butchering site, a quarry, an extended camp, a single habitation, and a rock shelter. All 24 sites are in the pinyon-juniper ecozone (see Table 4-29). Almost as uniform as the distribution of the sites among vegetation types is their distribution in relation to geology (see Table 4-30). Two are on Quaternary deposits and 22 are on the Navajo Formation of the Jurassic period. More varied is the breakdown of sites by geomorphology (see Table 4-31). Six sites are on ridges, five are on benches, four are in drainages, four are on mesas, two are in saddles, two are on rock outcroppings, and one is on a hill.

By elevation (see Table 4-32), most of the sites (22) are grouped in the 6,000 to 7,000 foot (1,829-2,134 m.) range. Another site is below in the 5,000 to 6,000 foot (1,524-1,829 m.) range while a second site is higher up in the range between the 7,000 and 8,000 foot (2,134-2,438 m.) elevation.

Annual rainfall (see Table 4-7) for all 24 sites varies between twelve and sixteen inches (305-407 mm.).

Since all Class II archeological sites of the Boulder Planning Unit are within National Forest boundaries,

BOULDER PLANNING UNIT

- ☐ Sample Area
- • Individual Class I Site
- ○ Individual Class II Site
- 5-9 Class II Sites
- 10-14 Class II Sites
- 15-19 Class II Sites
- 20-24 Class II Sites

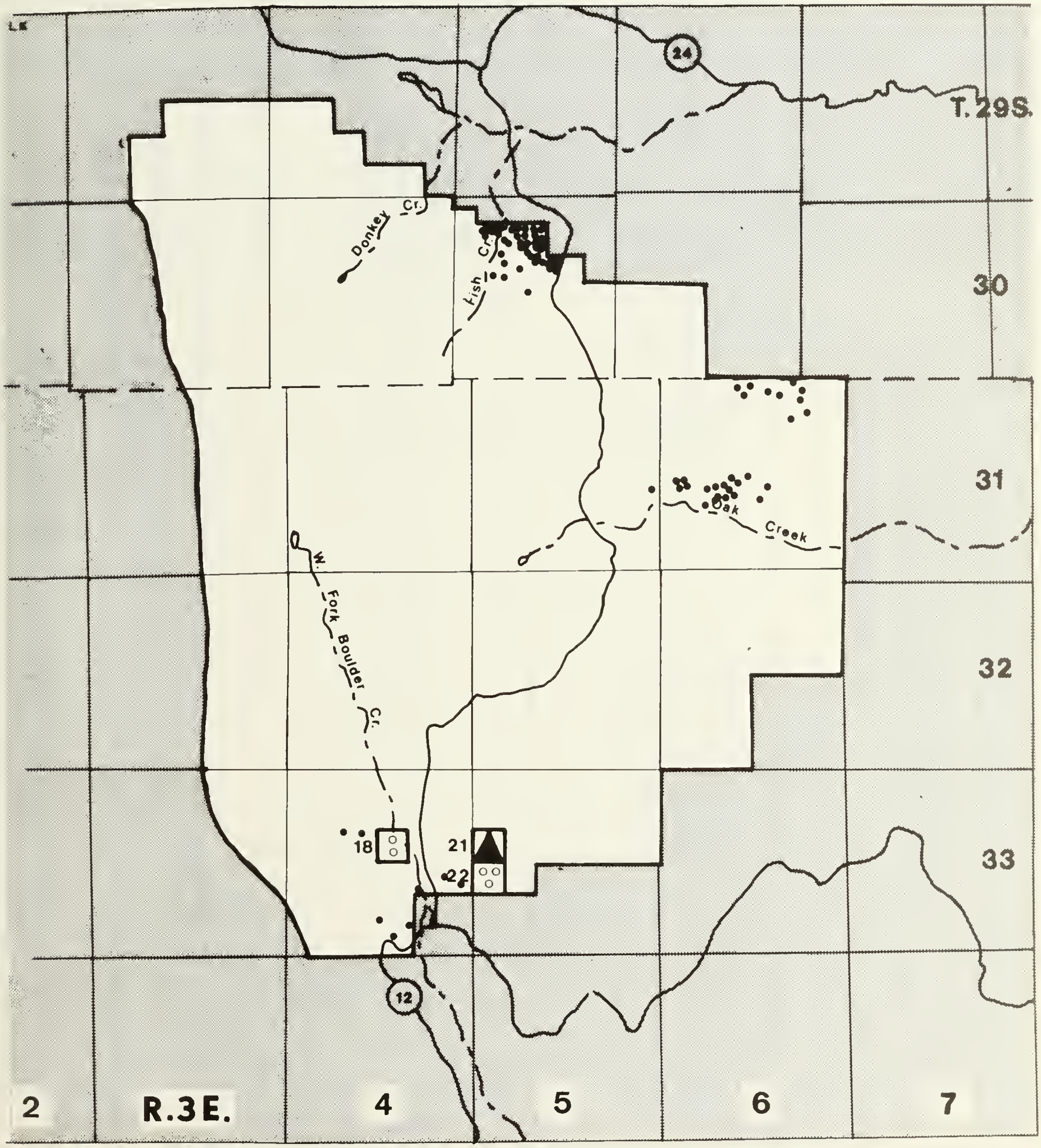


Figure 4-9

N
0 4 Miles 8

TABLE 4-29

BOULDER PLANNING UNIT

Sample Area	AERC Vegetation Zone	Legal Description	No. of Sites Located
18	Pinyon-juniper	T33S, R4E, Sec 15, NW$\frac{1}{4}$	2
21	Pinyon-juniper	T33S, R5E, Sec 18, NE$\frac{1}{4}$	19
22	Pinyon-juniper	T33S, R5E, Sec 19, NW$\frac{1}{4}$	3

TABLE 4-30
GEOLOGIC/SITE RELATIONSHIPS
BOULDER PLANNING UNIT

		TERTIARY	CRETACEOUS							JURASSIC									
Permanent Site Number	QUATERNARY	Wasatch Formation	~~Cretaceous Undivided~~	~~Kaiparowits~~	~~Straight Cliffs Wahweap Sandstone~~	~~Wahweap Sandstone~~	~~Straight Cliffs~~	~~Tropic Shale~~	~~Dakota Sandstone~~	~~Jurassic Undivided~~	Morrison Formation	~~Windsor Formation~~	~~Bluff Sandstone~~	Entrada Sandstone	Carmel Formation	Navajo Formation	~~Kayenta Formation~~	~~Moenkopi Formation~~	~~TRIASSIC~~
42Ga1741																X			
1742																X			
1743																X			
1744	X																		
1745	X																		
1746																X			
1747																X			
1748																X			
1749																X			
1750																X			
1751																X			
1752																X			
1753																X			
1754																X			
1755																X			
1756																X			
1757																X			
1758																X			
1759																X			
1760																X			
1761																X			
1762																X			
1763																X			
1764																X			

TABLE 4-31

GEOMORPHOLOGIC/SITE RELATIONSHIPS

BOULDER PLANNING UNIT

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ga1741									Ae								
1742								Ae									
1743													Ae				
1744	Bd																
1745								Rs									
1746								Rs									
1747								Rs									
1748												Ae					
1749									Ae								
1750								Ae									
1751								Ae									
1752					Rs												
1753					Rs												
1754			Al														
1755					Al												
1756					Al												
1757											Ae						
1758									Ae								
1759									Ae								
1760											Ae						
1761									Ae								
1762			Ae														
1763			Ae														
1764			Ae														
Sub totals 24	1		4		4			6	5		2	1	1				

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-32

BOULDER TABULAR DESCRIPTION

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
Lithic Scatter							
42Ga1742	22	6480	no	III*	Unknown	-	15m. diameter
42Ga1747	21	6480	no	III*	Unknown	-	100 X 40m.
42Ga1749	21	5820	no	III*	Unknown	-	30 X 15m.
42Ga1753	21	6680	no	III*	Unknown	-	15 X 5m.
42Ga1754	21	6800	no	III*	Unknown	-	7m. diameter
42Ga1756	21	6590	no	III*	Unknown	-	$15m.^2$
42Ga1757	21	6585	no	III*	Unknown	-	$16m.^2$
42Ga1758	21	6580	yes	III*	Unknown	-	35 X 15m.
42Ga1759	21	6580	yes	II*	Unknown	-	100 X 50m.
42Ga1760	21	6580	no	III*	Unknown	-	3m. diameter
42Ga1761	21	6580	no	III*	Unknown	-	25 X 15m.
42Ga1762	21	6580	no	III*	Unknown	-	10m. diameter
42Ga1763	21	6590	yes	III*	Late Archaic	ca. AD. 1	7m. diameter
42Ga1764	21	6540	no	III*	Unknown	-	15 X 5m.
Temporary Camp							
42Ga1746	21	6440	yes	III*	Kayenta	ca. AD. 1050	80 X 40m.
42Ga1752	21	6700	no	III*	Unknown	-	10 X 20m.
42Ga1755	21	6530	no	III*	Unknown	-	$10m.^2$

TABLE 4-32

BOULDER TABULAR DESCRIPTION (Continued)

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
<u>Rock Shelter</u>							
42Ga1744	18	6920	no	III*	Unknown	-	10 X 5m.
42Ga1748	21	6600	no	III*	Kayenta	ca. AD. 1050	20 X 50m.
<u>Single Habitation</u>							
42Ga1751	21	6560	yes	I*	Shoshonen	ca. AD. 1500	75m. diameter
<u>Extended Camp</u>							
42Ga1750	21	6520	no	II*	Unknown	-	70 X 35m.
<u>Hunting</u>							
42Ga1745	18	7300	yes	II*	Kayenta	ca. AD. 1050	333 X 100m.
<u>Quarry</u>							
42Ga1743	22	6500	no	III*	Unknown	-	300m. diameter
<u>Kill-Butchering</u>							
42Ga1741	22	6480	no	III*	Unknown	-	10m. diameter

site significance is expressed according to AERC's Forest rating system. (For a discussion of the Forest Service rating system, see the preceding chapter.) Five sites were assigned a significance rating above S-III which is the lowest rating level in the system (see Table 4-32). One of these, 42Ga1751, a single habitation, was given an S-I rating by the recording archeologist.

As in the other planning units, lithic scatters are the predominant site type in the Boulder Unit. The location of every newly recorded archeological site of the Boulder Unit in the pinyon-juniper ecozone is also in keeping with the general trend among planning units. Also, as in most other planning units, ridges are the favorite land feature for settlement or activity.

MARKAGUNT PLANNING UNIT (U.S.F.S.)

The sampling strategy for the Markagunt Planning Unit was determined by the Forest Service Regional Office in Ogden, Utah. It consisted of a one percent sample stratified by location to the coal resources in the unit. On this basis, fifteen quarter section sample areas were selected by the Forest Service and intensively surveyed by AERC in the fall of 1977.

The fifteen sample areas of the Markagunt Planning Unit are concentrated in its southern extremity (see Figure 4-10). Eight archeological sites were found on four of the fifteen sample areas (see Table 4-33).

All but one of the unit's sites are lithic scatters (see Table 4-36). The single exception is a temporary camp.

With regard to vegetation type, the Markagunt Unit's Class II archeological sites are all in the montane ecozone (see Table 4-33).

This ecozone consists of ponderosa, fir, spruce, and aspen communities and accordingly, the average elevation of the archeological sites in the Markagunt Unit is higher than that in most of the other SCP planning units (see Table 4-36).

MARKAGUNT PLANNING UNIT

- □ Sample Area
- • Individual Class I Site
- ○ Individual Class II Site
- ▨ 5-9 Class II Sites
- Coal Field
- — Coal Seam

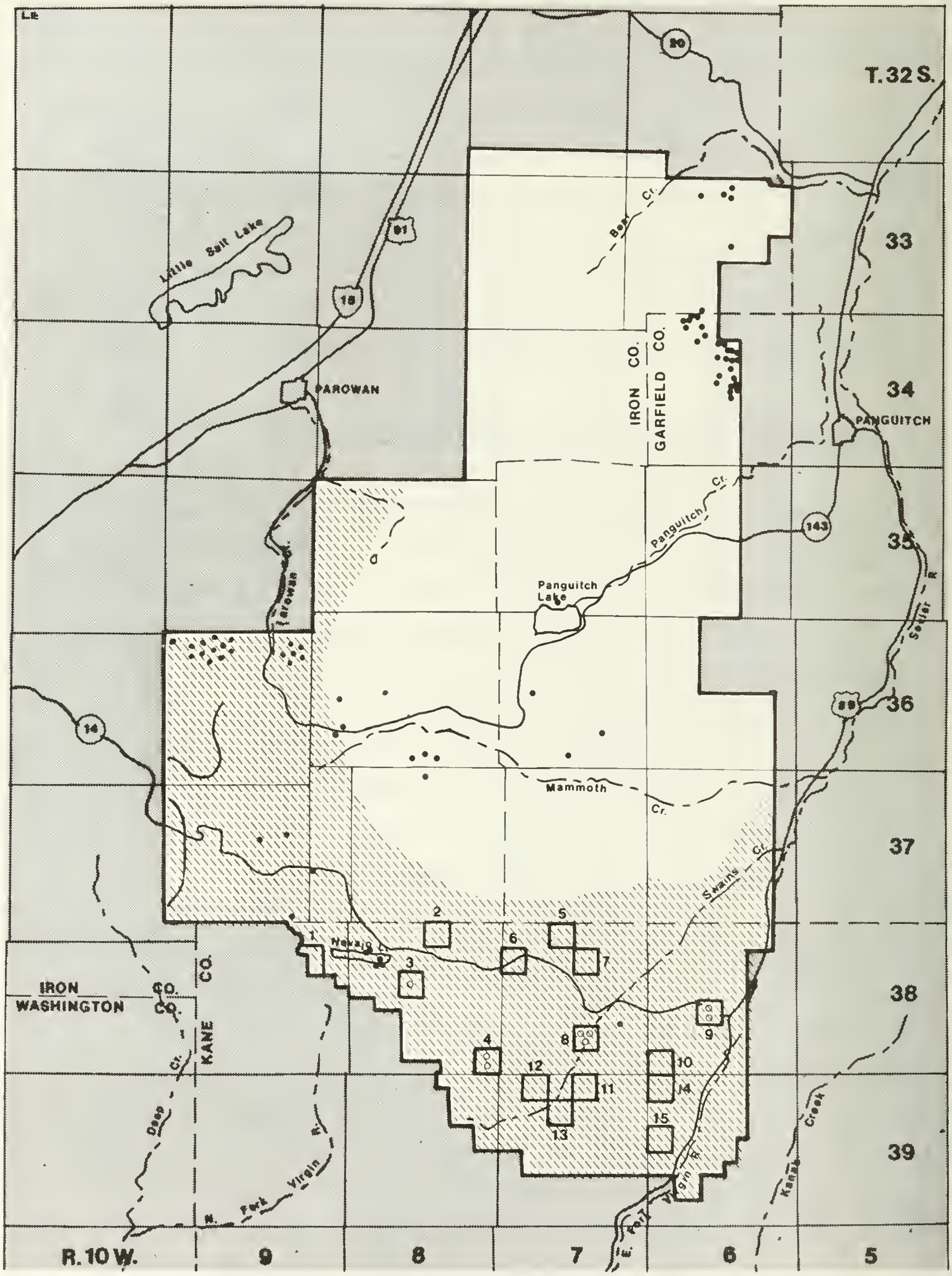


Figure 4-10

TABLE 4-33

MARKAGUNT PLANNING UNIT

Sample Area	AERC Vegetation Zone	Legal Description	No. of Sites Located
1	Montane	T38S, R9W, Sec 13, NE¼	0
2	Montane	T38S, R8W, Sec 3, NW¼	0
3	Montane	T38S, R8W, Sec 16, SW¼	1
4	Montane	T38S, R8W, Sec 36, SE¼	2
5	Montane	T38S, R7W, Sec 4, NE¼	0
6	Montane	T38S, R7W, Sec 7, NW¼	0
7	Montane	T38S, R7W, Sec 10, SW¼	0
8	Montane	T38S, R7W, Sec 27, SE¼	3
9	Montane	T38S, R6W, Sec 21, NE¼	2
10	Montane	T38S, R6W, Sec 31, NW¼	0
11	Montane	T39S, R7W, Sec 3, SW¼	0
12	Montane	T39S, R7W, Sec 5, SE¼	0
13	Montane	T39S, R7W, Sec 9, NE¼	0
14	Montane	T39S, R6W, Sec 6, NW	0
15	Montane	T39S, R6W, Sec 18, NE¼	0

TABLE 4-34

GEOLOGIC/SITE RELATIONSHIPS

MARKAGUNT PLANNING UNIT

Permanent Site Number	QUATERNARY	TERTIARY	CRETACEOUS							JURASSIC										TRIASSIC
		Wasatch Formation	Cretaceous Undivided	Kaiparowits	Straight Cliffs Wahweap Sandstone	Wahweap Sandstone	Straight Cliffs	Tropic Shale	Dakota Sandstone	Jurrassic Undivided	Morrison Formation	Windsor Formation	Bluff Sandstone	Entrada Sandstone	Carmel Formation	Navajo Formation	Kayenta Formation	Moenkopi Formation		
42Ka1910		X																		
1911		X																		
1912		X																		
1913		X																		
1914		X																		
1915		X																		
1916		X																		
1917		X																		

TABLE 4-35

GEOMORPHOLOGIC/SITE RELATIONSHIPS

MARKAGUNT PLANNING UNIT

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ka1910	Rs																
1911			Al														
1912			Al														
1913								Rs									
1914			Al														
1915			Al														
1916			Al														
1917			Al														
Sub totals 8	1		6					1									

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-36

MARKAGUNT TABULAR DESCRIPTION

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
Lithic Scatter							
42Ka1910	3	9360	no	III*	Unknown	-	10 X 10m.
42Ka1911	9	8000	yes	III*	Unknown	-	10 X 10m.
42Ka1912	9	7454	yes	III*	Unknown	-	5 X 5m.
42Ka1913	8	7800	yes	III*	Unknown	-	50 X 15m.
42Ka1914	8	7840	no	III*	Unknown	-	30 X 30m.
42Ka1915	8	7800	yes	III*	Kayenta	ca. AD. 1050	100 X 100m.
42Ka1917	4	8320	yes	III*	Late Archaic	ca. AD. 1	10 X 5m.
Temporary Camp							
42Ka1916	4	8250	yes	III*	Unknown	-	20 X 5m.

The geological association of the unit's eight Class II archeological sites is uniform; all are in the Wasatch Formation of the Tertiary period (see Table 4-34).

Land features associated with the unit's archeological sites include drainages (6 sites), a ridge (1 site), and a rim (1 site) (see Table 4-35).

Rainfall in the area is relatively high in comparison with that in the other planning units (see Table 4-7). Six sites receive between sixteen and twenty inches (407-508 mm.) of annual precipitation and two others are divided between the isohyetal zones of 25 to 30 inches (635-762 mm.) and 30 to 40 inches (762-1,016 mm.).

All of the eight archeological sites of the Markagunt Planning Unit were given the lowest significance rating of S-III (see Table 4-36) and since these sites are on National Forest lands, their significance was rated using AERC's Forest rating.

In conclusion, various characteristics distinguish the Markagunt site situation from that of the other planning units. Markagunt's sites are generally higher in elevation; they occupy an ecozone different from the usual pinyon-juniper ecozone, and possibly as a consequence of this, the site density among sample areas is markedly below average (see Table 4-1, column 6). Also between the 7,000 to 8,000 foot (2,134-2,438 m.) elevation, the growing season becomes too short for successful agriculture. In this light, it is interesting to note that all but one of the Markagunt Unit's newly evaluated sites are lithic scatters, indicating the temporary nature of prehistoric activity in this unit.

PAUNSAUGUNT-SEVIER PLANNING UNIT (Forest Service)

A one percent sample stratified by association with known coal resources was the research strategy utilized to define sample areas for survey in the Paunsaugunt-Sevier Planning Unit by the Forest Service. A total of 42 quarter section sample areas were determined for the survey;

PAUNSAUGUNT-SEVIER PLANNING UNIT

- □ Sample Area
- • Individual Class I Site
- ○ Individual Class II Site
- ⧄ 5-9 Class II Sites
- ░ Coal Field
- — Coal Seam

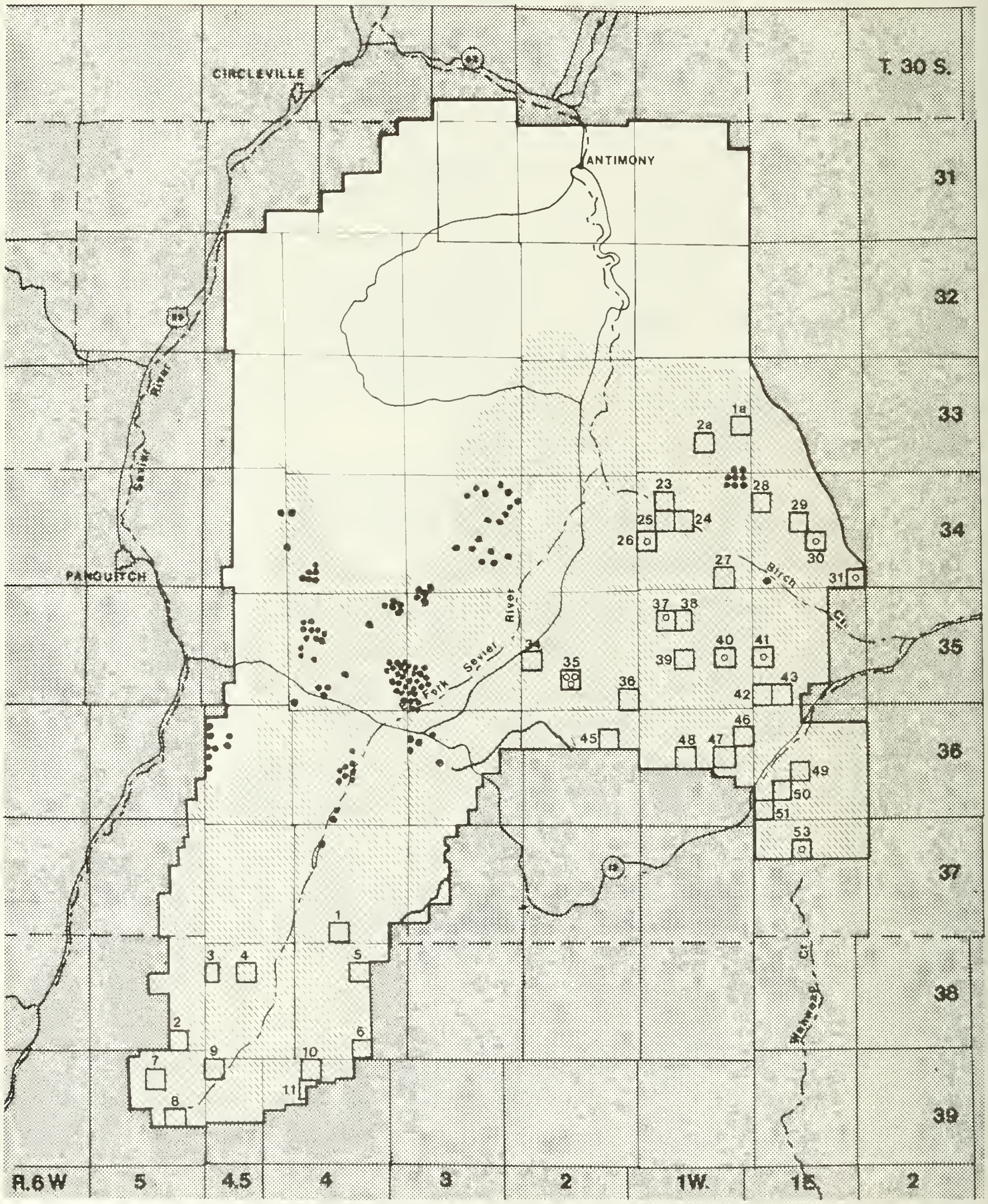
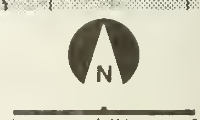


Figure 4-11



unfortunately, two sample areas received snow before they could be evaluated, and although repeated efforts were made in January 1978 to substitute two new sample areas, no localities could be found that were free of snow. Hence, a total of 40 sample areas in this unit was surveyed.

The ten archeological sites were found on only eight of the 40 survey areas (see Table 4-37). The sample areas and archeological sites are clustered in the southeastern part of the planning unit (see Figure 4-11).

All ten archeological sites in the Paunsaugunt-Sevier Planning Unit are lithic scatters (see Table 4-40) and fall equally by vegetation type (see Table 4-37) between the pinyon-juniper (6 sites) and the montane ecozone (4 sites).

Geologically (see Table 4-38), four sites are on the Wasatch Formation of the Tertiary period. The other six sites are associated with Cretaceous age deposits: five of them on the Kaiparowits Formation and one of them in the Straight Cliffs Formation.

Land features (see Table 4-39) associated with the unit's ten Class II archeological sites are primarily ridges (4 sites), followed by drainages (3 sites), terraces (2 sites), and a mesa top (1 site).

Elevation figures (see Table 4-40) for the unit's ten Class II archeological sites are 7,000 to 8,000 feet (2,134-2,438 m.) for five sites, 8,000 to 9,000 feet (2,438-2,743 m.) for four sites, and over 10,000 feet (3,048 m.) for one site.

Dividing the unit's sites by annual rainfall (see Table 4-7), six are in the twelve to sixteen inch (305-407 mm.) range, and four are in the sixteen to twenty inch (407-508 mm.) category.

Significance ratings for the ten sites are all S-III (see Table 4-40). (For an explanation of AERC's Forest rating system, see the preceding chapter.)

The environmental site relationships within the Paunsaugunt-Sevier Planning Unit differ in several important

TABLE 4-37

PAUNSAUGUNT-SEVIER PLANNING UNIT

Sample Area	AERC Vegetation Zone	Legal Description	No. of Sites Located
1	Montane	T37S, R4W, Sec 33, SW¼	0
1a	Montane	T33S, R1W, Sec 24, NE¼	0
2	Montane	T38S, R5W, Sec 35, SE¼	0
2a	Montane	T33S, R1W, Sec 27, NW¼	0
3	Montane	T38S, R4½W, Sec 8, NE¼	0
4	Montane	T38S, R4½W, Sec 10, NW¼	0
5	Montane	T38S, R4W, Sec 10, SW¼	0
6	Pinyon-juniper	T38S, R4W, Sec 34, SE¼	0
7	Montane	T39S, R5W, Sec 10, NE¼	0
8	Montane	T39S, R5W, Sec 23, NW¼	0
9	Montane	T39S, R4½W, Sec 3, SW¼	0
10	Pinyon-juniper	T39S, R4W, Sec 3, SE¼	0
11	Pinyon-juniper	T39S, R4W, Sec 9, NE¼	0
23	Montane	T34S, R1W, Sec 8, SW¼	0
24	Montane	T34S, R1W, Sec 16, SE¼	0
25	Montane	T34S, R1W, Sec 17, NE¼	0
26	Pinyon-juniper	T34S, R1W, Sec 19, NW¼	1
27	Montane	T34S, R1W, Sec 35, SW¼	0
28	Montane	T34S, R1E, Sec 7, SE¼	0
29	Montane	T34S, R1E, Sec 16, NE¼	0
30	Pinyon-juniper	T34S, R1E, Sec 22, NW¼	1
31	Pinyon-juniper	T34S, R1E, Sec 36, SW¼	1
34	Montane	T35S, R2W, Sec 19, NW¼	0

TABLE 4-37

PAUNSAUGUNT-SEVIER PLANNING UNIT (Continued)

Sample Area	AERC Vegetation Zone	Legal Description	No. of Sites Located
35	Pinyon-juniper	T35S, R2W, Sec 28, SW$\frac{1}{4}$	3
36	Pinyon-juniper	T35S, R2W, Sec 36, SE$\frac{1}{4}$	0
37	Montane	T35S, R1W, Sec 7, NE$\frac{1}{4}$	1
38	Montane	T35S, R1W, Sec 8, NW$\frac{1}{4}$	0
39	Montane	T35S, R1W, Sec 21, SW$\frac{1}{4}$	0
40	Montane	T35S, R1W, Sec 23, SE$\frac{1}{4}$	1
41	Montane	T35S, R1E, Sec 19, NE$\frac{1}{4}$	1
42	Pinyon-juniper	T35S, R1E, Sec 31, NW$\frac{1}{4}$	0
43	Pinyon-juniper	T35S, R1E, Sec 32, SW$\frac{1}{4}$	0
45	Montane	T36S, R2W, Sec 11, NE$\frac{1}{4}$	0
46	Pinyon-juniper	T36S, R1W, Sec 12, NW$\frac{1}{4}$	0
47	Pinyon-juniper	T36S, R1W, Sec 14, SW$\frac{1}{4}$	0
48	Montane	T36S, R1E, Sec 16, SE$\frac{1}{4}$	0
49	Pinyon-juniper	T36S, R1E, Sec 21, NE$\frac{1}{4}$	0
50	Pinyon-juniper	T36S, R1E, Sec 29, NW$\frac{1}{4}$	0
51	Pinyon-juniper	T36S, R1E, Sec 31, SW$\frac{1}{4}$	0
53	Montane	T37S, R1E, Sec 9, NE$\frac{1}{4}$	1

TABLE 4-38

GEOLOGIC/SITE RELATIONSHIPS

PAUNSAUGUNT-SEVIER PLANNING UNIT

Permanent Site Number	QUATERNARY	TERTIARY	CRETACEOUS							JURASSIC									TRIASSIC
		Wasatch Formation	~~Cretaceous Undivided~~	Kaiparowits	~~Straight Cliffs Wahweap Sandstone~~	~~Wahweap Sandstone~~	Straight Cliffs	Tropic Shale	Dakota Sandstone	~~Jurrassic Undivided~~	~~Morrison Formation~~	~~Windsor Formation~~	~~Bluff Sandstone~~	~~Entrada Sandstone~~	~~Carmel Formation~~	~~Navajo Formation~~	~~Kayenta Formation~~	~~Moenkopi Formation~~	
42Ga1630				X															
1631		X																	
1788		X																	
1789		X																	
1790		X																	
1791				X															
1792							X												
1793				X															
1794				X															
1795				X															

TABLE 4-39

GEOMORPHOLOGIC/SITE RELATIONSHIPS

PAUNSAUGUNT-SEVIER PLANNING UNIT

Permanent Site Number	Rim	Face	Drainage	Seep	Mesa top	Desert Pavement	Playa	Ridge	Bench	Terrace	Saddle	Alcove	Hillock	Hill	Cove	Slope	Plain
42Ga1630			Al														
1631										Rs							
1788								Rs									
1789								Al									
1790								Rs									
1791			Cl														
1792										Rs							
1793					Rs												
1794								Rs									
1795			Rs														
Sub totals 10			3		1			4		2							

Al = alluvial

Ae = aeolian

Bd = bedrock

Cl = colluvial

Rs = residual

TABLE 4-40

PAUNSAUGUNT-SEVIER TABULAR DESCRIPTION

Site Type and Number	Sample Area	Elevation (ft.)	Diagnostic Artifacts	FOREST* or CRES Rating	Cultural Affiliation	Temporal Range	Site Size
<u>Lithic Scatter</u>							
42Ga1630	35	7960	no	III*	Unknown	-	50 X 50m.
42Ga1631	40	10200	no	III*	Unknown	-	30 X 30m.
42Ga1788	26	8400	no	III*	Unknown	-	55 X 55m.
42Ga1789	37	8840	no	III*	Unknown	-	30 X 30m.
42Ga1790	53	7000	no	III*	Kayenta	ca. AD. 1050	5 X 5m.
42Ga1791	41	8140	no	III*	Unknown	-	2 X 2m.
42Ga1792	30	7480	yes	III*	Archaic	ca. BC. 2500	4 X 40m.
42Ga1793	31	7000	yes	III*	Kayenta	ca. AD. 1050	1000 X 200m.
42Ga1794	35	8050	no	III*	Unknown	-	200 X 100m.
42Ga1795	35	7900	no	III*	Unknown	-	50 X 50m.

respects from the general trend noted for the other planning units. Paunsaugunt-Sevier sites are unusually high in elevation, several of them are in the montane ecozone, their density per planning unit is relatively low, and all are lithic scatters. But these characteristics, while different from the general trend, parallel those of the Markagunt Planning Unit discussed previously. Very likely, the low site density and preponderance of lithic scatters in both cases can be attributed to the associated environmental factors of higher elevation and its restricted accessibility.

Sample Area Coordination

In this discussion, the Class II survey sample areas within the Southern Coal Project area are examined by planning unit with special attention given to sample areas without sites in order to consider varied environmental conditions that could affect differing site densities among planning units. The reasons for absence of cultural resource sites are not always apparent, but an evaluation of various environmental factors related to the presence or absence of sites can indicate basic patterns of ancient land use and provide some valuable insight into modern land use planning.

Seventy-five or 46 percent of the sample areas in the SCP had no sites. All of the 168 surveyed quarter section sample areas have been evaluated according to environmental characteristics, i.e., vegetation, distance to water, slope, elevation, geological Formations, and rainfall. A summary by planning unit of sample areas, both having and devoid of sites, has been developed in the following sections as listed below.

CEDAR PLANNING UNIT (BLM)

Of the four sample sections in the Cedar Planning Unit, one (#1) located near Kanarraville did not have sites. This 160 acre area contains the Moenkopi geological formation and is within the pinyon-juniper ecozone. It is situated on a steep slope and ridge area between 5,800 to 6,000 feet (1,768-1,829 m.) and receives a calculated twenty inches (508 mm.) of annual precipitation. Four sites are located just four kilometers northeast of this sample area in a saddle in sample area #2. Since all other environmental conditions are comparable between the two single areas, the steep terrain in area #1 apparently accounts for its lack of sites.

ESCALANTE RIVER PLANNING UNIT (BLM)

In the Circle Cliffs and Wagon Box Mesa locality of the Escalante River Planning Unit, there are eight sample areas without sites, compared to five which have cultural resource sites. This area is characterized by the Moenkopi geological formation, is situated in the pinyon-juniper ecozone between the 5,500 to 6,500 foot (1,676-1,981 m.) elevation level, and receives from eight to ten inches (203-254 mm.) of annual precipitation. The sample areas are characterized by intermittent streams that drain westward into the Escalante River. The five sample areas that contain sites in this locality feature thirteen lithic scatters and one temporary camp. These data indicate that the area was primarily a seasonal hunting/gathering zone during prehistoric times.

The central Escalante valley area drained by the western tributaries of the Escalante River has both arid-transitional and pinyon-juniper ecozones with scattered sagebrush habitats. The locality features the Navajo geological formation, is situated below the 5,000 foot (1,524 m.) elevation level, and receives precipitation varying from six to twelve inches (152-305 mm.) annually. Five of the twelve sample areas surveyed in this locality, extending from Harris Wash on the north and Coyote Gulch on the south, did not have sites. An additional seven sample areas had a total of eighteen sites, thirteen of which were lithic scatters. These data contrast sharply with the heavy site density found in both the immediate upper and lower tributaries of the Escalante River. All sample sections but one had sites in the Glen Canyon locality (50 sites in 9 sample areas), and all samples in the Escalante Mountains and Escalante primitive areas had sites (80 sites in 12 sample areas).

Absence of surface sites in the central Escalante valley locality can be attributed mainly to arid conditions in unprotected (open) areas which feature inadequate drainage and high erosion activity.

A total of three sample areas (#899, #984, #2585) located on or adjacent to the Straight Cliffs and having similar environmental conditions as demonstrated for the Escalante valley also had no sites, while two others (#744 and #1376) each had one lithic scatter. This area along Fifty Mile Mountain is characterized by varied formations of Navajo Sandstone, Entrada, Tropic Shale, Dakota, and Wahweap. Absence of cultural materials in this area was apparently due to predominantly cliff and shale formations in sample areas #899 and #984. The apparent lack of human activity in sample area #2585 can be attributed to steep slopes and heavy erosion in a predominantly pinyon-juniper ecozone along the base of the Straight Cliffs on Fifty Mile Bench. Habitation sites are located in Collet Canyon, the only break in terrain along the Straight Cliffs.

There is a relatively heavy density of Kayenta Anasazi sites (ca. 50 percent are habitation sites) along the Kaiparowits Plateau just above and west of the Straight Cliffs. This general locality features the Straight Cliffs sandstone formation with pinyon-juniper ecozones situated between 7,100 and 7,500 feet (2,164-2,286 m.) and receives from ten to twelve inches (254-305 mm.) of annual rainfall. Twenty-one sites were located in five sample areas. Two other areas (#1775 and #1027) did not have sites, but both were located on steep slopes of the plateaus where hunting activity was indicated by an isolated point in sample area #1775. Hunting activities are also suggested by the location of four lithic scatters in sample area #2747 which is also situated on the southwestern slopes of Fifty Mile Mountain. Sample Area #1027, containing no sites, is in a steep canyon and plateau region directly above Collet Canyon where indications of intensive prehistoric utilization were found, i.e., two habitation sites, a granary, and one lithic scatter.

The northeastern extremity of the Kaiparowits Plateau in the Upper Valley/Spring Canyon locality had five sample areas which did not contain sites. The geology of this locality features the Straight Cliffs sandstone formation in a predominantly pinyon-juniper ecozone. The sample areas are situated between the 6,400 to 7,400 foot (1,930-2,255 m.) elevation level. Annual precipitation varies from twelve to sixteen inches (305-406 mm.). Five lithic scatters indicating hunting or quarrying activity were recorded in three adjacent sample areas (#1, #567, #1048).

GARFIELD PLANNING UNIT (BLM)

All six sample areas of the Garfield Planning Unit contained sites. The site density of this unit is probably a result of favorable drainage and soil conditions along this upper Sevier River valley. The general elevation in this planning unit varies between the 6,600 and 7,200 foot elevations, and the climax vegetation during prehistory probably consisted of pinyon-juniper woodland with open grasslands and willow habitats along the river and drainage channels.

PARIA PLANNING UNIT (BLM)

This unit was not sampled during the Class II survey of the Southern Coal Project area.

WEST ZION PLANNING UNIT (BLM)

No sites were located in the one sample area surveyed within the West Zion Unit. The area contains the

Winsor geological formation, is situated in the mountain shrub ecozone at an elevation of approximately 6,200 feet, and lies on southern slopes and ridges just north of the Virgin River.

ZION PLANNING UNIT (BLM)

Only two out of ten sample areas in the Zion Planning Unit did not have sites. Both areas are predominantly located on slopes and ridges over the 7,000 foot (2,134 m.) elevation level. One area (#50) is a pinyon-juniper ecozone in the Dakota tropic formation, while the other (#94) is a mountain shrub ecozone in the Wahweap geological formation. Three lithic scatters were located just east of sample area #94 in #138 which features flats at 6,800 feet (2,073 m.). One site was located in the flats in sample area #19, but none was found in the broad benches and saddles of Table Bench at higher elevations in this sample area.

Surveys in sample areas #1a, #2a, #19, and #73 indicate extensive seasonal hunting and gathering activity of Kayenta Anasazi peoples from temporary and extended camp sites located on ridges and flats.

AQUARIUS SAMPLING STRATUM (Forest Service)

Five out of seventeen sample sections in the Aquarius unit did not have sites. Elevations in four of the five sample areas without sites were above the 8,000 foot (2,438 m.) elevation and ranged from 7,000 to 8,000 feet (2,134-2,438 m.) in the fifth section (#10). These areas consist of Navajo Sandstone and undifferentiated alluvium formations in the pinyon-juniper and montane ecozones with sixteen to twenty inches (406-508 mm.) of annual rainfall. The terrain in these five samples is diverse including a canyon mouth, washes, flats, and steep slopes. Lithic scatter sites near Tule Lakes at 8,500 feet (2,591 m.) indicate hunting or quarry activity in this locality. Most of the other 49 sites recorded in the Aquarius Unit are temporary camps, lithic scatters, or quarries located below the 7,500 foot (2,286 m.) elevation and are associated with upper drainages of the Escalante River.

BOULDER SAMPLING STRATUM (Forest Service)

All three sample areas in the Boulder Unit contained sites. This limited sampling confined to the southern extremity of the Boulder Unit negates any evaluation of sample areas without sites.

MARKAGUNT PLANNING UNIT (Forest Service)

Eleven of the fifteen sample areas surveyed in the Markagunt Unit did not have sites. The sampling areas, confined to the southern quarter of the unit, are in the Wasatch and Quaternary Basalt Formations and are in the montane ecozone with ample rainfall which averages sixteen inches (406 mm.) annually. Elevations of these sample areas range from 7,200 to 9,200 feet (2,195-2,804 m.). The terrain includes slopes and flats, but the generally heavy duff in the flats tends to hide any evidences of cultural activity. Seven lithic scatters and one temporary camp were recorded between the 7,454 and 9,360 foot (2,272-2,853 m.) elevations which probably substantiates an hypothesis that the higher elevations were primarily used for hunting and quarrying.

PAUNSAUGUNT-SEVIER PLANNING UNIT (Forest Service)

The survey in the Paunsaugunt-Sevier Unit was most significant for examining sample areas without sites. A total of forty sample areas was surveyed for cultural resources. Only ten lithic scatter sites in eight sample areas were recorded. Sixteen sample areas without sites were located at higher elevations from 8,000 to 10,000 feet (2,438-3,048 m.) in the montane ecozone. Twelve of these sample areas (#2-4, #7-9, #23-25, #38, #39) were in the Wasatch geological formation, three (#1a, 2a, 27) in Quaternary undifferentiated alluvium, and one (#28) in

Tertiary Basalt. Lithic scatters were found in three localities at 8,400 feet (2,560 m.), 8,840 feet (2,451 m.) and even at the 10,000 foot (3,048 m.) level on the east rim of the Table Cliff Plateau. Also, a number of lithic scatters and hunting sites along the western slopes of Emery Valley and in the Griffin Top area are known from previous research in the locality. These sites and their locations indicate hunting activity throughout the general overall area of the survey. The nearest known habitation site located in the SCP survey of the Paunsaugunt-Sevier Unit is a Kayenta Anasazi single habitation in a pinyon-juniper ecozone at the 6,800 foot (2,038 m.) elevation in Birch Creek Canyon near the eastern base of the Escalante Mountains. No habitation sites were located above the 7,000 foot (2,134 m.) elevation during the SCP survey in the Dixie National Forest.

Eight sample areas (#36, 42, 43, 46, 47, 49, 50, 51) in the Kaiparowits geological formation situated in the pinyon-juniper ecozone above the 7,400 foot (2,255 m.) elevation were evaluated. Two of these sample areas extended into the montane ecozone at the 8,400 foot (2,560 m.) elevation. Two others (#45 and #48) in the same vicinity were associated with the Wahweap Sandstone. All of these sample areas are located along the eastern slopes of the Escalante Mountains in localities containing few flat ridge or bench areas where sites are normally found. Sloping terrain appears to be the major criteria governing the apparent absence of sites in these ten sample areas.

Five other sample areas (#1, 5, 6, 10, 11) located along the southeastern edge of Bryce Canyon National Park did not have sites. Geologic formations here include Winsor, Wahweap Sandstone, Jurassic Undivided, and Tropic Shale. Elevation ranges between 7,000 and 8,000 feet (2,134-2,438 m.) and the vegetation is related to both the pinyon-juniper and montane ecozones. Except for the two sample areas in Tropic Shale (#10, #11), environmental conditions in this unit are generally favorable for known activity, and there is no apparent reason for an absence of sites. Sample areas #1 and #5 are in the Willis Creek drainage. Sample area #6 is situated on a slope which includes a prominent ridge and is approximately three kilometers northwest of a temporary camp located in the Zion Planning Unit. Ancient inhabitants may have avoided this area because of the unusual geological formations found in Bryce Canyon.

As with other planning units surveyed in the Dixie National Forest, conditions in the Paunsaugunt-Sevier unit were not always ideal for observing cultural remains due to the duff and heavy vegetation. Exposed residual soils on ridges and benches which could be carefully evaluated, however, generally lacked sites in the montane and alpine transitional ecozones above the 8,000 foot level.

In conclusion, the basic factors which appear to influence the amount of past human activity in the project area are accessibility and resource. Sample areas surveyed in higher elevations, on steep slopes, and in difficult terrain have traditionally had a low degree of utilization. Lower elevations which are not on major drainages nor on access routes and have marginal resource value contain only sporadic evidences of human activity generally related to specialized procurement activities, e.g., quarrying or pine nut gathering.

PART C: ARTIFACT INVENTORY

Lithic Artifacts

CHIPPED STONE

A representative number of chipped stone artifacts was selected for analysis and drawn for this report. The artifacts, numbering 285, were segregated into three basic categories; projectile points and notched knives, biface blades, and general tools. The majority of the artifacts, 226, were placed in the category of projectile points and notched knives. There were 48 biface blades, and 11 artifacts were categorized as tools. Within the category of tools were placed artifacts defined as drills, awls, punches, scrapers, and unifacially flaked or prismatic blades.

Projectile Points and Notched Knives

Projectile points have been categorized on the basis of their morphology and presented in an arrangement that reflects their morphological relationship from the earliest types to the most recent. However, the placement of these points within given categories and the name assigned to each category should not be understood to represent strict chronological or cultural affiliations at this stage of examination. The reason for this seeming contradiction is that many of these point types have an extremely long temporal range and may appear within any cultural context from Early Archaic to Fremont or Shoshonean. Cultural correlation with ceramics and other factors is examined in another section of this chapter, and no attempt will be made here to make a cultural evaluation of this material.

Lake Mojave Points: There was one point collected that manifests the characteristic appearance of the Lake Mojave point type of the Early Archaic period (see Figure 4-12a). It has the typical blunt distal end which widens to broad shoulders and diminishes in width toward the rounded base. The point is thick and slightly bulbous, and shows affinities with earlier point types from Paleo Indian contexts.

Humbolt Points: Two points collected show resemblance to the Middle Archaic points of the Humbolt series. Examples of these may be seen in Figures 4-13a and b. Like the Lake Mojave point, these are wider near the tip or center with slightly diminishing width toward the base. The first example has shallow notches and a concave base. Figure 4-13b has the basic outline of the Humbolt type, but is quite crude and may not be assigned to this category with confidence. It also shows evidence of having been reworked.

Northern and Bitterroot Points: There are three points that have characteristics typical of these Early Archaic point types. One point (Figure 4-12d) is triangular in shape with side notches near the proximal end and a straight base. These features are typical of northern point types (Jennings 1957:fig. 96b; Aikens 1970: fig. 19d). Two points (Figures 4-12b and c) have the side notching and concave base of the bitterroot type, but the stem is taller and narrower and the concave area is not as pronounced as the typical bitterroot point (Jennings 1957: fig. 97). These two examples may suggest a variant between the bitterroot and sudden side notched points of the Middle Archaic.

Sudden Side Notch Points: There are four examples (see Figure 4-14) of points resembling sudden side notched points of the Middle Archaic as defined by Holmer (Holmer, personal communication) at Sudden Shelter in south central

Utah. These points exhibit the side notches and straight base typical of this point type. One example (Figure 4-14d) has been broken and reworked, but the original notches are still evident.

Hawken Side Notch Points: Three points exhibit characteristics of the Hawken side notched points of the Middle Archaic. Typical features of this point are wide shoulders just above the side notches and a shallow, narrower stem with a straight base. Examples of this type may be seen in Figure 4-15a, b, and c. Of these, Figure 4-15b is the most typical.

Rocker Base Points: Points that manifest characteristics of the rocker base type as defined by Holmer, are shown in Figures 4-16 and 4-17. Typically, these points have convex sides, side or corner notching, and a convex base. The convex base is the distinguishing feature between this type and those of the sudden side notch or Elko corner notch points of the Middle Archaic.

San Rafael Side Notch Points: Three points collected during the survey have features typical of San Rafael side notch points. These points are long with convex sides, shallow side notches, and a deeply notched or concave base that emphasizes pointed or rounded basal corners. This type has been dated to the Middle Archaic at Sudden Shelter by Holmer (Holmer, personal communication). Examples may be seen in Figures 4-13c, d, and e.

Eared Points: There are 23 points in this collection that show affinities with points of the Pinto and Elko eared or split stem types of the Early and Middle Archaic, respectively (cf Hester & Heizer 1973:fig. 2; Aikens 1970:fig. 20; Jennings 1957:fig. 100). Examples of these may be seen in Figures 4-18 through 4-21, beginning with those most closely resembling Pinto types and progressing to those that are most typical of the Elko eared points.

Characteristic of all of these points are convex sides, corner notching, and basal notching to effect a split stem with pointed or rounded tangs. These points may have square to proximally oriented shoulders (cf Figures 4-20c; 4-21a, b, c, f, g, and h), or can be rounded to shoulderless (cf Figures 4-18a, c, d, and e; 4-19c and d; 4-20a and d). The Pinto and Elko series are among the earliest Great Basin Desert Archaic point types, while the Elko series shows a continued use and influence throughout the entire Archaic and post Archaic periods in the Great Basin Area.

Large Notched Points: By far, the greatest number of points collected on the survey were those that show features resembling the large notched points that make their appearance in the Archaic and continue through the Fremont and Kayenta Anasazi period. These points have a tremendous temporal and spatial range, and for this reason are of limited value for cultural correlation. Points in this category may be side or corner notched, with straight or slightly concave bases. They range in size from small dart points (Figure 4-30) to large knives (Figures 4-31a and b). Many of these points may have been used as spear points, dart points, knives, or all three. Examples of those collected may be seen in Figures 4-22 through 4-31.

Gypsum Points: Typical of the Late Archaic and Fremont periods is the gypsum point. The gypsum point has straight or convex sides, rounded or slightly distinguished shoulders, and a diminishing stem with a rounded base. This type ranges in size from small dart and arrow points of 25 mm. in length to large points measuring 60 to 70 mm. in length. There were 29 points collected that manifest the gypsum point characteristics. These may be seen in Figures 4-32 through 4-36. Morphologically, these points show definite affinities with stemmed types of the later Fremont and Kayenta Anasazi cultures. Some typical examples may be seen in Figures 4-32e and f;

4-33b and g; 4-34b, c, and d; and 4-35e.

Large Stemmed Points: There were eleven points placed in the category of large stemmed points (cf Figure 4-37). They are morphologically similar to gypsum points, but are different in the respect that they have definite notches, and the stems have either straight or slightly concave or convex bases as opposed to the short rounded base of the gypsum points. They are all smaller dart points or arrow points and probably demonstrate a continuity of type from Archaic to post Archaic periods.

Stemmed Arrow Points: Sixteen points from the survey show relationships with a stemmed style of point. These points typically are small arrow points with rounded or straight shoulders and small straight or diminishing basal stems (Meighan, et al 1956:figure 15). The sides are either straight or slightly concave. Some good examples of this type may be seen in Figures 4-38a and c; and 4-39a, b, and e. Figure 4-38g shows an example of deep corner notching and is a reworked point.

Parowan Basal Notched Points: Four points (Figures 4-40a through d) show affinities with Parowan basal notched points. These have straight or concave edges and distally oriented basal notches, which result in the short tangs being identical in length with the stem. A good example of this type may be seen in Figures 4-40a, b, and c.

Rose Spring Points: Small arrow points resembling those of the Rose Spring type are shown in Figures 4-41a through e. These are similar to the stemmed points, except that the edges are straight to convex, and the shoulders are straight to slightly rounded.

Eastgate Points: There was one point collected on the survey that has the characteristics of the Eastgate point type. These points typically have concave sides with pointed, flaring, proximally oriented shoulders, exaggerated corner notches, and an expanding to straight stem with a straight convex base (Aikens 1970:fig. 18). The point may be seen in Figure 4-41f.

Cottonwood Triangular Points: Twelve points characteristic of the Cottonwood triangular point type were collected on the survey. These points are typically small and thin, with straight, convex or concave sides, straight or slightly concave bases, and no notching (Fagan 1974:fig. 18). Examples of these may be seen in Figures 4-42 and 4-43. They are of a size that may indicate use as arrow points or small blades. Some typical forms are reproduced in Figures 4-42c and f and 4-43a.

Bull Creek Points: Four projectile points show affinities with the Bull Creek point type that is characteristic of Kayenta Anasazi assemblages (Dennis Weder, personal communication). These points are basically triangular in shape with straight or concave sides and a concave or notched base that emphasizes the basal corners (cf Taylor 1957:fig. 34). These points may range in size from ca. 20 to 60 mm. Examples of points with Bull Creek characteristics may be seen in Figure 4-44.

Desert Side Notch Points: There were six points collected during the SCP survey that are typical of the desert side notch points that are generally found in Shoshonean cultural associations. These points are basically triangular with straight or convex edges, have concave bases, small side notches, and frequently are basal notched (cf Fagan 1974:fig. 14). They are generally small, thin, and delicately flaked. Examples are shown in Figures 4-45a through f.

Incomplete/Unknown Points: Twenty points were placed in this category because they were either incomplete, fragmented without definable characteristics, or were not typical of any specific group of projectile point type. These artifacts are shown in Figures 4-46 and 4-47.

Biface Blades

Figures 4-48 through 4-54 depict a representative sample of the biface blades collected on the survey. These blades may have had the function of knives or preforms. Their general morphology is too basic, and their temporal and spatial range is too great for use in cultural or temporal definition. The reproductions in Figures 4-48 through 4-54 are arranged from the smallest bifaces to the largest, and grouped together on the basis of similar size and shape.

General Tools

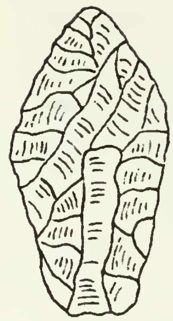
Chipped stone tools are depicted in Figures 4-55 and 4-56. These include three drills (Figures 4-55a, b, and c), one possible drill or projectile point (Figure 4-55d), one blade drill or knife (Figure 4-55e), two awls or punches (Figures 4-56a and b), one scraper (Figure 4-56c), one unifacially flaked blade (Figure 4-56d), and two prismatic blades (Figures 4-56e and f).

GROUND STONE

No ground stone artifacts were collected during the Southern Coal Project survey.

Figure 4-12

(ACTUAL SIZE)



(a)

42In439

(b)

42Ka1895

(c)

42Ga1787

(d)

42Ga1783

Figure 4-13

(ACTUAL SIZE)

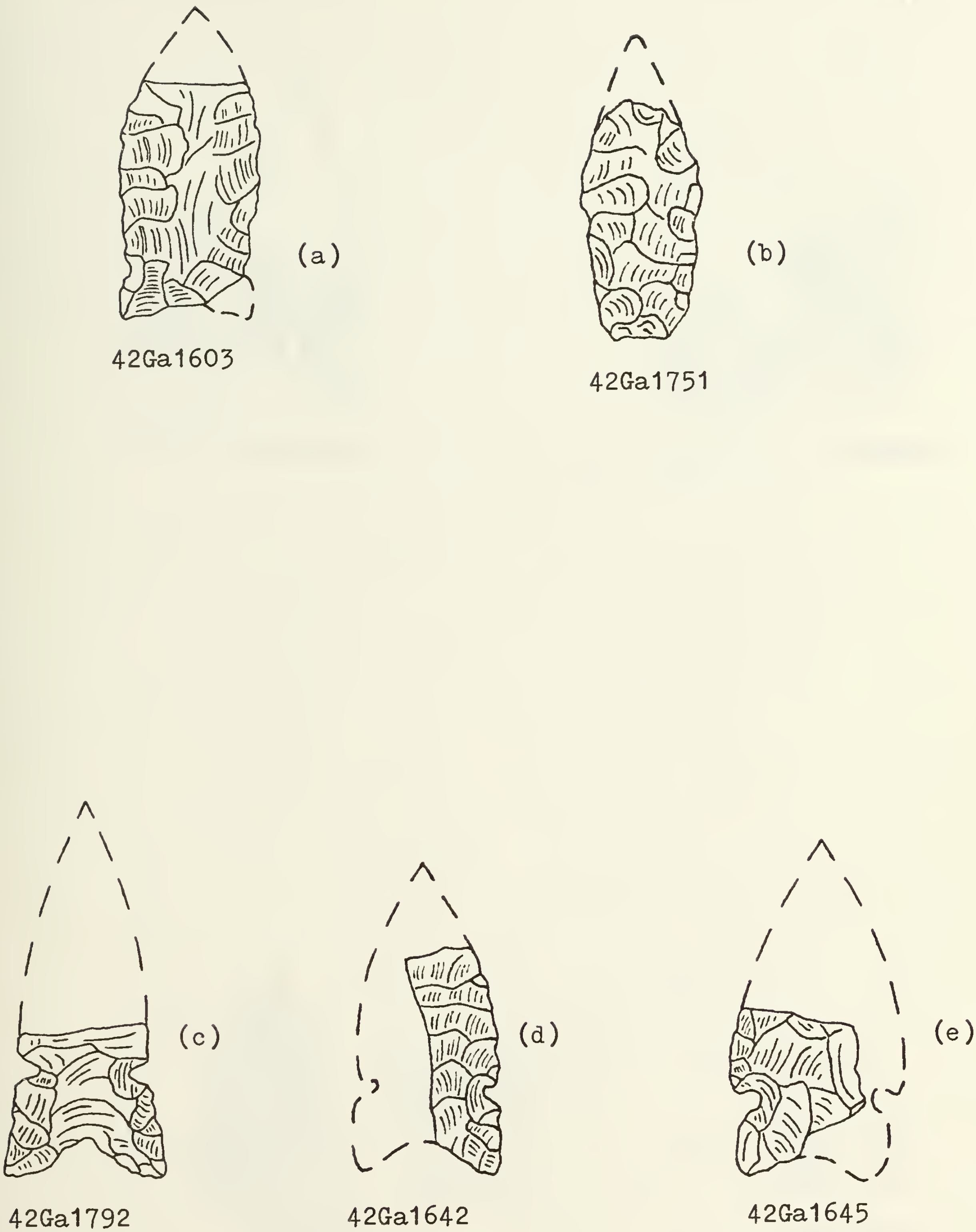


Figure 4-14

(ACTUAL SIZE)

(a)

42Ga1780

(b)

42Ga1645

(c)

42Ka1918

(d)

42Ga1758

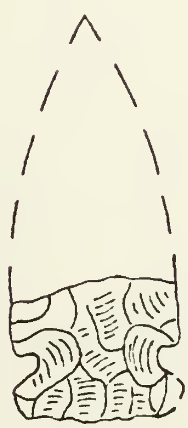
(ACTUAL SIZE)

(a)

42Ga1781

(b)

42Ga1787



(c)

42Ga1726

Figure 4-16

(ACTUAL SIZE)

(a)

42Ga1751

(b)

42Ga1593

(c)

42Ka1918

(d)

42Ga1641

Figure 4-17

(ACTUAL SIZE)

(a)

42Ga1726

(b)

42Ga1745

(c)

42Ga1642

(d)

42Ga1601

(e)

42Ga1602

(f)

42Ga1726

(g)

42Ga1745

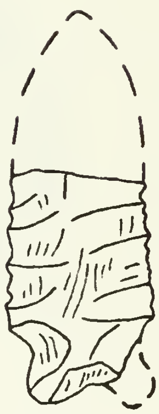
(ACTUAL SIZE)

(a)

42Ga1774

(b)

42Ga1596



(c)

42Ka1932

(d)

42Ga1787

(e)

04M/X2 (2)

(ACTUAL SIZE)

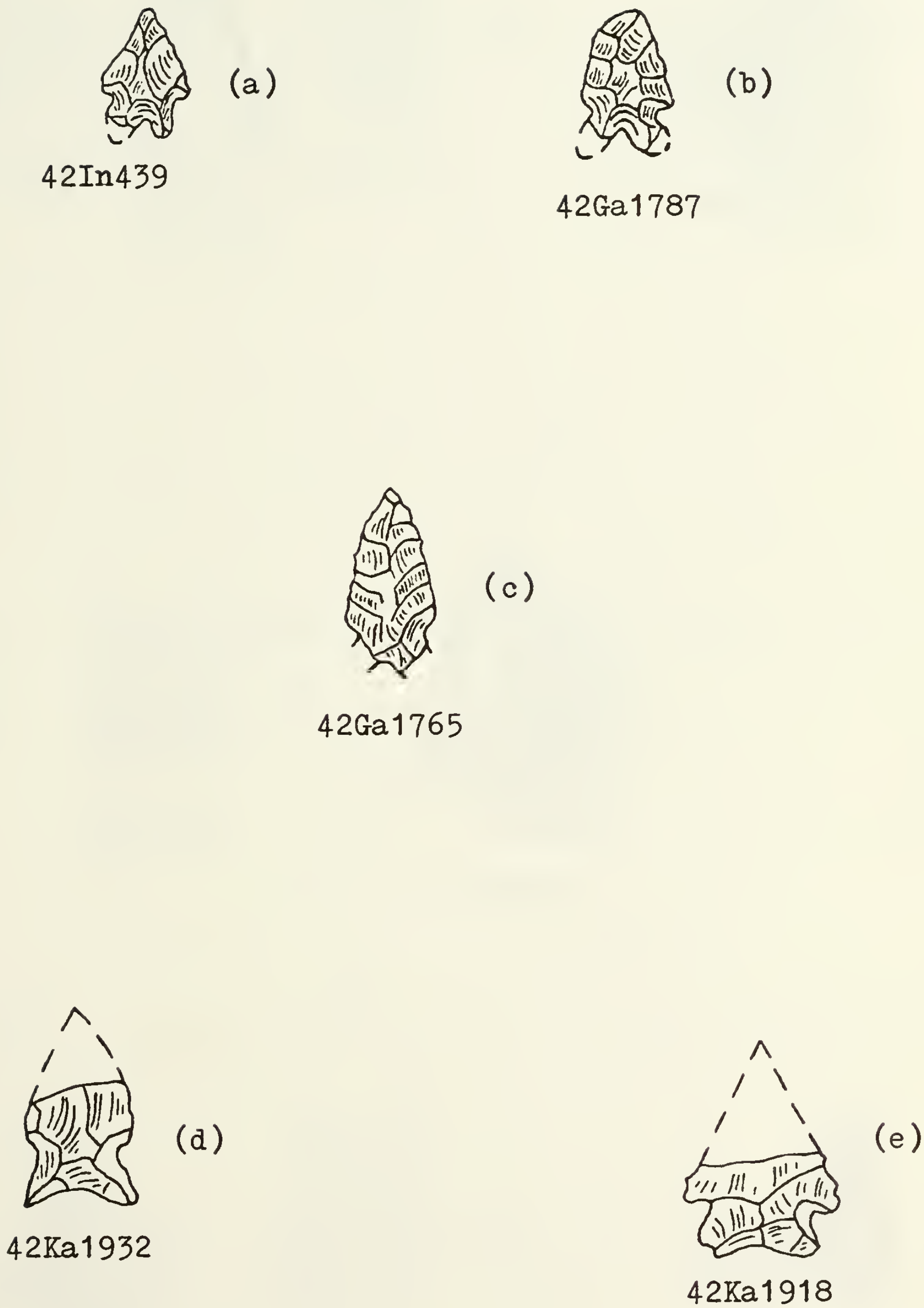


Figure 4-20

(ACTUAL SIZE)

(a)

42Ga1652

(b)

42Ka1915

(c)

04K/X8

(d)

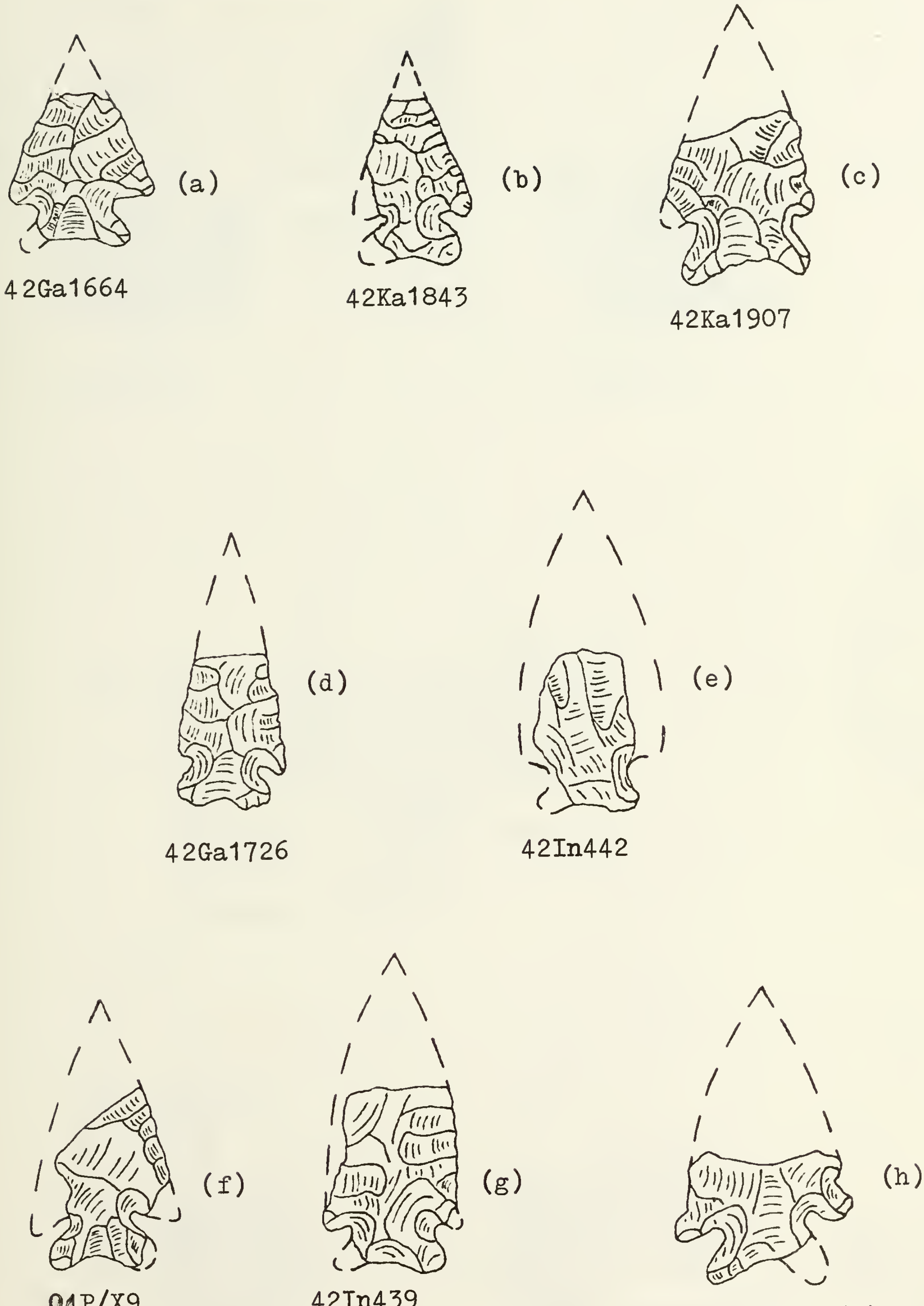
42Ga1682

(e)

42Ga1656

Figure 4-21

(ACTUAL SIZE)



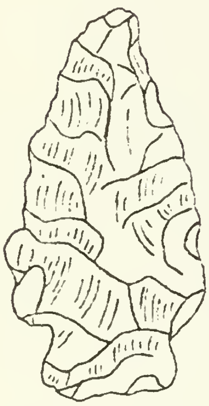
(ACTUAL SIZE)

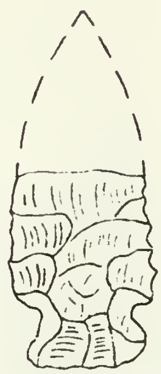

(a)
42Ga1730

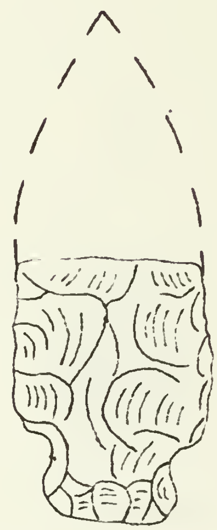

(b)
42Ga1745


(c)
42Ga1603


(d)
42Ga1628


(e)
42Ka1916


(f)
42Ga1745


(g)
42Ka1951


(h)
04J/X4

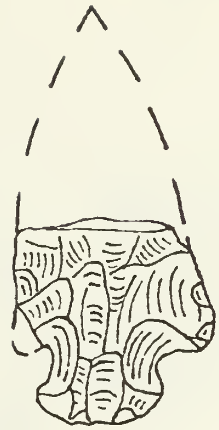

(i)
42Ga1773


(j)
42In442

(ACTUAL SIZE)

(a)

42Ga1787

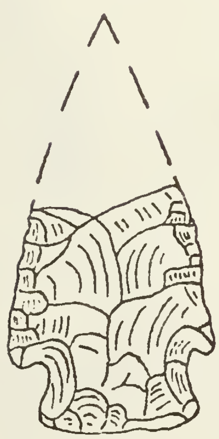


(b)

42Ka1915

(c)

42Ga1781



(d)

42Ga1593

(e)

04K/X7 (1)

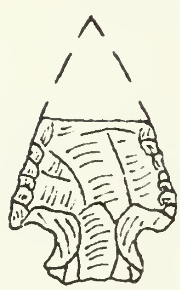
(ACTUAL SIZE)

(a)

42Ga1769

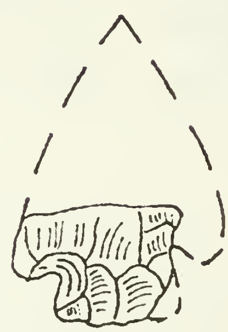
(b)

42Ga1664



(c)

42Ka1883



(d)

42Ka1880

(e)

42Ga1602

Figure 4-25

(ACTUAL SIZE)

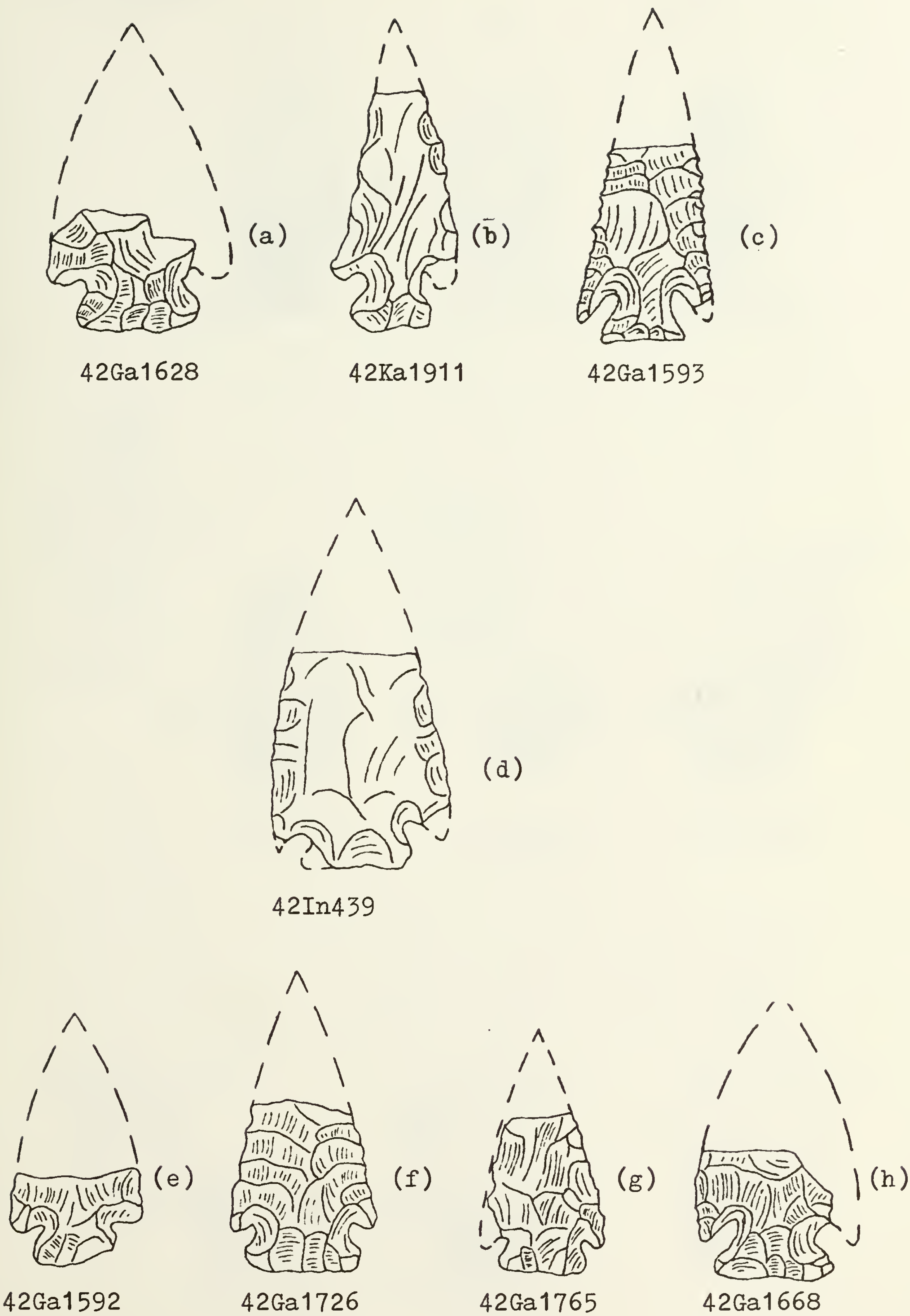


Figure 4-26

(ACTUAL SIZE)

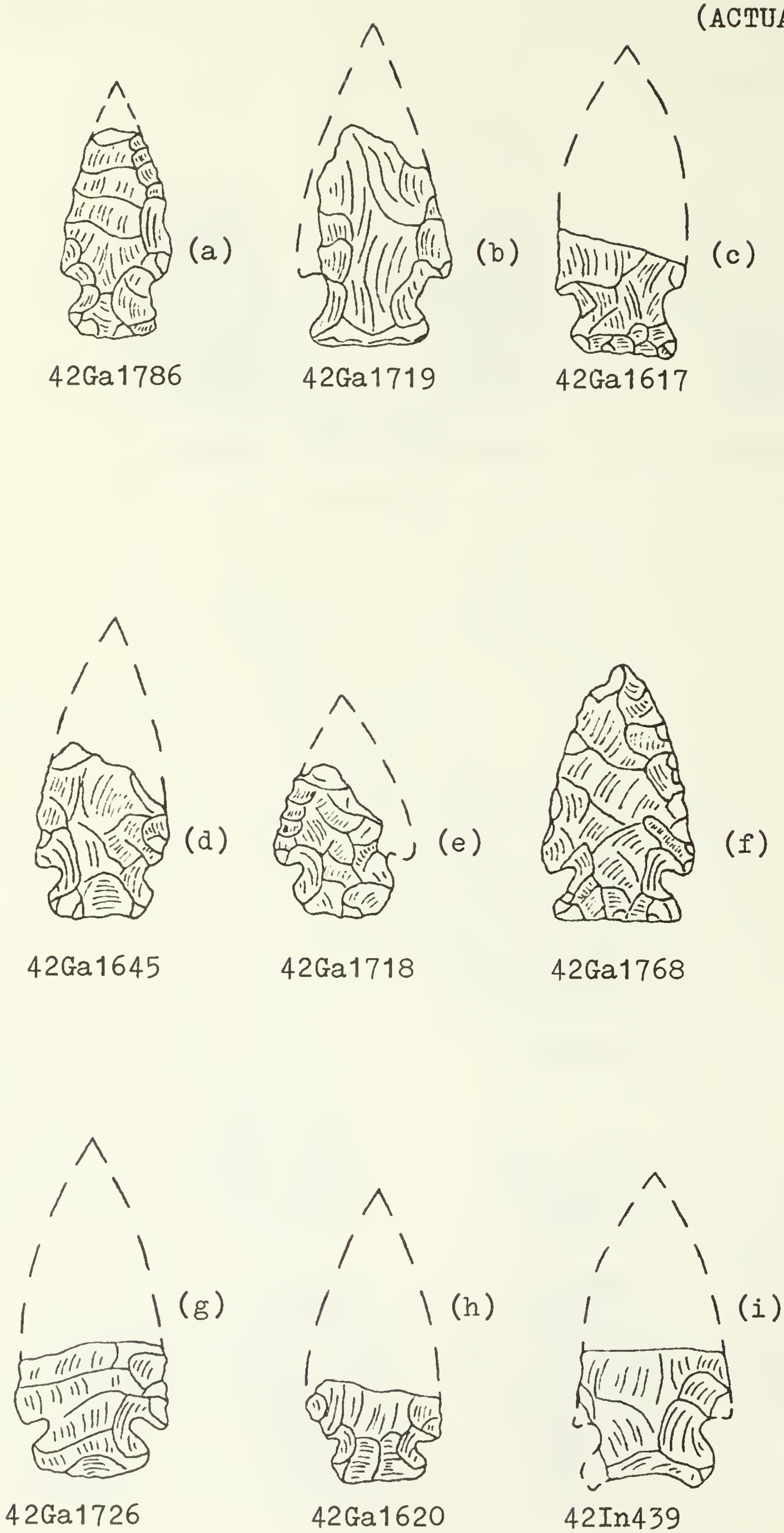


Figure 4-27

(ACTUAL SIZE)

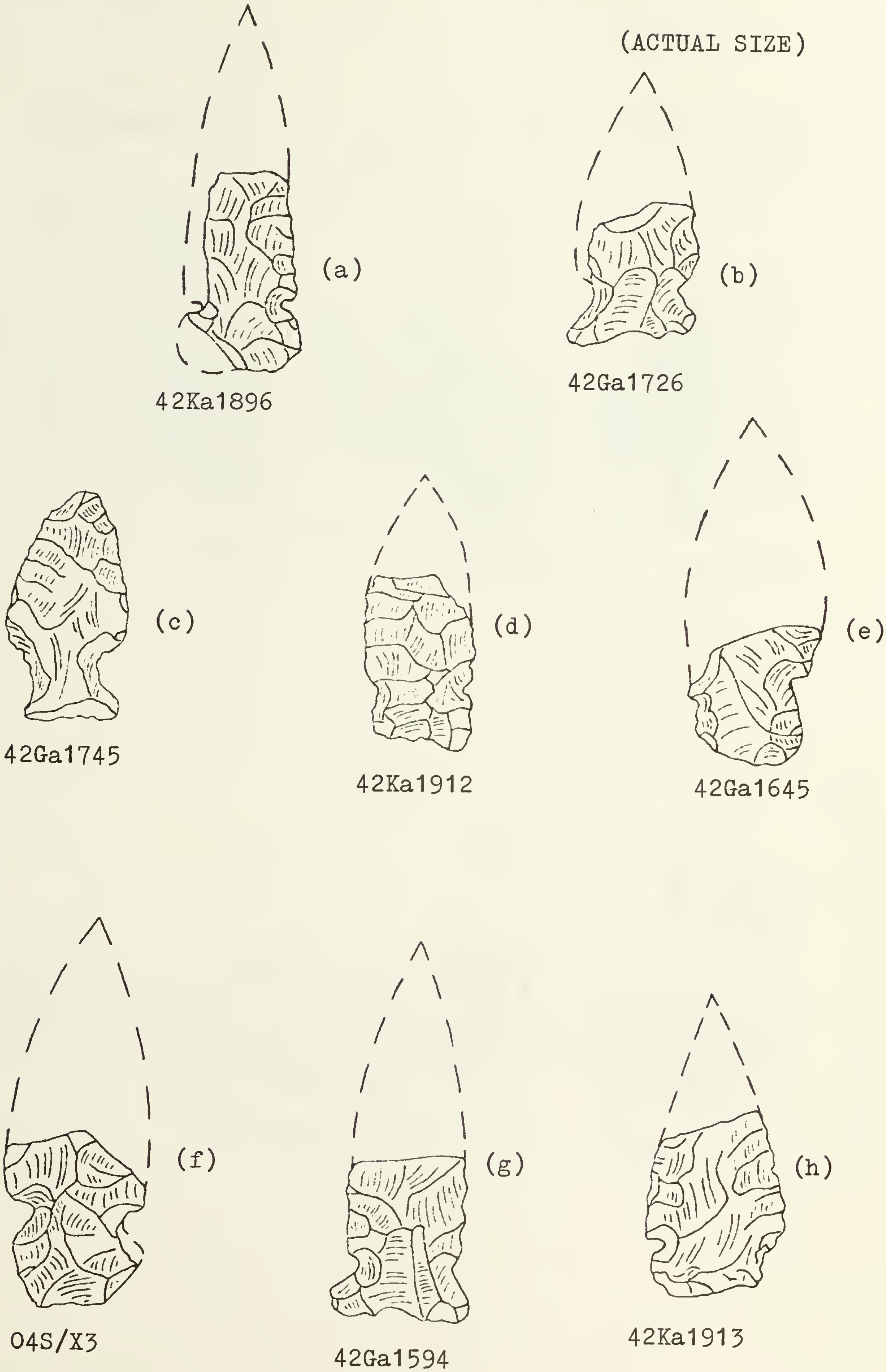


Figure 4-28

(ACTUAL SIZE)

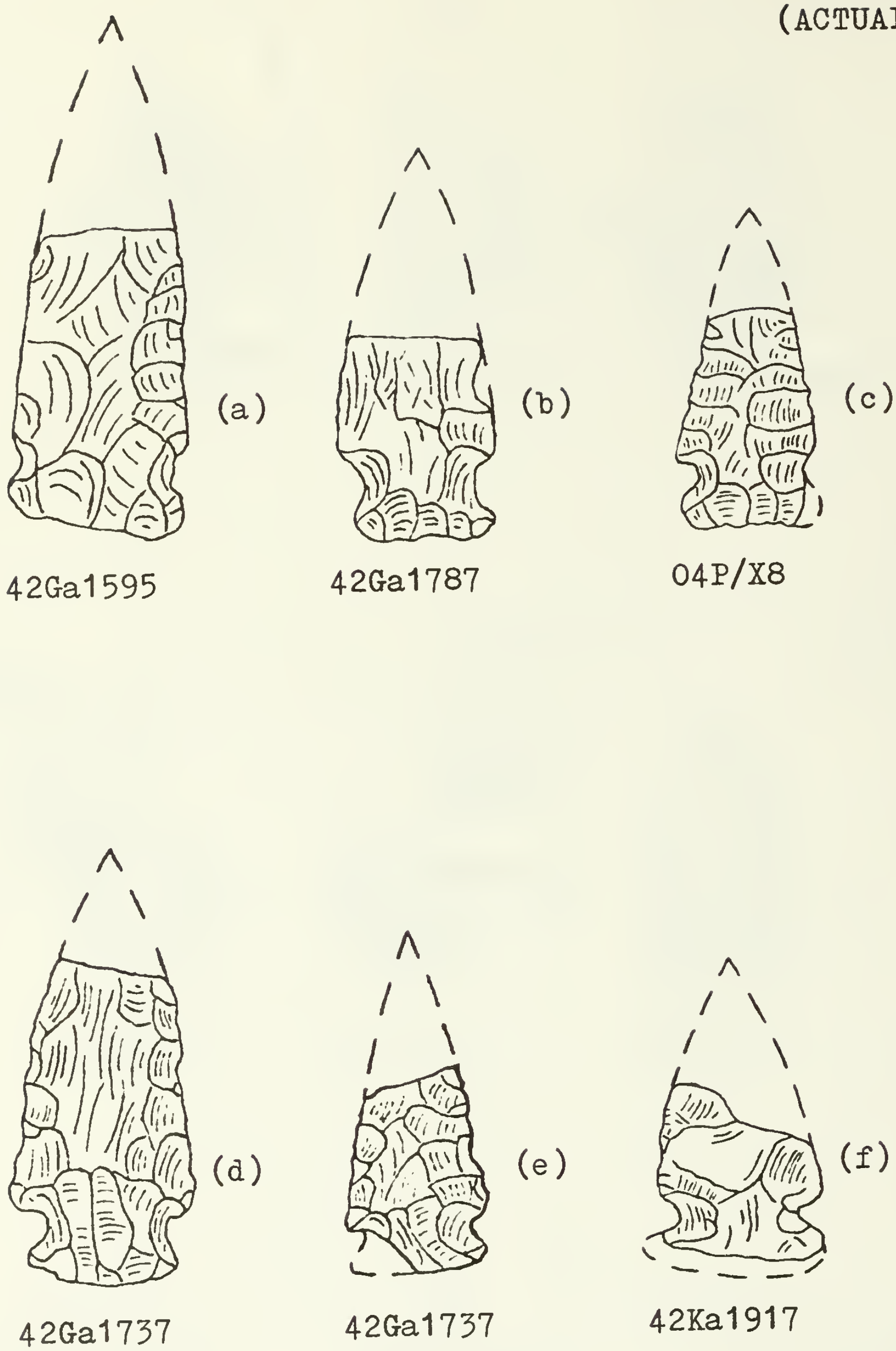


Figure 4-29

(ACTUAL SIZE)

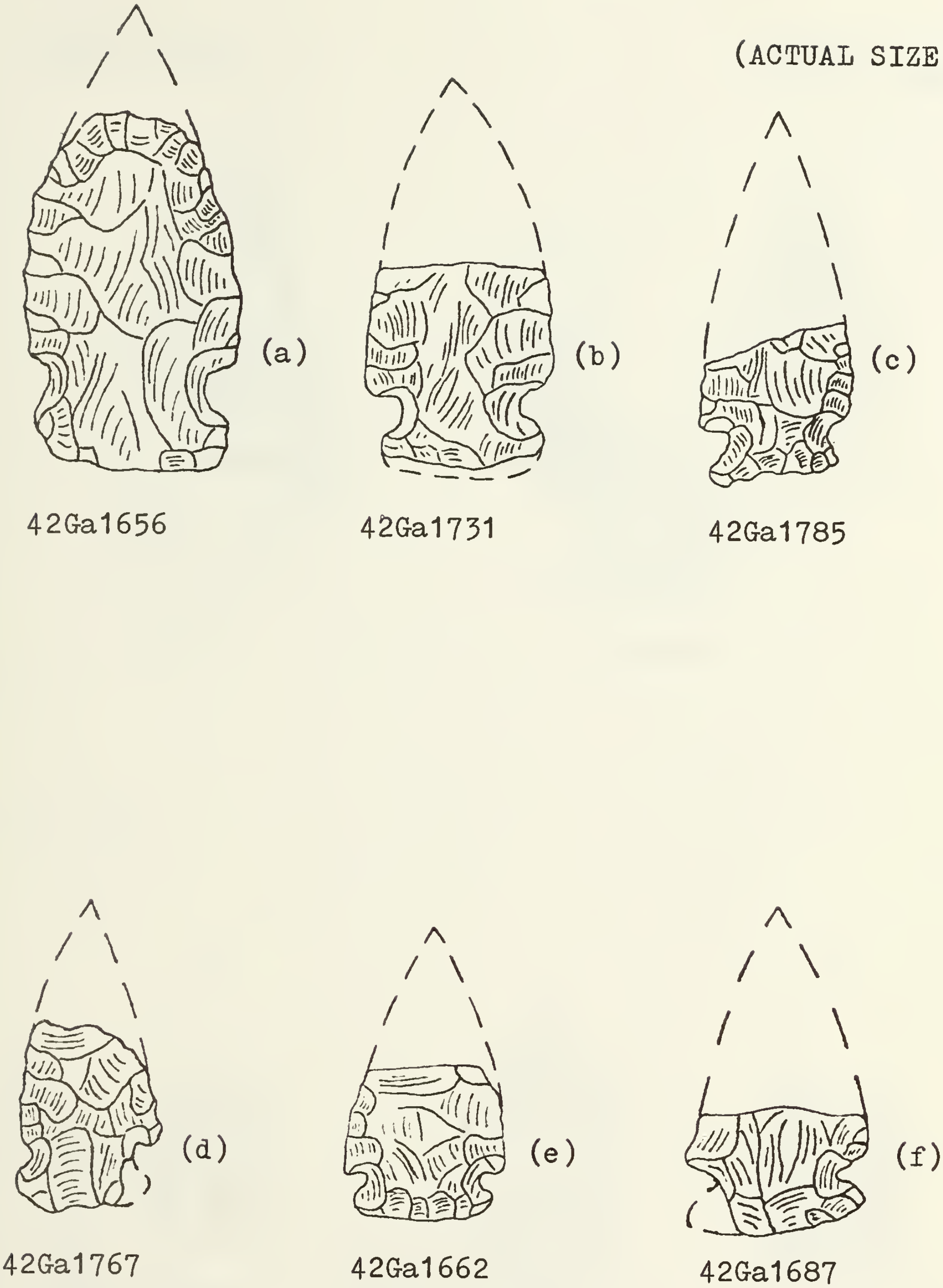


Figure 4-30

(ACTUAL SIZE)

(a)

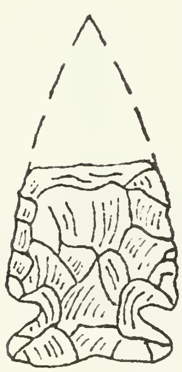
42Ga1765

(b)

42Ka1918

(c)

42Ka1930



(d)

42Ga1697

(e)

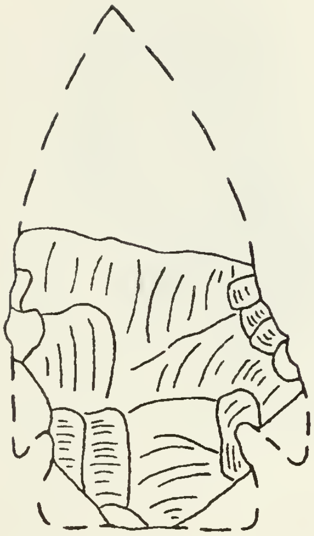
42Ka1883

(f)

42Ga1729

Figure 4-31

(ACTUAL SIZE)

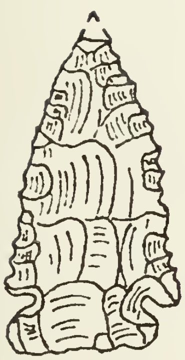


(a)

42In439

(b)

42In440

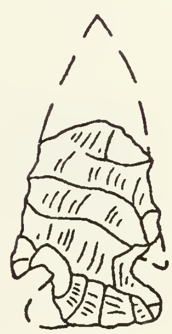


(c)

42Ga1627

(d)

04S/X1



(e)

42Ka1866

(ACTUAL SIZE)


(a)
42In439
(b)
42Ga1649
(c)
42Ga1787
(d)
42Ka1931
(e)
42Ga1669
(f)
42Ga1745

Figure 4-33

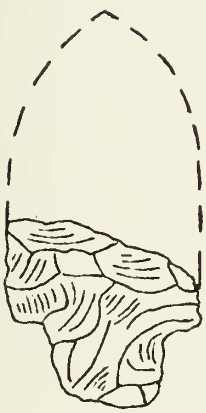
(ACTUAL SIZE)

(a)

42Ga1666

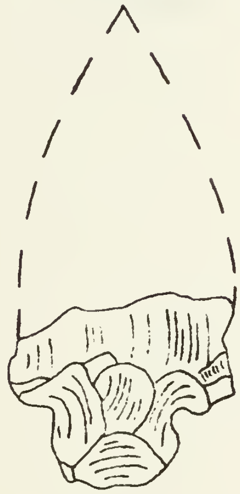
(b)

42In439



(c)

42Ga1765



(d)

42In439

(e)

42In439

(f)

42Ga1780

(g)

04S/X17

Figure 4-34

(ACTUAL SIZE)

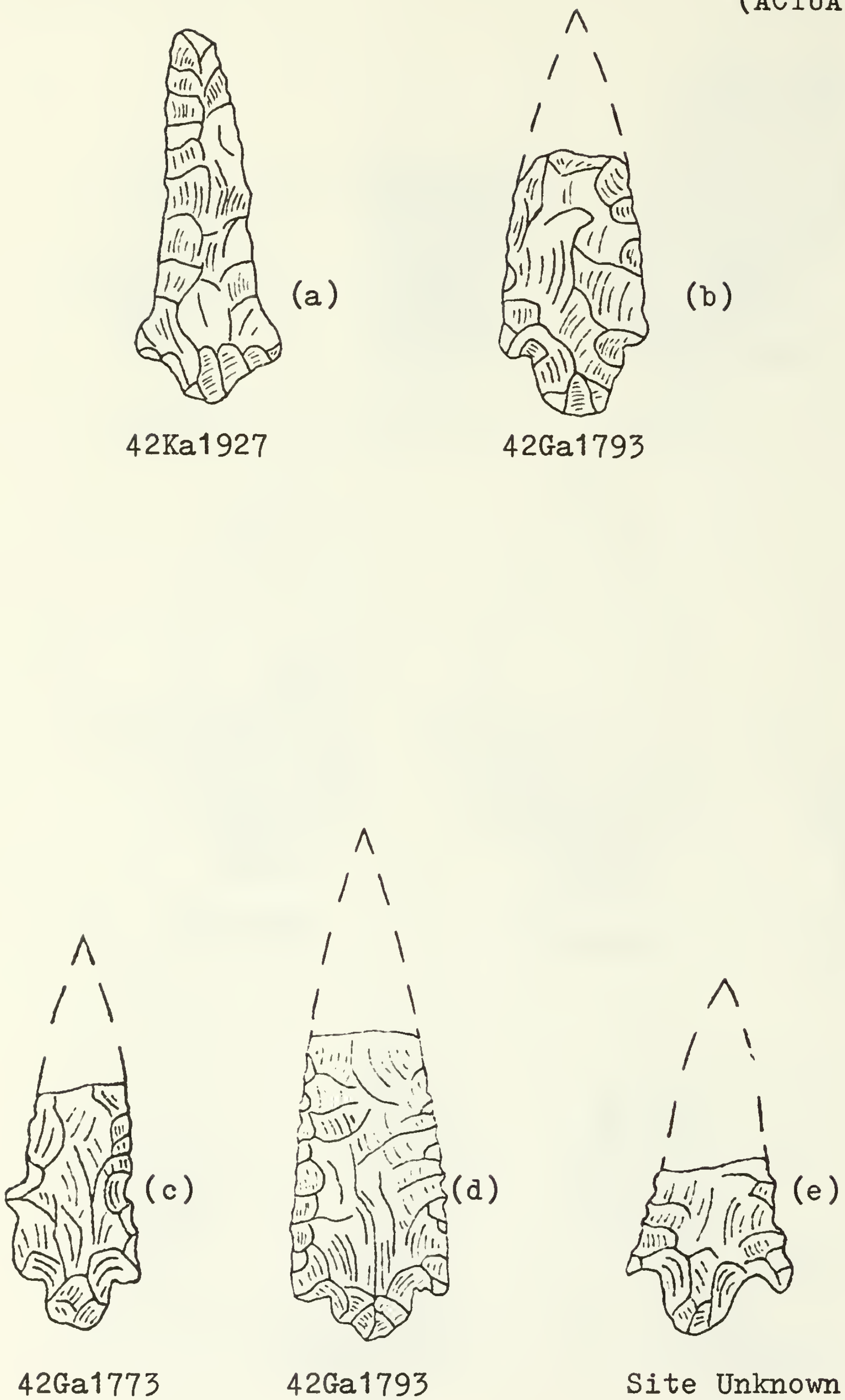


Figure 4-35

(ACTUAL SIZE)

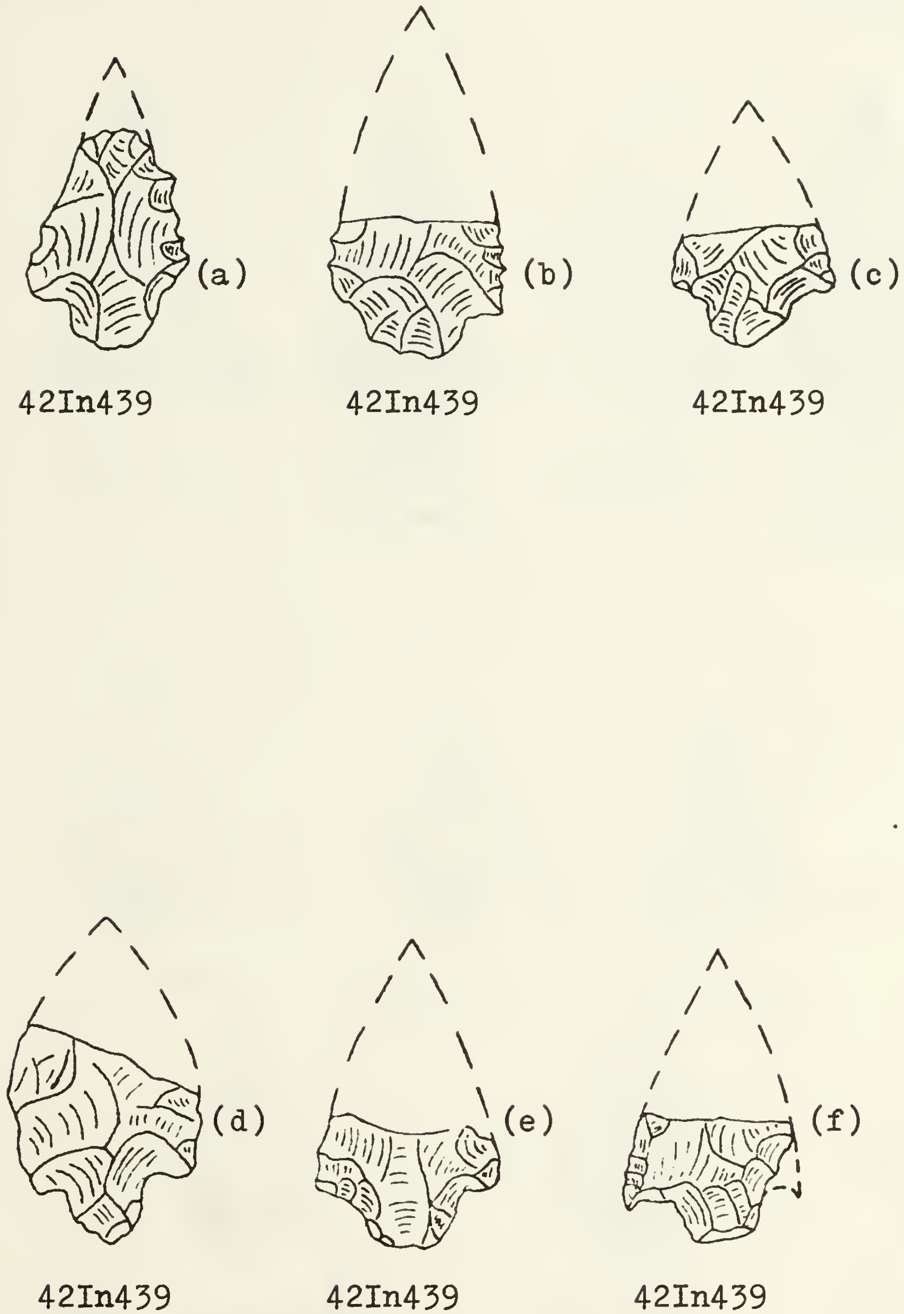
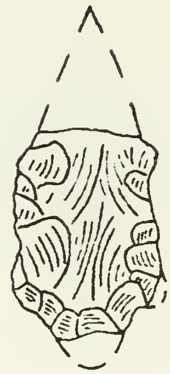


Figure 4-36

(ACTUAL SIZE)

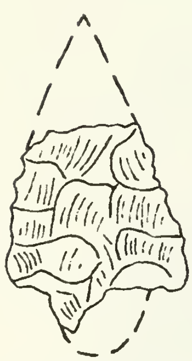
(a)

42Ga1766



(b)

42Ga1774



(c)

42Ga1596

(d)

42Ga1751

(e)

42Ga1690

Figure 4-37

(ACTUAL SIZE)

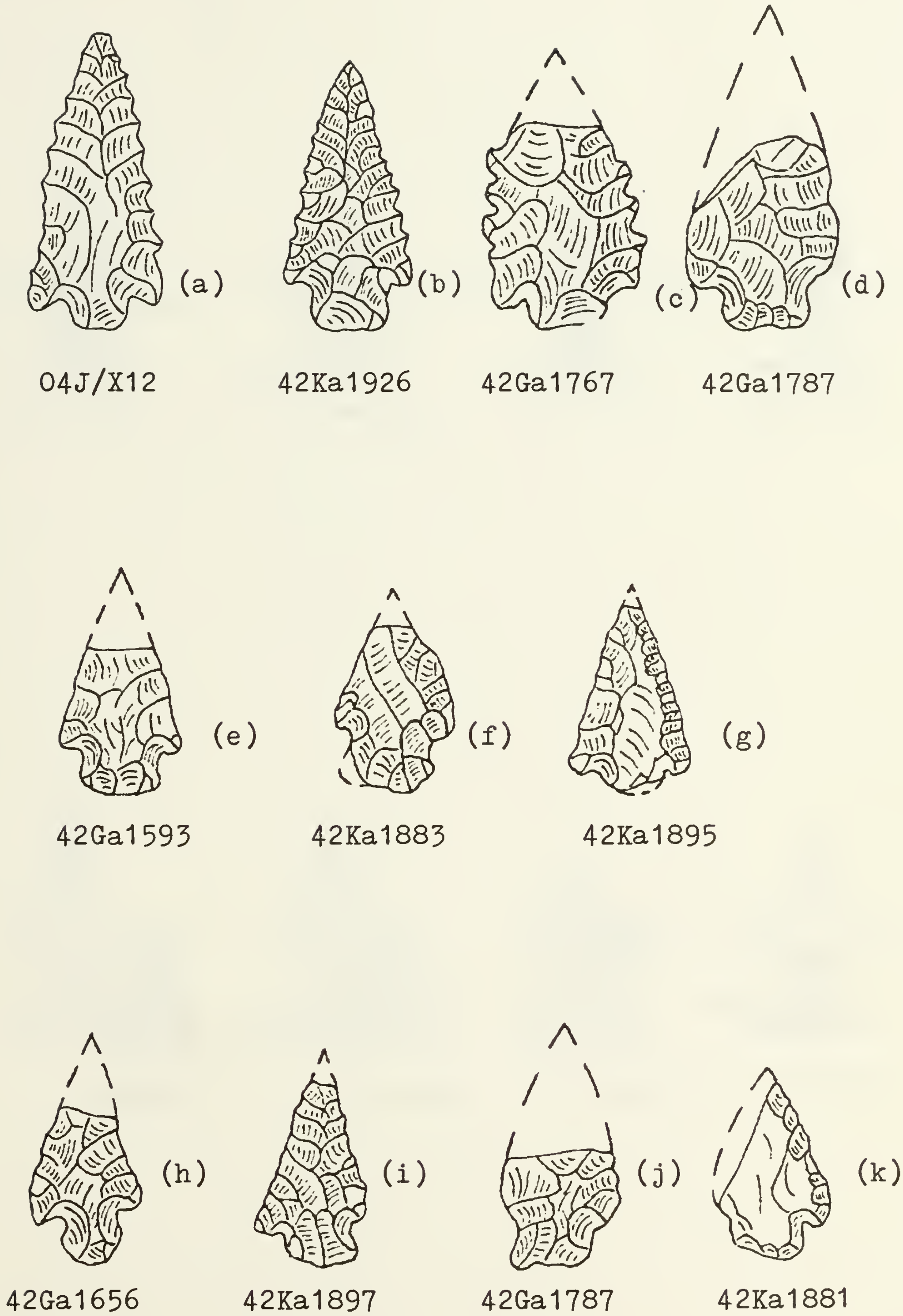


Figure 4-38

(ACTUAL SIZE)

 (a)
42Ga1590

 (b)
42Ga1770

 (c)
42Ka1892

 (d)
42Ga1746

 (e)
42In439

 (f)
42Ga1619

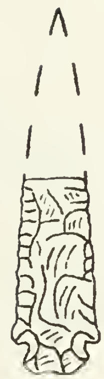
 (g)
42Ga1652

 (h)
42In439

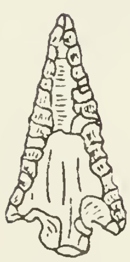
(ACTUAL SIZE)


(a)
42Ka1896


(b)
42Ga1589


(c)
42Ga1653


(d)
42Ga1793


(e)
42Ga1579


(f)
42Ka1897


(g)
04P/X5


(h)
42Ka1841

Figure 4-40

(ACTUAL SIZE)

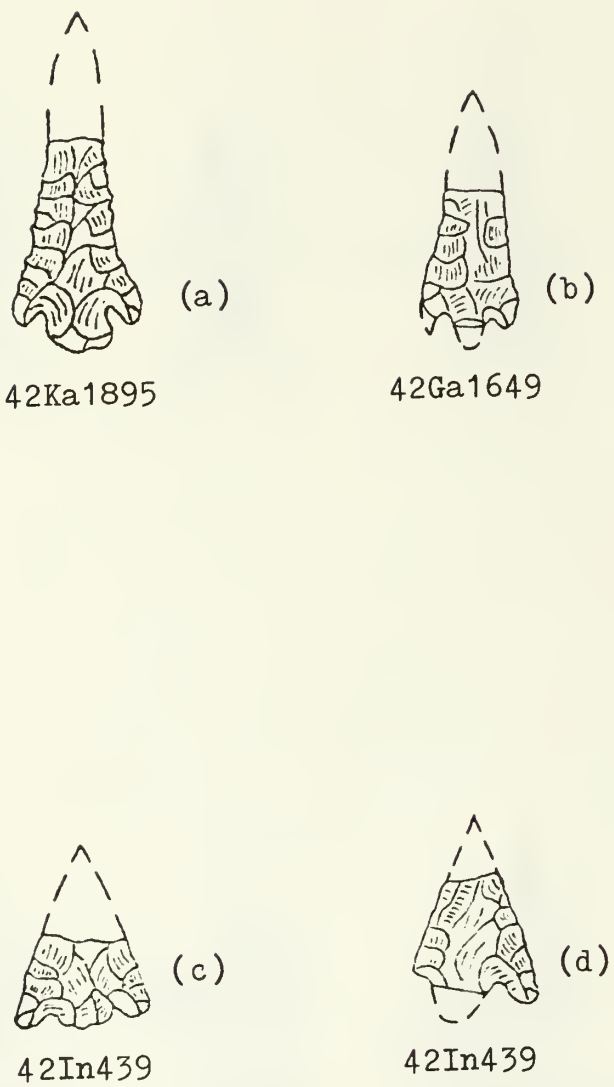
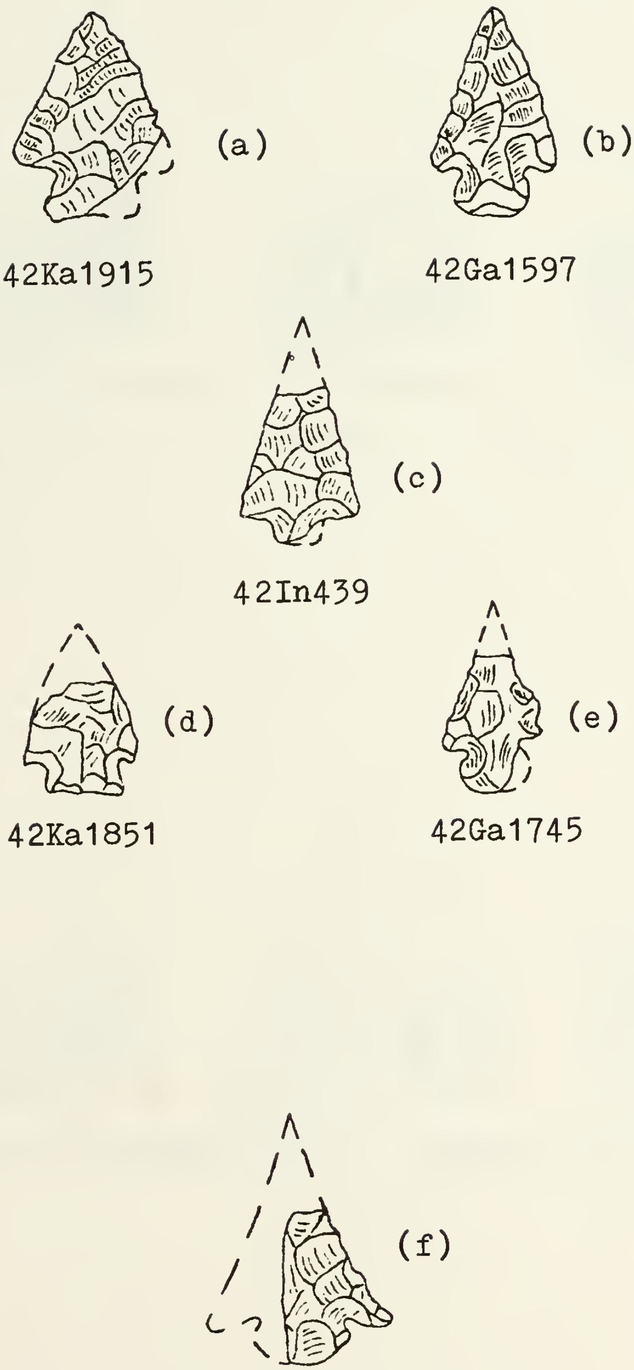


Figure 4-41

(ACTUAL SIZE)



(a) 42Ka1915

(b) 42Ga1597

(c) 42In439

(d) 42Ka1851

(e) 42Ga1745

(f) 04S/X2 (2)

(ACTUAL SIZE)

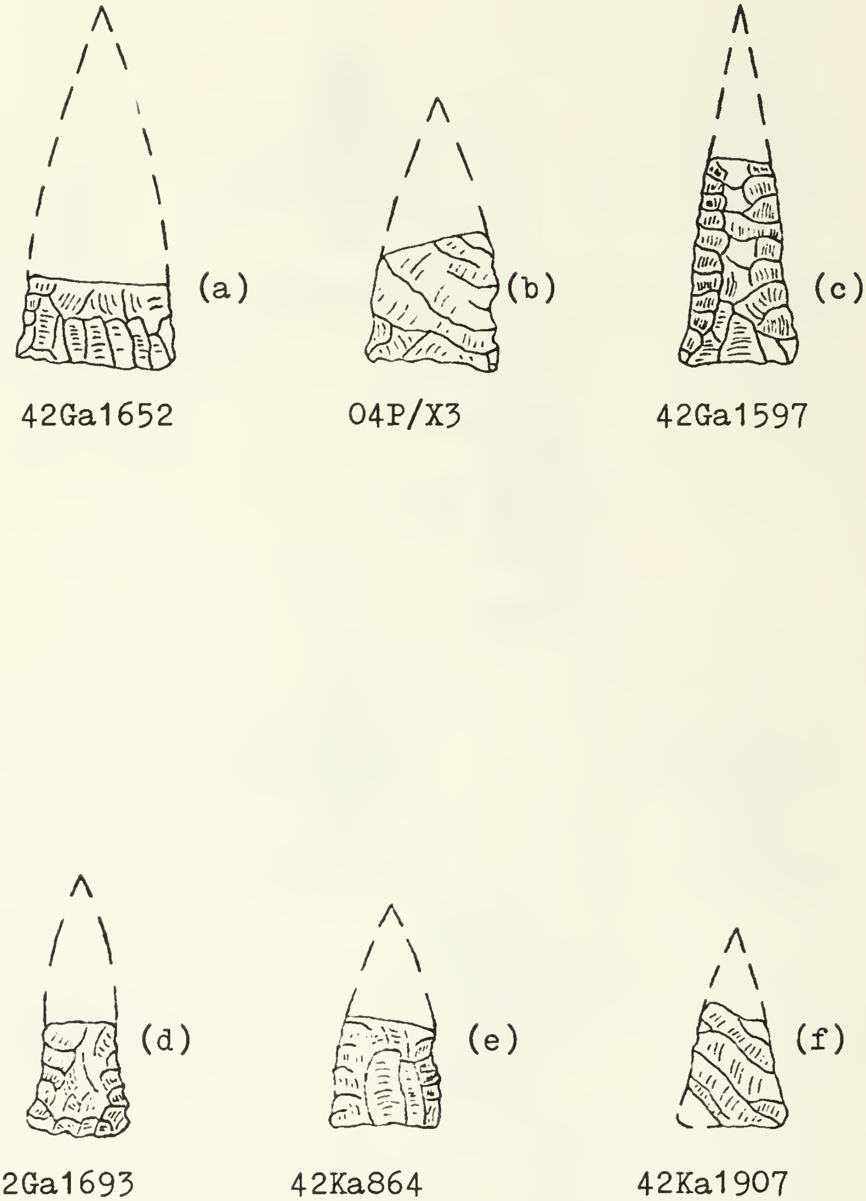

(a)
42Ga1652
(b)
04P/X3
(c)
42Ga1597
(d)
42Ga1693
(e)
42Ka864
(f)
42Ka1907

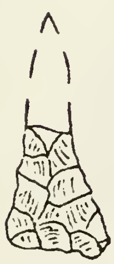
Figure 4-43

(ACTUAL SIZE)


(a)
42Ga1778


(b)
42Ka1851

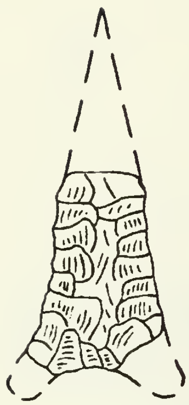

(c)
42Ka1957


(d)
42In439


(e)
42In439

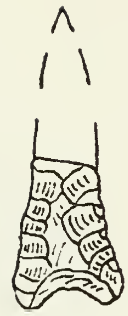

(f)
42In439

(ACTUAL SIZE)



(a)

42Ka1866



(b)

42Ka1898

(c)

42In442

(d)

42Ka1899

(ACTUAL SIZE)


(a)
42Ga1678


(b)
04F/X1


(c)
42Ka1873


(d)
42Ka864


(e)
42Ga1705


(f)
42Ka1855

Figure 4-46

(ACTUAL SIZE)

(a)

42Ga1779

(b)

42Ga1693

(c)

42Ga1763

(d)

42Ga1665

(e)

04K/X11

(f)

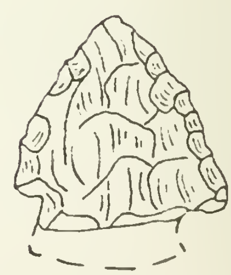
42Ka1915

(g)

42In439

(h)

04J/X9



(i)

04K/X10

Figure 4-47

(ACTUAL SIZE)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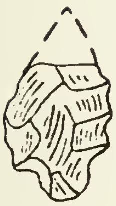
42In439

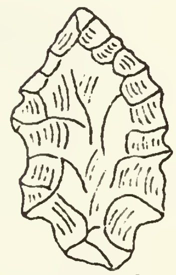

(b)
42Ka1851

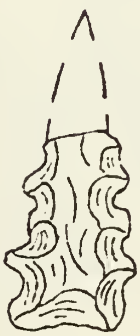

(c)
42Ka1916


(d)
42Ka1932


(e)
04F/X5


(f)
42Ga1765


(g)
42In439

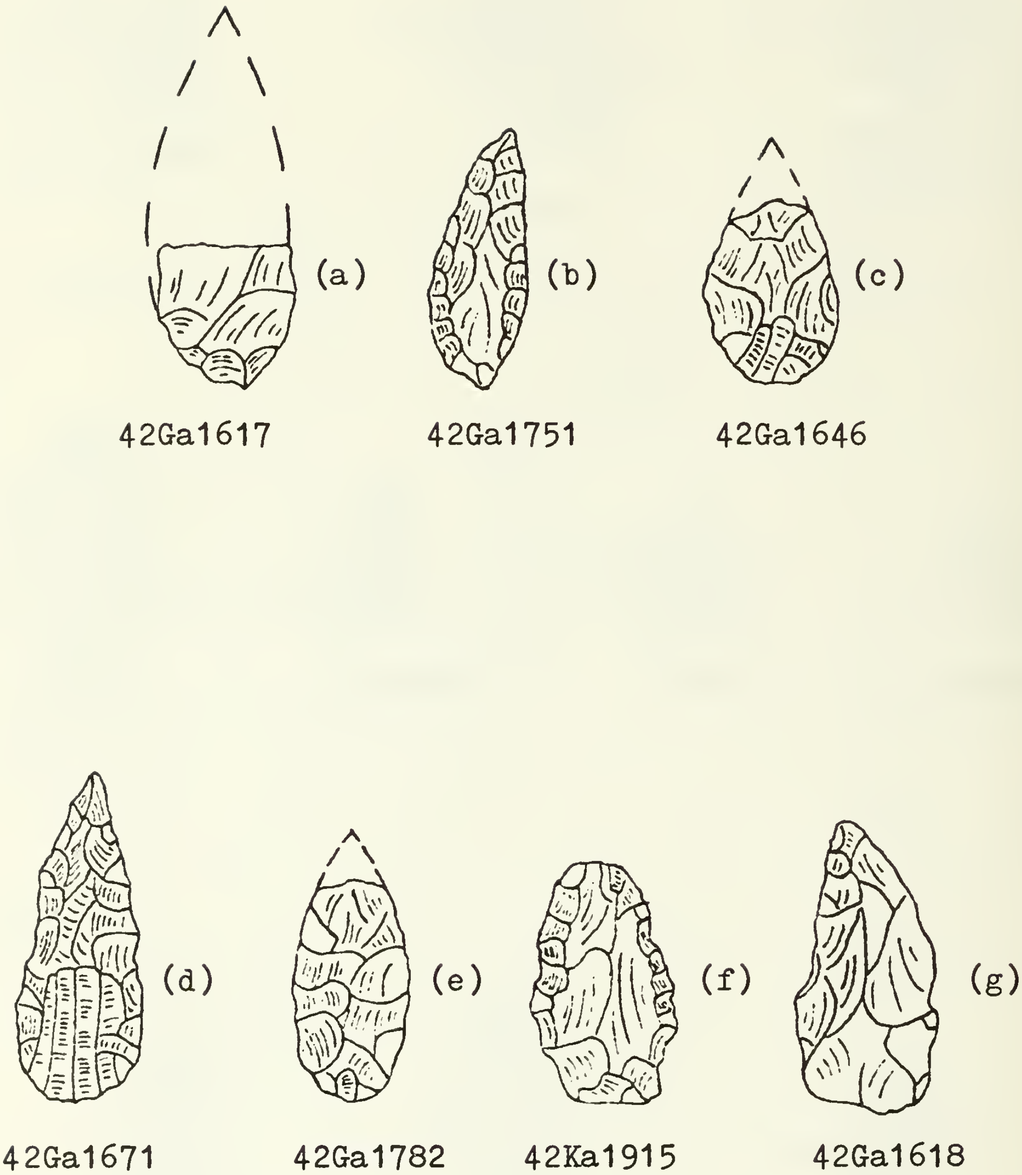

(h)
42Ga1751


(i)
42Ga1782


(j)
42Ga1745


(k)
42In439

(ACTUAL SIZE)


(a)
(b)
(c)
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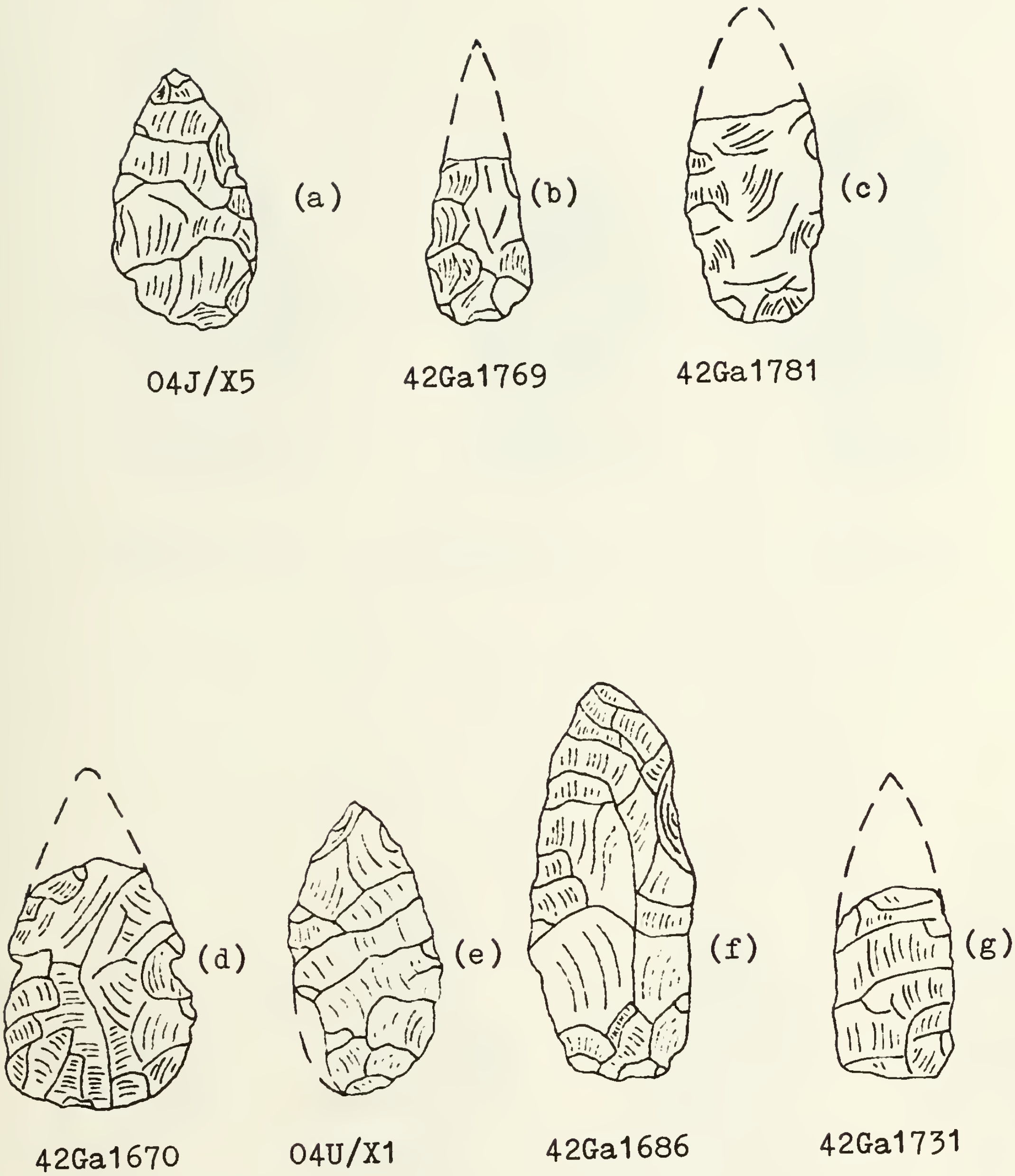
42Ga1751
42Ga1646
(d)
(e)
(f)
(g)
42Ga1671
42Ga1782
42Ka1915
42Ga1618

Figure 4-49

(ACTUAL SIZE)



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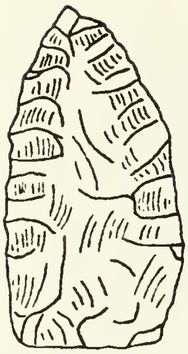
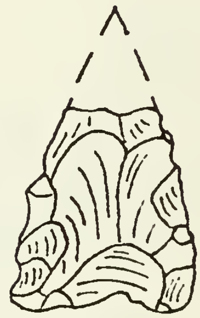

(a)
42Ga1664


(b)
42Ga1729


(c)
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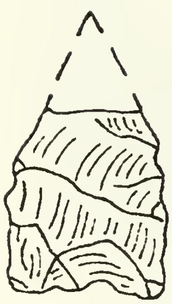
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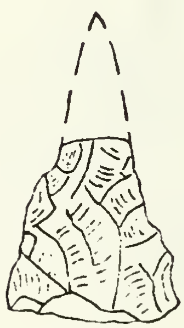
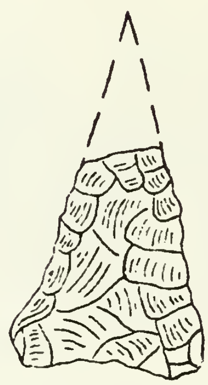
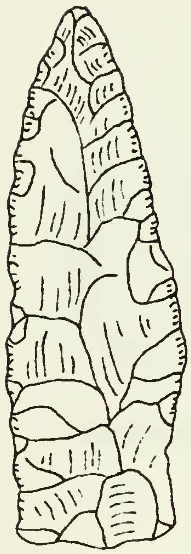

(e)
42In439


(f)
42Ga1778


(g)
04K/X6

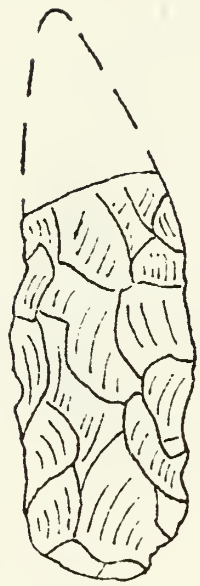
(ACTUAL SIZE)


(a)

04M/X2 (1)


(b)

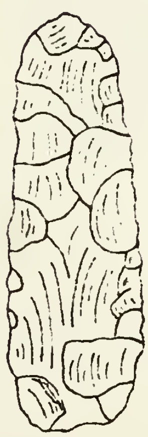
42Ga1658


(c)

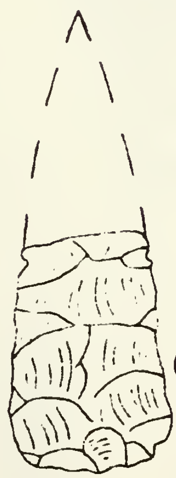
42Ka1859


(d)

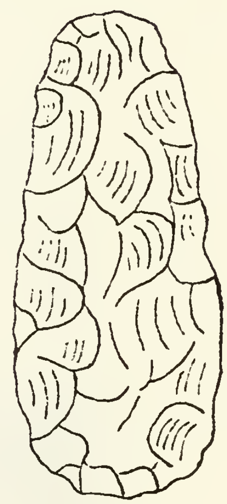
42Ka1930


(e)

42Ga1728


(f)

04J/X7


(g)

42Ka1953

Figure 4-52

(ACTUAL SIZE)

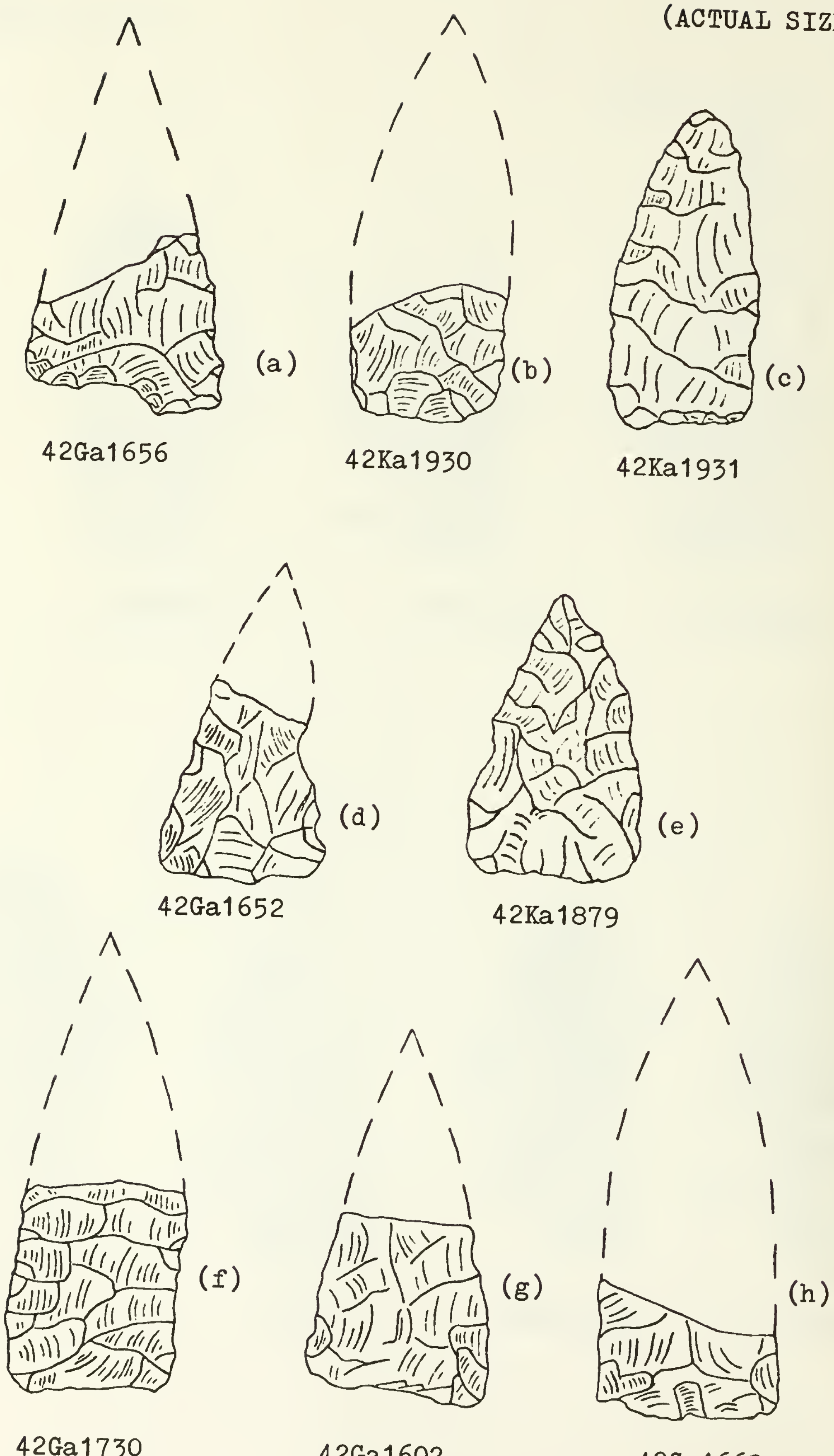
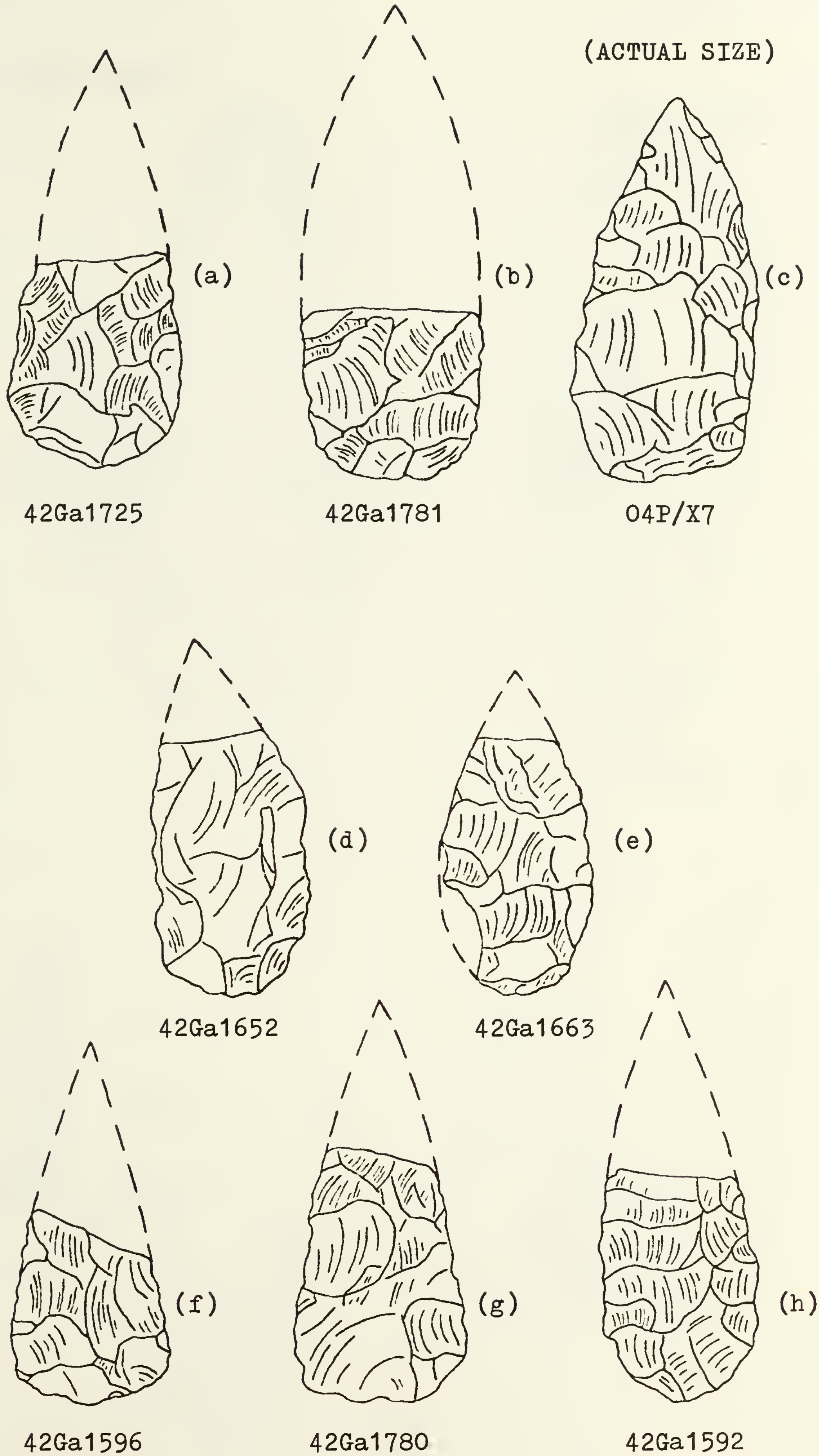


Figure 4-53

(ACTUAL SIZE)



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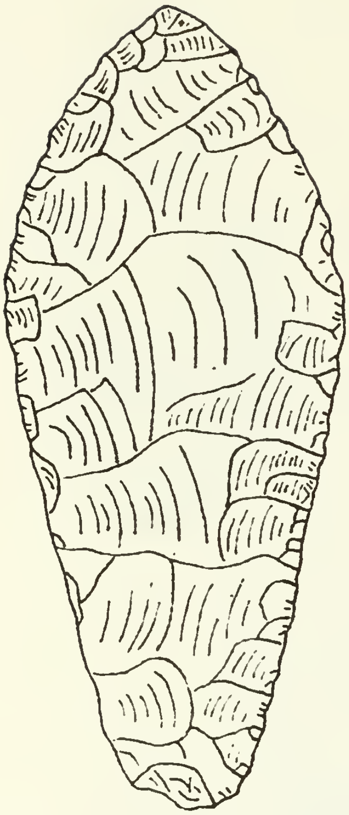
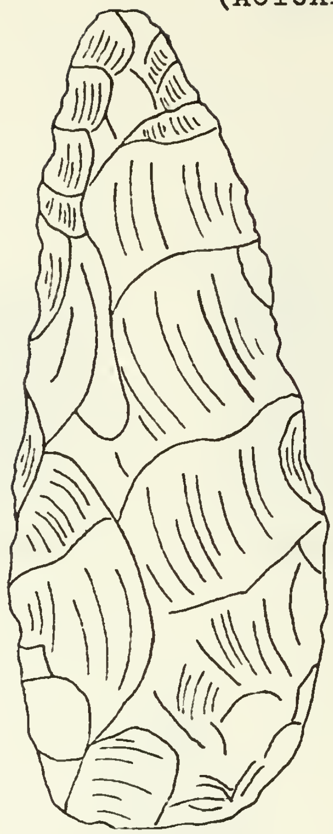


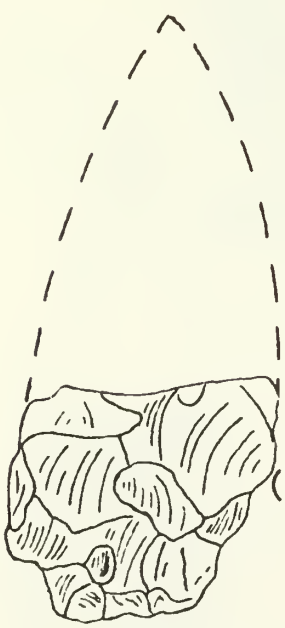
(a)

42Ga1675



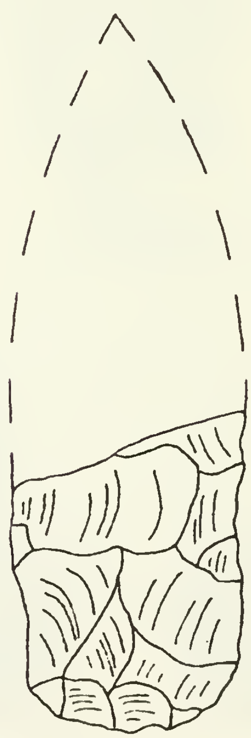
(b)

42Ga1745



(c)

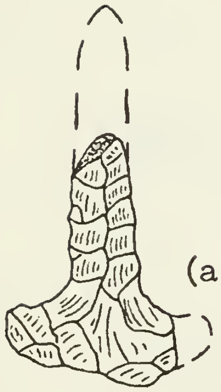
42Ga1771



(d)

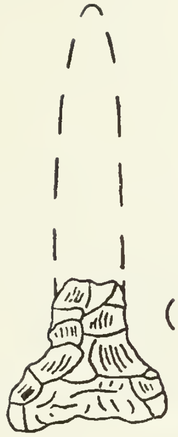
42Ga1603

(ACTUAL SIZE)



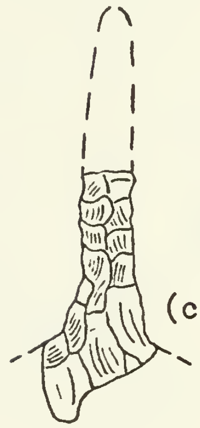
(a)

04B/X2



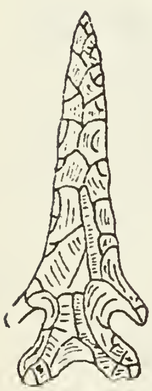
(b)

42In439



(c)

42Ga1628



(d)

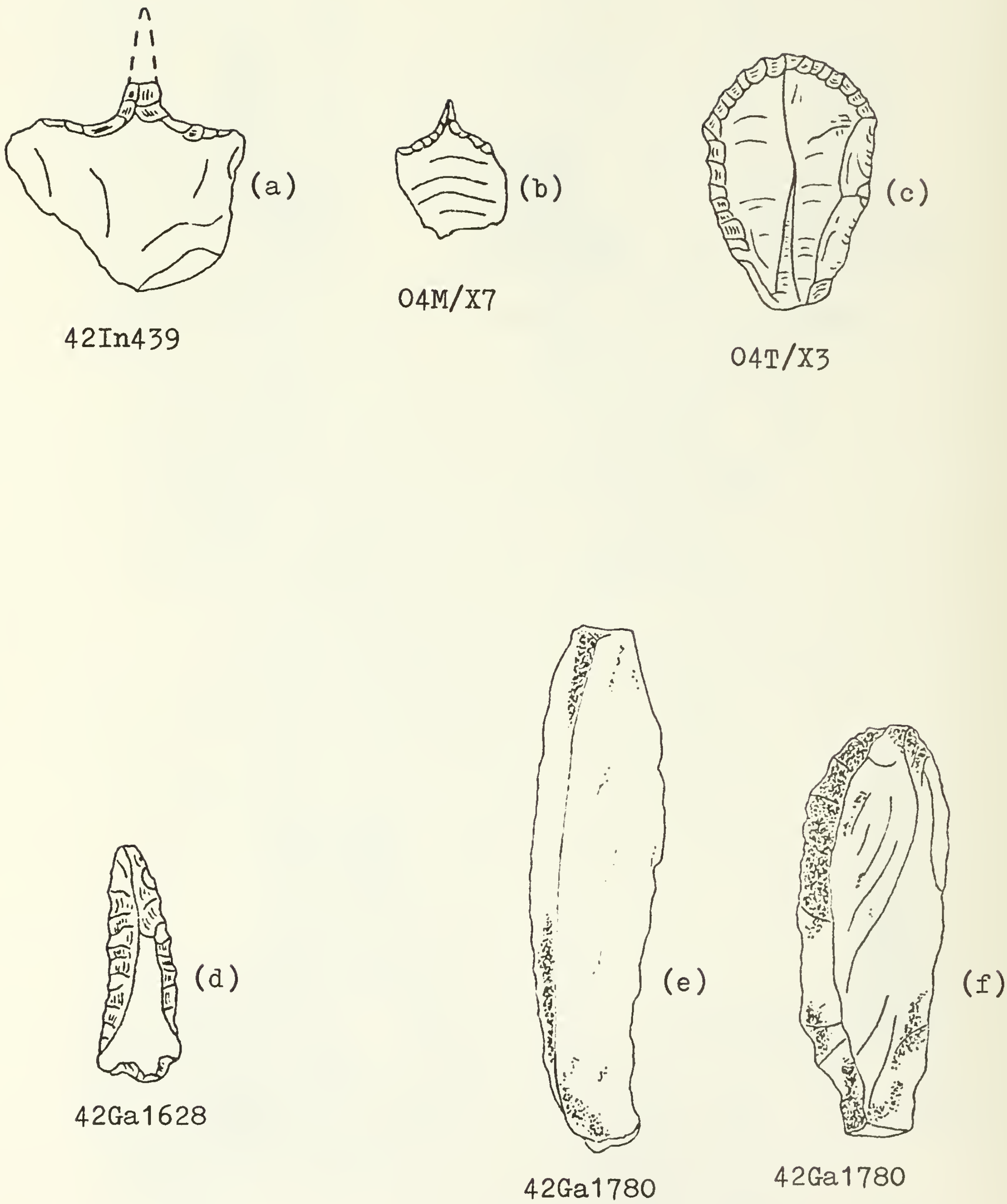
42Ga1670

(e)

42Ga1765

Figure 4-56

(ACTUAL SIZE)



Ceramics

Ceramic lots were collected at 87 sites (25%) of all 348 sites recorded and from six isolated finds. The ceramic analysis* was accomplished using Colton (1955), Colton and Hargrave (1937), and Madsen (1977) as source books. Additionally, the type collections of the Utah Museum of Natural History were consulted as a means of confirming the typological assignments.

A total of 1,035 sherds was typed with only 21 (2%) of those collected remaining unclassified. Five unidentified sherds from two separate vessels, possibly misfired Tsegi Orange ceramics, were collected from 42Ga1685. The remaining untyped sherds represent anomalous tempering or paste consistency and could not be adequately typed.

As the aim of the typology was to evaluate the temporal and cultural affiliation of recorded sites, special procedures were instituted in the typing process. Following Colton (1955) and Colton and Hargrave (1937), each ware was segregated initially, then subdivided into its respective series (if applicable) and types. Divergence from normally accepted procedure occurred in the evaluation of North Creek Gray and Snake Valley Gray sherds which were assigned to painted and corrugated varieties rather than to separate types. In cases where surface treatment was the only variable in distinguishing between two or more sherds, the ceramics were considered to be of a variety rather than placed into two distinct types.

Additionally, in the case of Tusayan Gray ware, no clear distinction could be made between the Tsegi and Virgin series. The typological distinction between the two series is based on the amount of non-quartz sands of tan to black color. Tsegi series ceramics are predominantly

*The limited amount of collected artifacts precluded the development of frequency distribution tables.

quartz sand, while Virgin series reflect additions of non-quartz sands. The difficulty in distinguishing these types on the basis of one continuous variable has been pointed out by Colton and Hargrave (1937:17), and the difficulty became apparent when such divisions were attempted on the survey collections. All Tusayan Gray corrugated sherds were included under the North Creek Gray type as a corrugated variety due to their geographical location in the Virgin area.

The following shorthand type descriptions are provided as a guide to the characteristics of the evaluated ceramics and as a means of listing those criteria used to segregate and differentiate the types. The number of representative sherds is listed in each type category and pertinent typological observations are included. The type descriptions are based upon visual examination with a 20 power binocular microscope and generally agree with established types.

<u>KAYENTA WARES</u>

WARE: Tsegi Orange

SERIES:

TYPE: Tsegi Orange - 14 sherds

Clay: Chunky (earthenware fracture) matrix
Color: Orange/red to red
Temper: Predominantly sherd with quartzite sands
Thickness: 4-6mm
Surface Finish: Slipped and polished with occasional red wash
Recognition: Impermanent red wash over orange clay body. Unpainted
Variations: None observed

WARE: Tsegi Orange

SERIES:

TYPE: Tusayan Black/Red - 5 sherds

Clay: Fine (earthenware fracture) matrix
Color: Brick red to orange with reduction core
Temper: Fine round quartz sand with ground sherd
Thickness: 4-6mm

Surface Finish: Red wash over smoothed clay. Well polished. Black mineral paint
Recognition: Distinctive hatchured design in black paint on red wash with orange body clay; yellow sherd temper visible on surfaces
Variations: None observed

WARE: Tsegi Orange

SERIES:

TYPE: Citadel Polychrome - 3 sherds

Clay: Chunky (earthenware fracture) matrix
Color: Brick red to orange
Temper: Non-quartz sand and ground sherd
Thickness: 4-6mm
Surface Finish: Smoothed and polished with red wash and black mineral paint
Recognition: Distinctive solid design elements with black and red paint on orange clay. Yellow sherd temper visible on surfaces
Variations: None observed

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Discussion: The types are primarily recognizable by decoration, but it should be noted that the clay structures and tempering materials also differ. In some cases, Tsegi Orange sherds may be unpainted body sherds of Tusayan black on red.

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WARE: Tusayan White

SERIES: Tsegi

TYPE: Black Mesa black on white - 11 sherds

Clay: Dense chunky (soap fracture) matrix
Color: Light gray
Temper: Medium-fine quartz sand
Thickness: 5-8mm
Surface Finish: Black mineral paint on polished and slipped interior
Recognition: Black Mesa style designs with sand temper and slip
Variations: None observed

WARE: Tusayan White

SERIES: Tsegi

TYPE: Shato black on white - 1 vessel fragment

Clay: Fine dense (snap fracture) matrix
Color: Light gray with reduction core
Temper: Predominantly crushed sherd
Thickness: 5mm
Surface Finish: Black mineral paint on polished interior; clapboard corrugated exterior
Recognition: Bold Sosi designs with clapboard exterior and sherd temper
Variations: None observed

WARE: Tusayan White

SERIES: Tsegi

TYPE: Sosi black on white - 6 sherds

Clay: Dense chunky (soap fracture) matrix
Color: Light gray
Temper: Abundant quartz sand
Thickness: 3-7mm
Surface Finish: Black mineral paint over slipped and polished clay
Recognition: Sand tempered white sherds with Sosi designs on a thin white slip
Variations: None observed

WARE: Tusayan White

SERIES: Tsegi

TYPE: Dogoszhi black on white - 2 sherds

Clay: Fine dense (snap fracture) matrix
Color: Light to medium gray
Temper: Abundant quartz sand
Thickness: 6mm
Surface Finish: Thin black mineral paint on unslipped polished clay
Recognition: Sand tempered white sherds with Dogoszhi style designs on unslipped clay
Variations: None observed

KAYENTA WARES (Cont.)

WARE: Tusayan White

SERIES: Tsegi

TYPE: Garfield black on white - 2 sherds

Clay: Fine dense (uneven fracture) matrix
Color: Medium gray
Temper: Abundant colored (non-quartz) sand
Thickness: 3-5mm
Surface Finish: Thin black mineral paint with polished slip
Recognition: Black paint on slipped sherds with non-quartz sand temper
Variations: None observed

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Discussion: The Tusayan White wares form distinctive types, and their type designations have been retained rather than making them variations of a single type. No type description was available for Garfield black on white, but the sherds from the survey match those in the Utah Museum of Natural History type collections, and McFadden (1976:2) has been followed in assigning these sherds to the Tusayan White ware - Tsegi series.

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VIRGIN WARES

WARE: Tusayan Gray

SERIES: Virgin

TYPE: North Creek Gray - 319 sherds

Clay: Dense chunky (soap fracture) matrix
Color: Light gray to white
Temper: Abundant rounded quartz sand with tan to black rounded sand
Thickness: 4-6mm
Surface Finish: Smoothed but rarely polished
Recognition: Thin coarse gray sherds with abundant sand temper visible on both surfaces
Variations: North Creek black on gray (53 sherds) with black organic based mineral paint on bowls; North Creek corrugated with finger impressed corrugations (90 sherds)

WARE: Tusayan Gray

SERIES: Coombs

TYPE: Coombs Gray - 94 sherds

Clay: Dense chunky (soap fracture) matrix
Color: Light gray to white
Temper: Rounded crystalline black basalt and rounded quartz (large)
Thickness: 4-8mm
Surface Finish: Roughly smoothed and carelessly polished
Recognition: Thin coarse gray sherds with large black basalt temper contrasting with white clay body
Variations: Fugitive red exterior wash

WARE: Shinarump White

SERIES:

TYPE: Virgin black on white - 11 sherds

Clay: Compact fine (uneven fracture) matrix
Color: Dark gray to red on black
Temper: Abundant quartz sand, angular white fragments, 1 sherd tempered
Thickness: 4-6mm
Surface Finish: Black mineral paint over heavy polished slip
Recognition: Black designs over heavy slip with clay body of sand and angular fragments with characteristic purple tint
Variations: None observed

WARE: Shinarump Gray

SERIES:

TYPE: Shinarump brown - 11 sherds

Clay: Compact fine (uneven fracture) matrix
Color: Dark Gray to red on black
Temper: Abundant white quartz sand with angular white fragments
Thickness: 5-8mm
Surface Finish: Roughly smoothed; overfired so temper protrudes
Recognition: Distinctive purple tinge with protruding temper
Variations: None observed

WARE: Moapa Gray

SERIES:

TYPE: Moapa black on gray (Dogoszhi style) - 1 sherd

Clay: Fine dense (uneven fracture) matrix
Color: White
Temper: Predominantly olivine sand
Thickness: 3mm
Surface Finish: Black mineral paint over interior crazed slip
Recognition: Distinctive olivine temper sherds with black paint on crazed white slip
Variations: Fugitive red exterior wash

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Discussion: Shinarump Brown and Virgin black on white are distinctive types. North Creek Gray is the predominant type recovered from the survey with North Creek corrugated--a variety of Tusayan corrugated and generally inseparable from it--and North Creek black on gray (possibly equivalent with Washington black on white) assigned as varieties of North Creek Gray. The clay and temper constitution of the varieties is nearly identical to the type and appears to vary only in surface manipulation. Bowls and wide-mouth jars are represented. Moapa black on gray is distinctive because of its pale green olivine temper, but is only represented by one sherd. Coombs Gray is that type defined at Coombs Village (Lister 1960) and generally resembles Emery/Sevier Gray. Because of the basalt tempering material in both types, Coombs Gray can easily be segregated by its different clay structure, crystalline basaltic temper, and lack of careful surface treatment. Bowls and wide-mouth jars are represented.

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FREMONT WARES

WARE: Utah Desert Gray

SERIES: Salt Lake

TYPE: Sevier/Emery Gray - 71 sherds

Clay: Fine grained (non-silty) matrix
Color: Light to dark gray
Temper: Angular to rounded dark gray (lithic) basalt with rounded quartz
Thickness: 4-8mm
Surface Finish: Smoothed and polished
Recognition: Thin gray sherds with basalt tempering
Variations: Fugitive red exterior wash; Sevier black on gray with brown/black organic paint - 1 sherd

WARE: Utah Desert Gray

SERIES: Snake Valley

TYPE: Snake Valley Gray - 30 sherds

Clay: Fine grained (silty) matrix
Color: Light to dark gray
Temper: Fine angular crushed quartz with biotite and muscovite
Thickness: 3-5mm
Surface Finish: Smoothed and polished
Recognition: Fine thin gray sherds with mica apparent on surfaces
Variations: Fugitive red exterior wash; Snake Valley black on gray with black mineral paint - 2 sherds (1 restorable bowl); Snake Valley corrugated with tool impressed polished corrugations - 1 sherd

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Discussion: No attempt was made to differentiate between Sevier and Emery Gray, as the primary typological difference is temper size (Madsen and Lindsay 1977:52), and such a differentiation would have served little purpose in this study. Two varieties of Snake Valley Gray, Snake Valley black on gray and Snake Valley corrugated are typologically Snake Valley sherds with added painting or corrugations. Unpainted body sherds from Snake Valley black on gray were considered as Snake Valley Gray.

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HOPI WARES

WARE: Jeddito Yellow

SERIES: Jeddito - 1 sherd

TYPE: Jeddito black on yellow

Clay: Fine hard (snap fracture) matrix
Color: Yellow
Temper: Sparse round quartz sand
Thickness: 4mm
Surface Finish: Smoothed and polished with dark brown mineral paint
Recognition: Distinctive brown paint on yellow/cream clay
Variations: None observed

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Discussion: A very distinctive yellow ceramic, but only one sherd was recovered from the survey area.

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SHOSHONEAN WARES

WARE:

SERIES

TYPE: Shoshonean Utility - 327 sherds

Clay: Sandy friable (earthenware fracture) matrix
Color: Brown to black
Temper: Sparse large non-quartz sand
Thickness: 6-8mm
Surface Finish: Wiped interior, manipulated exterior
Recognition: Distinctive coarse sherds with pinched and incised exterior
Variations: None observed

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Discussion: No ware category could be determined for the Shoshonean ceramics. Two vessels which appear to have been decorated over their entire exterior surfaces are represented. Both appear to have been open-mouth vessels with rounded bottoms.

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One partial vessel consisting of the neck and a portion of the body was recovered from the old wagon trail (42Ga1861), which goes to Hole in the Rock. This vessel is the only historic ceramic recovered from the survey. The vessel appears to have been a cream jar, and is an earthenware clay with distinctive brown "Albany" slip. The vessel could date from approximately 1850 to 1900 or perhaps slightly later.

Nine worked sherds (four of North Creek Gray and five of Coombs Gray) were recovered. In each case, the edge showed a rounded or ground appearance with a curvilinear orientation, but as only fragments were found, no statement concerning use is possible. One Tusayan black on red sherd was biconically drilled, possibly for the repair of a cracked wall.

The rationale for attempting to relate the ceramics recovered from the survey to existing typologies was to delineate cultural affiliation for those sites and a temporal span of site use. One difficulty immediately encountered in the attempt was the undated status of a number of the types represented in the collection. Additionally, many of the dated types have broad time spans associated with them (McFadden 1976) and so are of little utility in pinpointing sites as to their time of use. Only a few generalizations are possible concerning the time spans represented by the ceramics.

There is a general lack of recognizably early types in the collection; the majority of types fall in the general Pueblo II stage (A.D. 800-1100) with occasional sherds indicating an early Pueblo III affiliation (A.D. 1100-1150). The presence of a Pueblo IV sherd (Jeddito black on orange) at 42Ka1871 possibly indicates a sporadic post-abandonment Pueblo interest in the area (Lister 1964:62). Shoshonean plainware is undated, but its presence denotes a post-abandonment use of the area by non-Pueblo populations possibly until protohistoric times. The lack of Pueblo I and Late Pueblo III ceramics in the collections parallels Aiken's recognition of the general Pueblo II nature of the Virgin area (1966:4).

Determination of cultural affiliation by ceramic remains was feasible as the recognized types could generally be assigned to one of the three (Fremont, Virgin/Kayenta, Shoshonean) ceramic traditions present in the area. However, as no systematic collection procedure was utilized to recover the samples, it was impossible to accurately determine the relative percentages of the culturally diagnostic wares on any one site, and therefore determine which wares are intrusive. Of the 87 collected sites, 52 (60%) have only Virgin/Kayenta sherds in association, while 14 (16%) have both Virgin/Kayenta and Fremont ceramics. Some ten sites (11%) have only Fremont ceramics, while two sites (2%) have both Fremont and Shoshonean ceramics. Combining these figures, 76% shows Virgin/Kayenta affiliation, while 30% shows Fremont influence. The remaining sites exhibit ceramics of varied affiliation, including Shoshonean (3), Historic (1), Hopi (1), and unknown (4).

Isolated ceramic finds also exhibited the priority of Virgin/Kayenta ceramics, with five of the six isolated occurrences being Virgin/Kayenta, and the sixth containing Fremont ceramics.

The identity of the Virgin cultural division as a separate entity from the Kayenta Anasazi to the south has been discussed by Aikens (1966), and the viewpoint taken in regard to the ceramic analysis is that--

in the time frame delineated by the ceramics--the Virgin can be considered a distinct cultural grouping. Thus, in most cases, Kayenta wares can be differentiated from those of the Virgin area. However, the utility of considering the presence of these Kayenta wares as indicative of Kayenta occupation per se, cannot be substantiated strictly on the basis of the homogeneity of these two groups. This influence in Pueblo II times may reflect an economic social relationship based upon trade rather than settlement. Therefore, the presence of these Kayenta wares in Virgin sites indicates this continued interaction between the two groups, but not necessarily the occurrence of Kayenta settlements.

A significant percentage (16%) of the Desert Gray ware ceramics of Fremont affiliation in association with Virgin/Kayenta wares could be interpreted as coresidency of these sites (not necessarily at the same time), but the preponderance of Virgin/Kayenta sherds in relation to only limited numbers of Fremont ceramics is parsimoniously explained by trade with adjacent Fremont populations (Lister 1964:65). The presence of Fremont ceramics without Virgin/Kayenta associations or in association with later Shoshonean occupations (12%), however, does indicate the possibility that Fremont occupation, adjacent to, and possibly even earlier than Pueblo sites, did occur (Lister 1964:65).

As previously discussed, the nature of the survey and collection techniques precludes any firm statement to the relationship of these sites containing both Fremont and Virgin/Kayenta ceramics, but the supporting evidence indicates the area as being predominantly Virgin/Kayenta with Fremont trade wares and occasional Fremont affiliated sites. Intensive site evaluations utilizing standardized collection procedures and test excavations oriented to this problem will be required to evaluate the exact nature of Fremont and Virgin/Kayenta interaction.

Artifact Evaluation

Field research in the Southern Coal Project resulted in a reevaluation of the projectile point typology being employed by AERC in assessing cultural affiliation. At first, those projectile points or blades which were considered to be of Kayenta manufacture consisted solely of the concave base triangular blade/point which has been identified in various Kayenta sites in direct association with Kayenta-Pueblo II ceramics (cf Beals et al 1945:199; Lister et al 1960:Figure 67a, b, c; Sharrock 1964:Figure 50l, m; Lipe et al 1960:Figure 43j, k, m; Gunnerson 1959:Figure 36a; Weller 1959:Figure 19h, i, j, k; and Suhm 1959:Figure 7c, 21x). This style of point has been given the name, "Bull Creek," by Dennis Weder of AERC, who found specimens in both Fremont and Kayenta cultural contexts in the Bull Creek excavations near Henry Mountains. These excavations were conducted by the University of Utah during the 1976-1977 seasons. This type has also been found in Fremont associations at the Poplar Knob and Old Woman Sites as reported by Taylor (1957:Figure 25g, h, i, j, k, and Figure 34c, d, e, f, and g).

AERC's initial categorization of points collected in the Southern Coal Project was based on the general Archaic, Anasazi, Fremont, and Shoshonean types which are applicable in the eastern Great Basin area. This orientation is partially apparent in the layout and description of lithics provided in Part C of this chapter.

Lithic types associated with Kayenta occupations in the project areas were finally identified through combining sketches of lithics with identified ceramics found at each collected site. This association of data not only permitted an identification of typical Pueblo II lithics, but resulted in a definite reorientation of AERC's procedures for lithic analysis.

Figure 4-57 demonstrates the six different projectile point styles that were repeatedly found in association with Kayenta-Virgin ceramics. These styles include the elongated, rounded, proximally oriented tang stemmed point shown in Figure 4-57a. Other styles are a broad base arrow point (Figure 4-57c); a square shouldered, stemmed style (Figure 4-57d); the straight versus concave base point and small blades as shown in Figure 4-57e, f, and g; and the eared point style with or without serration and tangs (Figure 4-57h and i). This last style was found in twelve separate cultural associations which included various P-II ceramics (42Ga1652, 1682, and 42Ka1883). Lithic associations include the small triangular straight base points (42Ga1693), the elongated point style shown in 4-57a (42Ka1895), the broad stemmed arrow point style (42Ga1664, 42Ka1883, and 1915), and the stemmed point represented in Figure 4-57d (42Ga1656). Pottery found in association with this eared style include Tusayan Gray wares, Sosi black on white, and Virgin black on white.

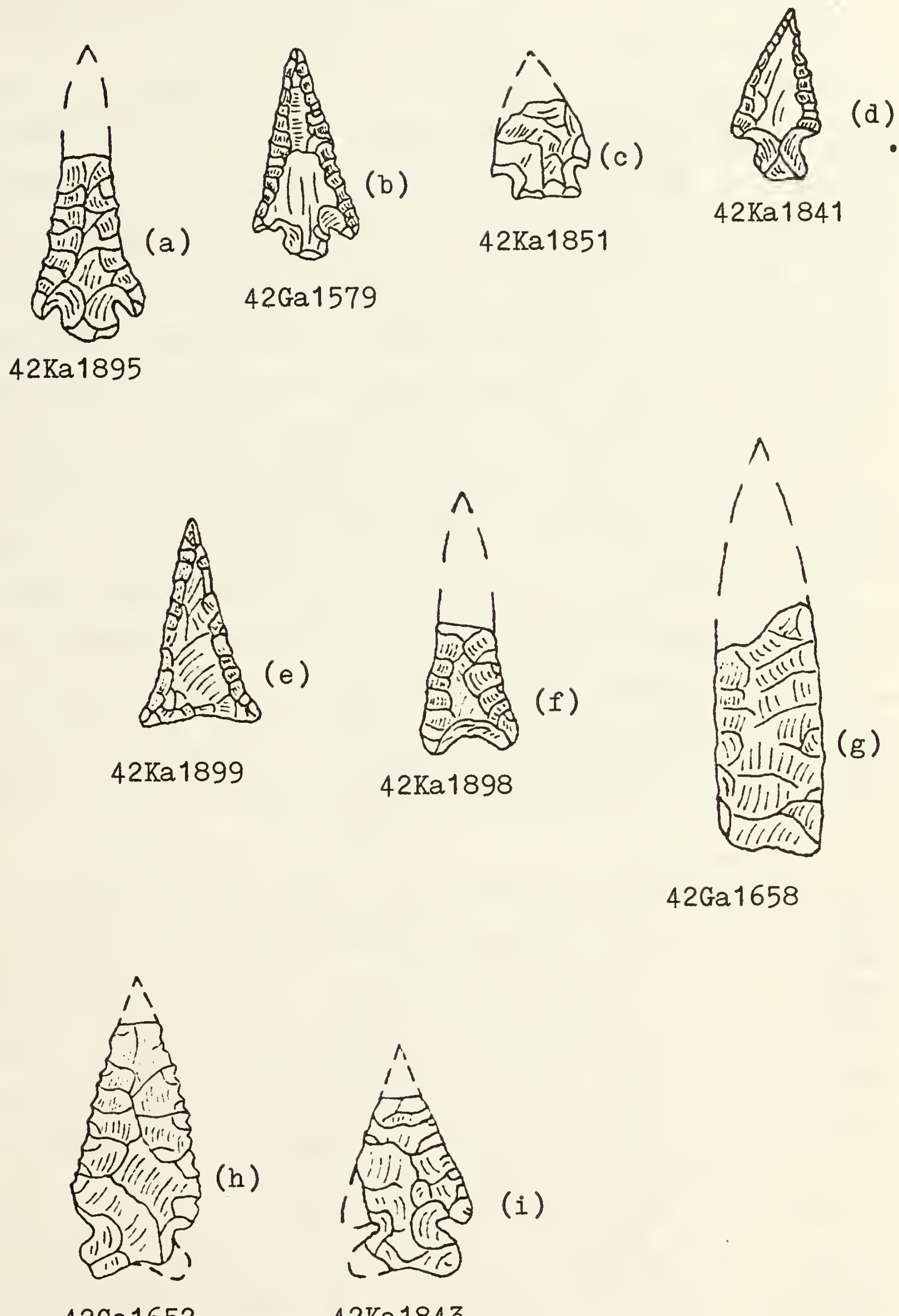
In addition, the possible point shown in Figure 4-55d may actually represent a combination of the elko eared style of base (Figure 4-57h and i) with the elongated, medially thinned, rounded base style portrayed in Figure 4-57a.

Artifacts similar to some of the eight point styles shown in Figure 4-57 have been found at numerous Kayenta sites in south-central Utah; hence, a Kayenta association appears most plausible. These styles are similar to others recorded in the area by the following researchers:

4-57a and b:	Sharrock et al 1961:Figure 841; Sharrock 1964; Figure 50a; Gunnerson 1959:Figure 36i, j, k; Weller 1959:Figure 17f, g; and Suhm 1959:8f and 21e, f, g, and h;
4-57d:	Lipe et al 1960:Figure 43a, b, c; and Weller 1959:Figure 17k;
4-57h and i:	Sharrock et al 1961:Figure 84h; Lister

Figure 4-57

(ACTUAL SIZE)



et al 1960:Figure 67g; Lipe et al 1960:Figure 43h; Gunnerson 1959:37i; Fowler 1959:Figure 2a, c; Suhm 1959: Figure 9b, and 22c.

The survey provided a number of Gypsum style points/ knives which generally indicate a Fremont or Late Archaic occupation. Several factors can be stated concerning associations of this style with other diagnostic artifacts. Gypsum points were found at sites 42Ga1649, 1745, 1751, 1774, 1780, and 42In439 in association with other point style and ceramics. Different ceramic types include Coombs Gray (42Ga1745), Fremont Sevier Gray (42In439), and Shoshonean utility ware (42Ga1751). As a means of further comparison, all the lithics collected from 42In439 are represented in Figure 4-58. Diagnostic point types associated with the Gypsum at these six sites include an Early Archaic Lake Mojave point (42In439) which is shown in Figure 4-10a; a possible Middle Archaic Sudden Side Notched point (42Ga1780) as shown in Figure 4-12a; a variety of small, stemmed arrow points (cf Figure 4-39e and Figures 4-41a through e) which have now been found in both Fremont and Kayenta cultural associations; and at site 42Ga1649, the elongated style point (see Figure 4-40b) which is possibly associated with the Kayenta occupation of the project area. The heavy concentration of Gypsum points at a definite Fremont site (42In439) and the general paucity of both Gypsum and Parowan points in the heavily occupied Escalante-Kaiparowits localities signal the good possibility that the Kayenta peoples did not actively incorporate these styles into their tool kit. Additional research into this relationship should be initiated before a final statement can be made, however.

The paucity of Archaic and Paleo Indian sites in the project area has been commented on elsewhere (e.g. Jennings 1966:56). The number of points or knives which on first examination appear to have Archaic characteristics but were actually recovered from Post Archaic Anasazi contexts is striking.

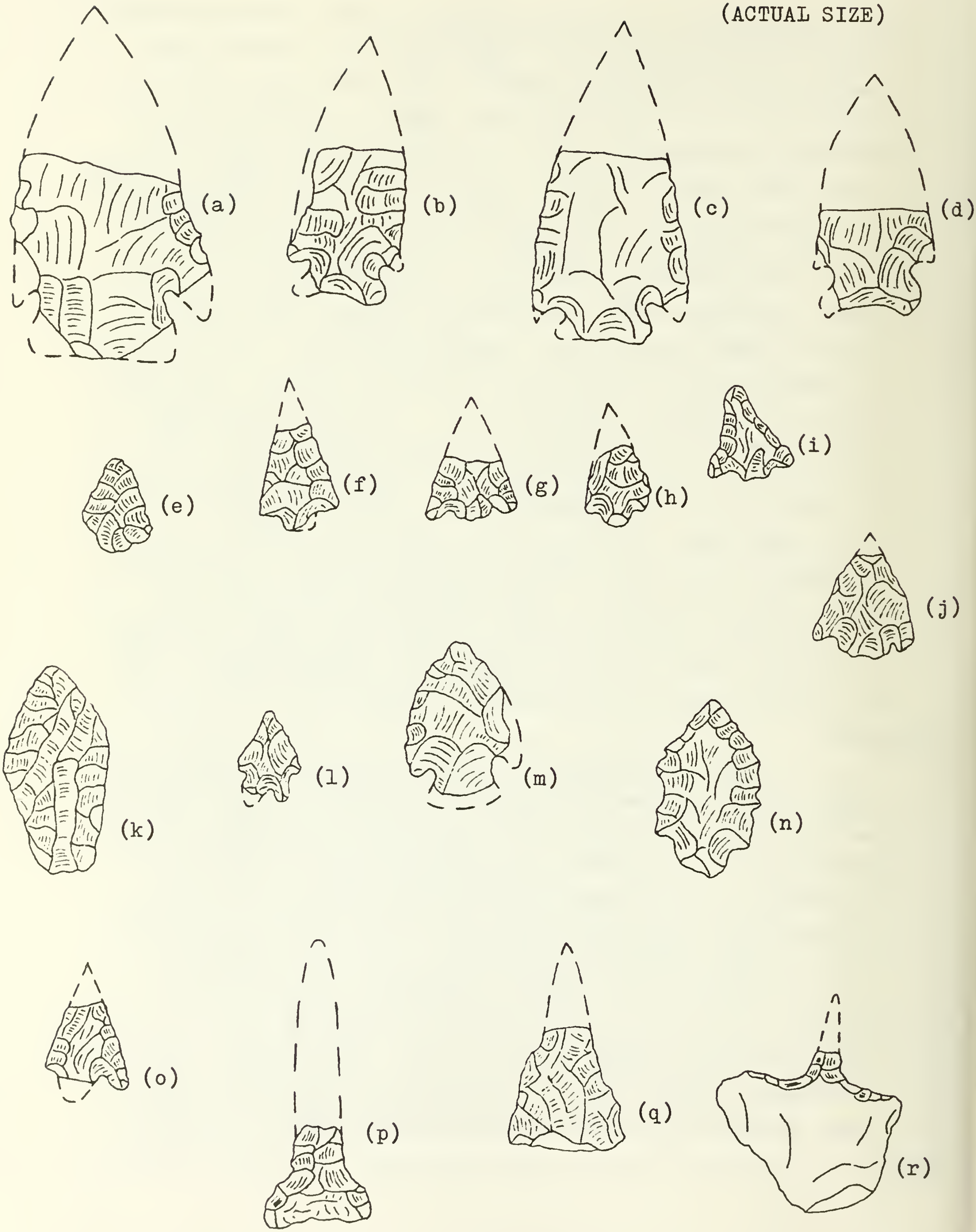
Three explanations can be provided. The area had significant Archaic occupation and many of their lithics are now being found in multi-component contexts. Possibly, as a second explanation, the Pueblo II peoples heavily manufactured and utilized a variety of large corner notched and side notched tools. This Kayenta-Virgin tool category is now being confused as having an Archaic origin because of its basic similarities with such styles as the Hawken, Sudden, Bitterroot, and San Rafael Side Notched points found to the northeast of the SCP area. The side notched arrow points of the contemporary Pueblo II Mesa Verde Anasazi demonstrate an innovation which was heavily in use on the east drainage of the Colorado, but was not demonstrated within the SCP collection and is only rarely found in the western drainages of the Colorado (cf Sharrock et al 1961:Figure 84j; Sharrock 1964:Figure 50b, c; and Sharrock et al 1963:Figure 69m). One would assume that if the Mesa Verde Pueblo II side notch was a stimulus to increased Kayenta side notch utilization, that the Kayenta would have initiated it in the preparation of projectile points as well as large knives. Hence, Mesa Verde stimulus of the side notch cannot be adequately demonstrated nor can the idea of exclusive Kayenta P-II manufacture of the large tools.

The third explanation for the frequent occurrence of large side and corner notched tools on Kayenta sites, and the most plausible, consists of a compromise between the other two explanations given above. The Kayenta-Virgin peoples, like the Fremont, made these tools for specific uses but the similarity between their styles and those which could have been of Archaic period manufacture is so close that it is nearly impossible to identify an Archaic component in a Kayenta site context without the additional aid of excavation and/or definite Archaic points, e.g., a Lake Mojave. Therefore, infrequent Archaic period or Basketmaker II and III tools are being masked by the similar and more numerous P-II tools.

42In439

Figure 4-58

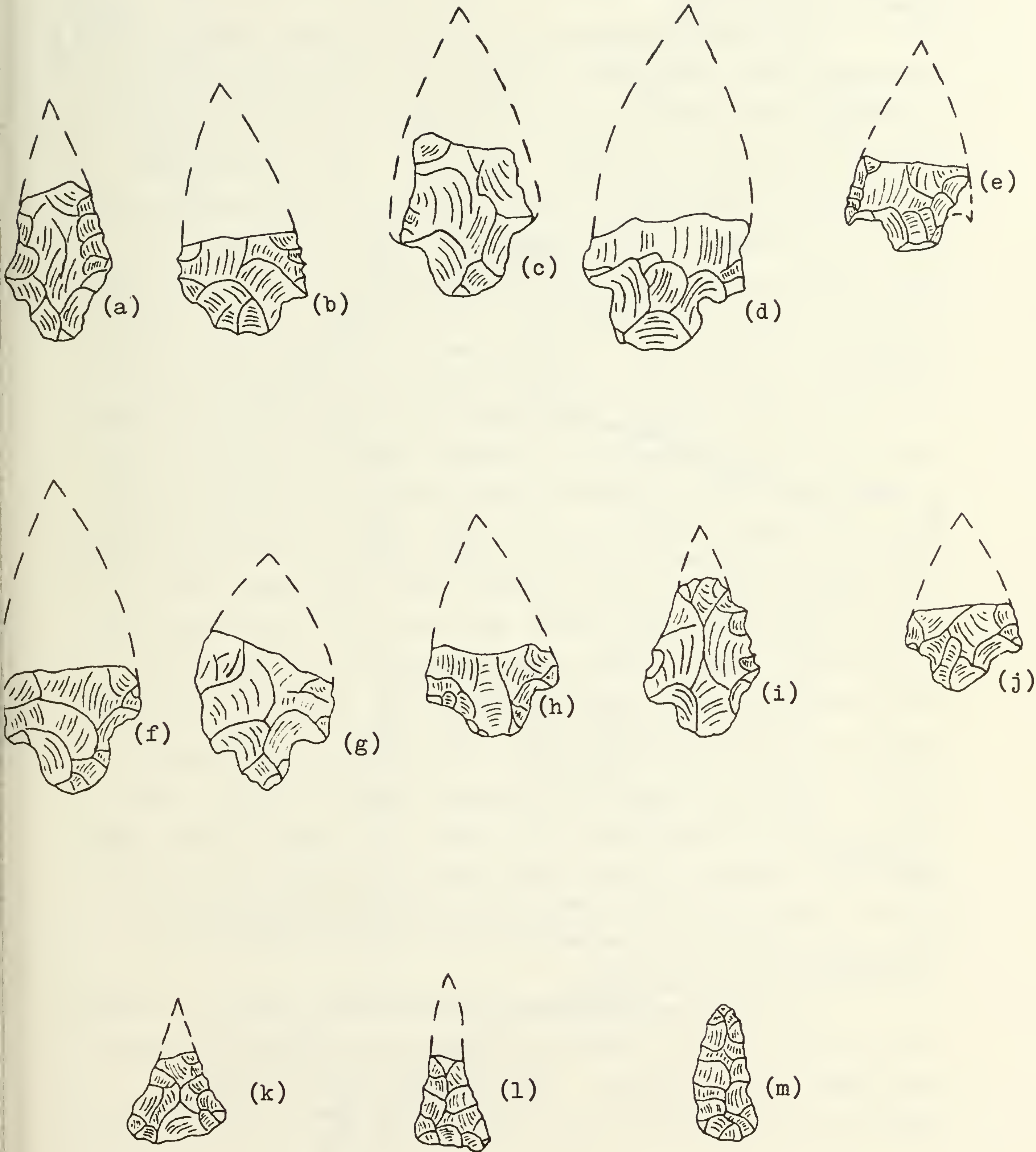
(ACTUAL SIZE)



42In439

Figure 4-58
(Cont.)

(ACTUAL SIZE)

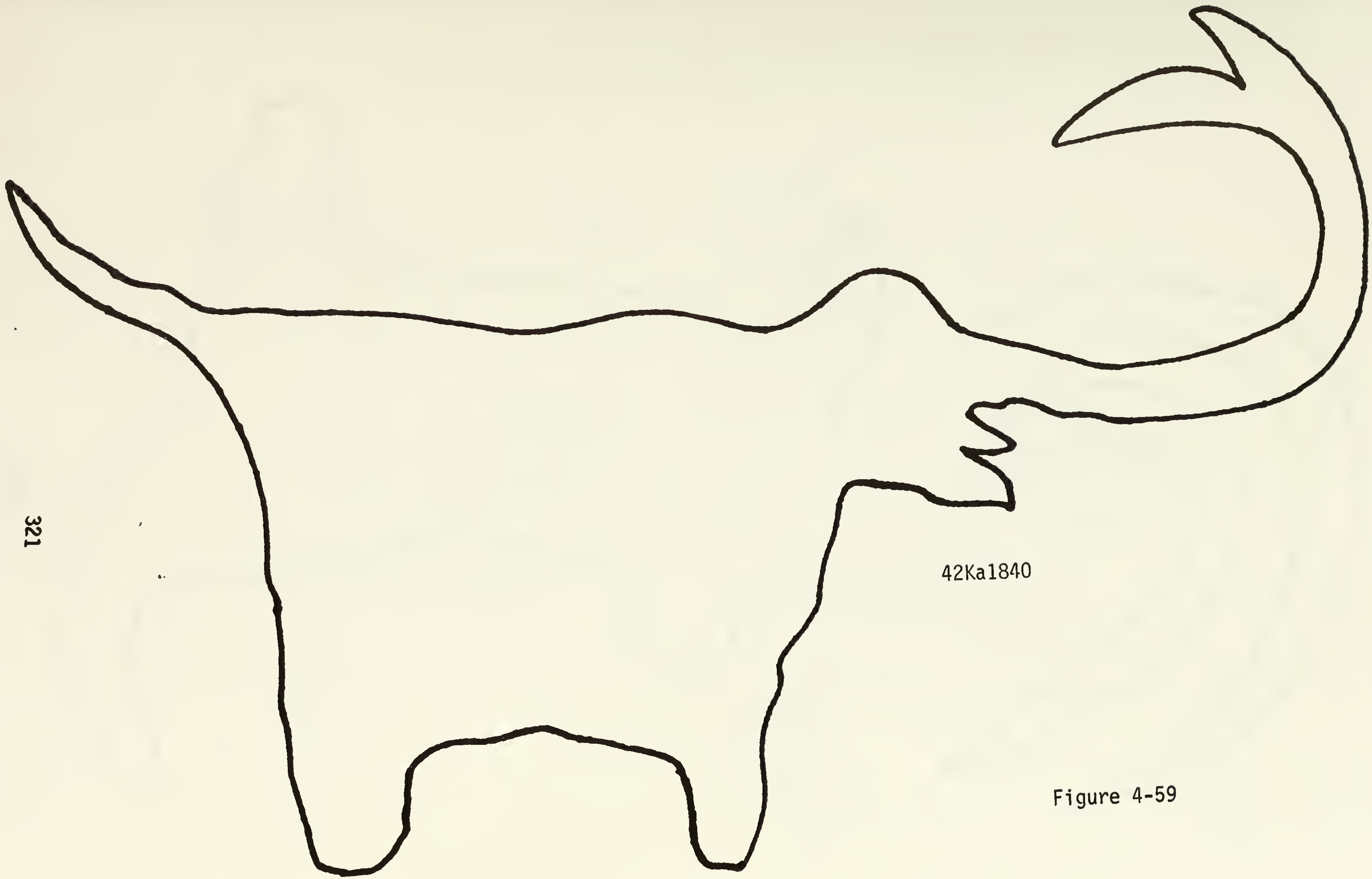


This third explanation appears to have the most merit and provides the archeologist with the conceptual basis from which suitable research designs can be constructed to shed additional light on the problem.

No portable Paleo-Indian artifacts were observed or collected during the survey; however, two possible mammoth pictographs were observed at pictograph sites 42Ka1840 and 1843. These sites are situated in Willow Gulch between the Escalante River and Fifty Mile Mountain. The pictures were sketched and photographed during the survey and representations have been provided in this report in Figures 4-59 and 4-60. Both symbols are situated on petroglyph panels found less than a half mile apart and both have been weathered but are still fairly well discernible. In each case, the tusks, knob on the top of the head, and tail are well defined and identifiable.

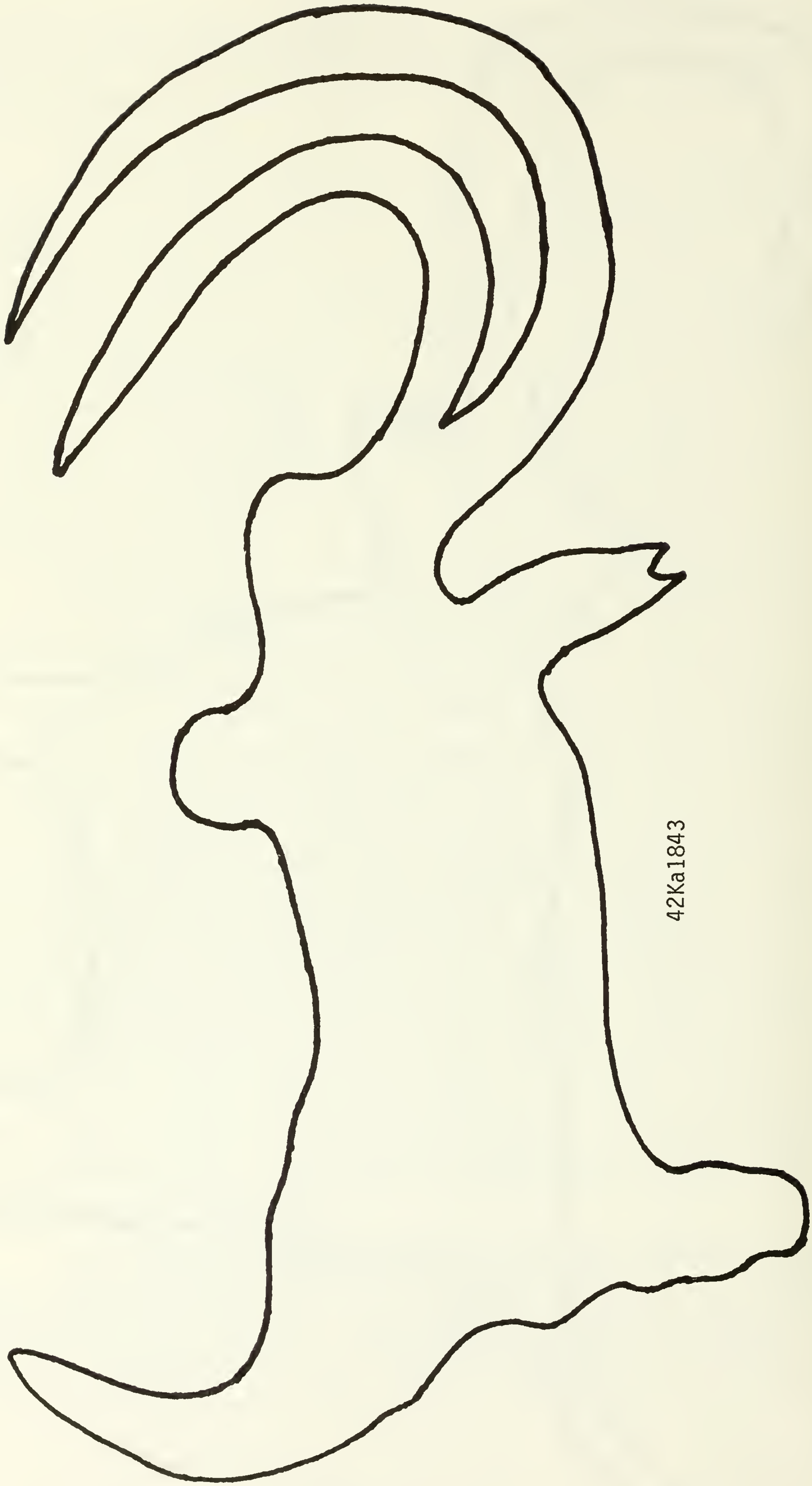
The occurrence of a Lake Mojave point in Iron County (42In439) is of interest. Two similar points were also found on the surface in Iron County near Lund, Utah (cf Keller and Hunt 1967:Figure 2c and d). All three points were recovered within a 15 mile radius and are identical with the Lake Mojave range of variation recorded farther west (see Tuohy 1969). A fourth Lake Mojave point which is similar to these three was recovered by Hauck in 1976 from southeastern Utah near the Woodenshoe Buttes and will be reported on separately in AERC Paper No. 4 which outlines AERC's 1976 and 1977 seasons in San Juan County. The occurrence of four known Lake Mojave points in southern Utah at elevations varying from ca. 5000 feet at Lund to 6200 feet at the SCP site in Iron County, and 8200 foot elevation in San Juan County indicates not only the spatial range involved in this Early Archaic manifestation, but demonstrates the diversity of environments which were apparently being utilized.

The sparse occupancy of Basketmaker peoples in south-central Utah has been recorded on both the eastern and western drainages of the Colorado. Basketmaker II sites dating between ca. A.D. 200 and 300 have been located in the Red Rock



42Ka1840

Figure 4-59

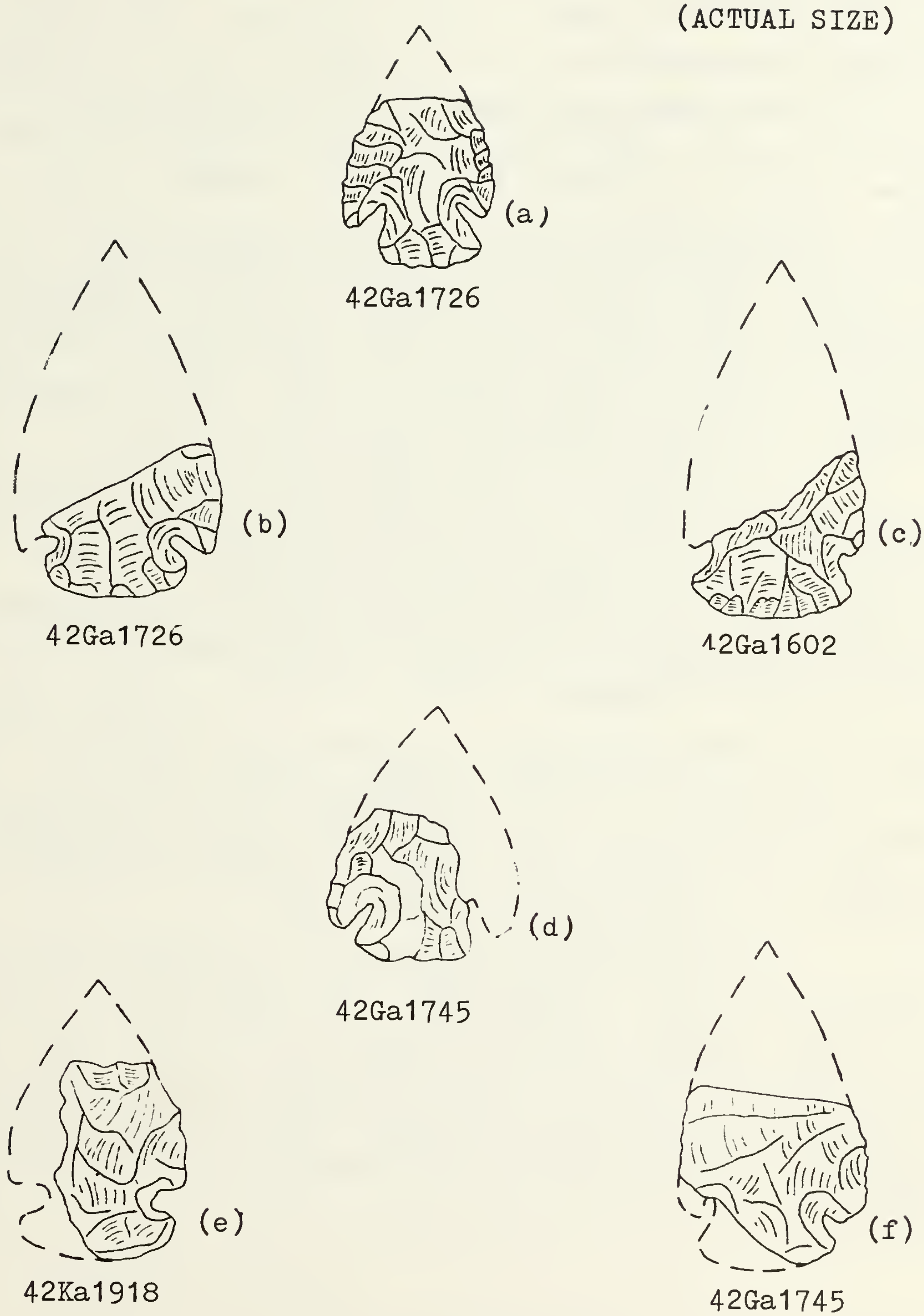


42Ka1843

Figure 4-60

Figure 4-61

(ACTUAL SIZE)



Plateau on the east side of the Colorado. These occupations centered around Moqui Canyon and Castle Wash have been ascribed to a brief White Dog phase by Lipe (1970:93). This short occupancy was characterized by an "apparent partial dependence . . . on food collecting (which) implies that a fair part of their time was spent in mobile hunting and/or gathering groups" (Lipe 1970:104). The apparent cultural hiatus on the Red Rock Plateau after the White Dog phase between ca. A.D. 300 and the late Eleventh Century appears to have its corollary in the south-central region of Utah. Evidences of Basketmaker habitation on the western drainages of the Colorado indicate a sparse, brief occupation period and a subsequent reduction of cultural activity until ca. A.D. 1050.

Basketmaker II occupations have been demonstrated at Cave DuPont located about eight miles northwest of Kanab in Cave Lake Canyon (Nusbaum 1922) and near Boulder at the Image Cave site. Steward's 1941 report also indicates possible Basketmaker II occupation in the Vermilion Cliffs area northeast of Kanab.

A few points which morphologically resemble BM-II points recovered in San Juan County of Utah, from sites near Durango, Colorado, and from Basketmaker sites in northern Arizona were collected during the SCP survey. Representations of these points are shown in Figure 4-61.

No identifiable Basketmaker III points were recovered during the survey. A Basketmaker III occupation in Cottonwood Wash (LaMar Lindsay, personal communication) near Kanab suggests the potential for limited BM III activity in the study area. No identifiable Lino Gray or Kana'a Gray ceramics related to Basketmaker III and Pueblo I cultures were collected during the survey.

Chapter 5

RECOMMENDATIONS FOR FUTURE RESEARCH

PART A: CULTURAL DATA GAPS

The data gaps apparent to the researchers as a result of the Southern Coal Project can be best presented through comparison with those gaps outlined for the Central Coal Project (Hauck et al 1977). First, the total lack of definite Paleo Indian remains (the possibly proboscidian petroglyphs are merely suggestive) in the SCP parallels the situation of the CCP. Sufficient artifacts have been found to indicate a probable, albeit sparse, presence in the state, but it is felt that the very sparseness of those materials precludes their discovery by any sampling stratum that does not delineate the cultural and environmental parameters known to be associated with early megafauna hunters.

In their work in the Rio Grande Valley of New Mexico, Judge and Dawson (1972) have been able to delineate the environmental parameters for Paleo Indian site location as well as make statements on the cultural aspects of scheduling. Under a similar methodology, large areas of Utah could also be examined for such activity. It is apparent that until such programs are undertaken, the data gaps concerning the Paleo Indian stage of cultural activity in the area will remain. It is entirely possible that the isolated occurrences of diagnostic artifacts of Paleo Indian manufacture are merely of heirloom status and not indicative of a detailed Paleo Indian presence in Utah; however, neither possibility can be tested under the current evaluation system.

The lack of multiple habitations in the CCP survey was attributed in part to the sampling design developed by the BLM and the USFS and implemented in the survey (Hauck et al 1977:352). Utilization of identical procedures for the SCP, however, did recover multiple habitation sites in some quantity. Exploration of the data discrepancy between the two areas indicates that the contributing factor in determining the presence or absence of multiple habitation sites--commonly assumed to indicate horticultural activity--is environmental and that the determination varies as to the horticultural group involved.

Figure 5-1 plots the known Fremont utilization in the Central Coal Project area. Figure 5-2 is a similar plot of the Virgin/Kayenta utilization of the Southern Coal Project area. It is readily apparent that the primary Fremont activity is river drainage oriented; the drainages of Muddy Creek, Ferron Creek, Bull Creek and the Upper Green River all show concentrated site distributions, many of which are multiple habitations. On the comparable SCP map, the known Anasazi habitation pattern is predominantly away from the major drainages and is primarily elevation oriented, especially toward the well watered Kaiparowits Plateau. Thus the SCP survey recorded significant numbers of multiple habitation sites because the sampling stratum structure based on vegetational parameters, specifically pinyon-juniper, parallels the Anasazi preference for high elevation pinyon-juniper horticultural locations. The failure of that sampling procedure to locate multiple habitations in the predominantly Fremont CCP area indicates, and the proposal deserves consideration, that differing procedures are called for in evaluation of differing cultural groups.

The lack of a substantial data base for sites whose value is less than Historic Register status, as delineated in the CCP report, continues to be a problem in the evaluation of those sites in the field and in analysis. Additionally, the lack of substantive field procedures for the identification and evaluation of historic sites is in need of development. Archeological procedures are useful in the recovery and recording of these sites, but the general lack of familiarity by prehistoric

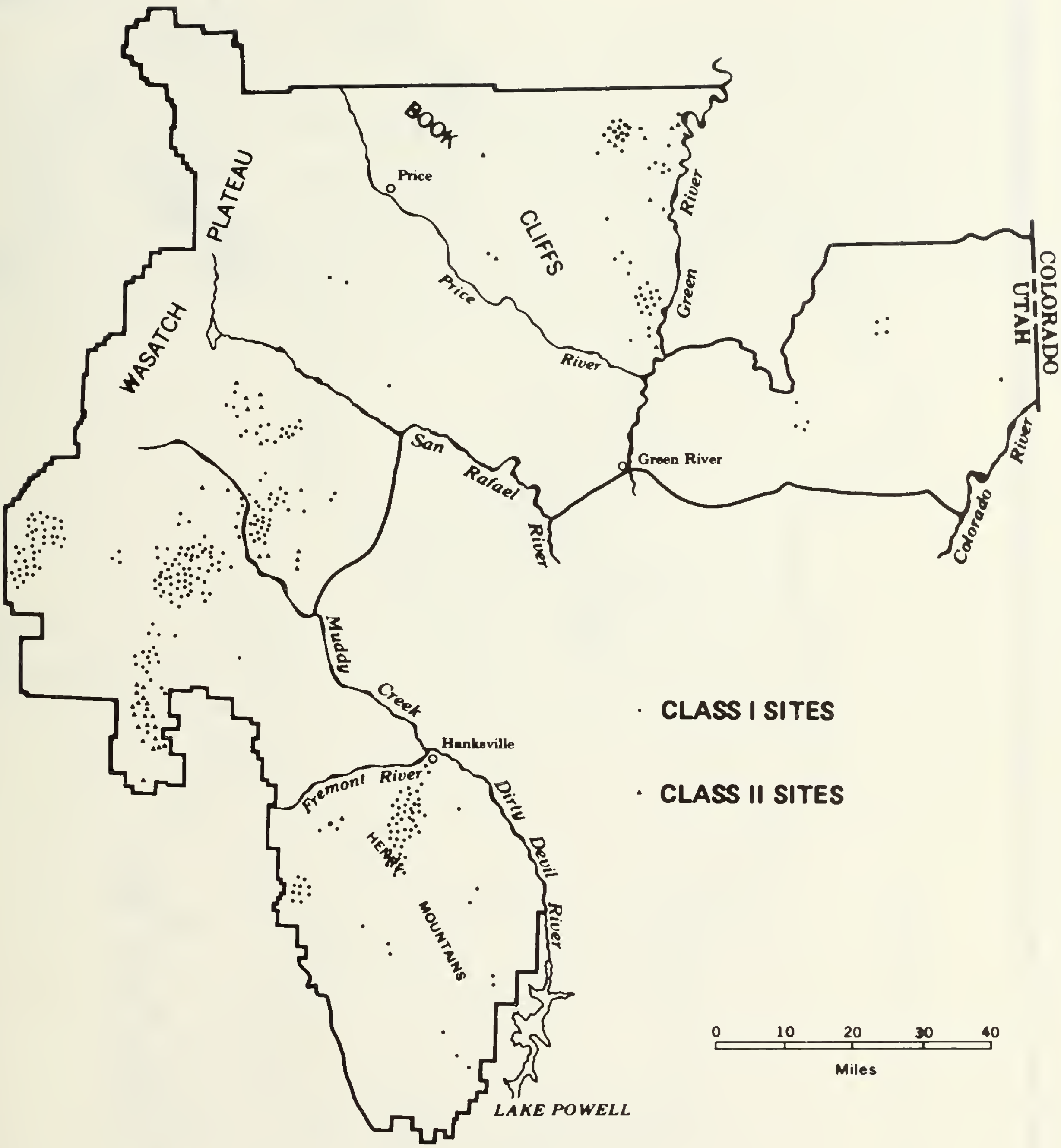


FIG. 5-1

Project area map showing major topographic features and Fremont site locations

KAYENTA·ANASAZI SITE LOCATIONS

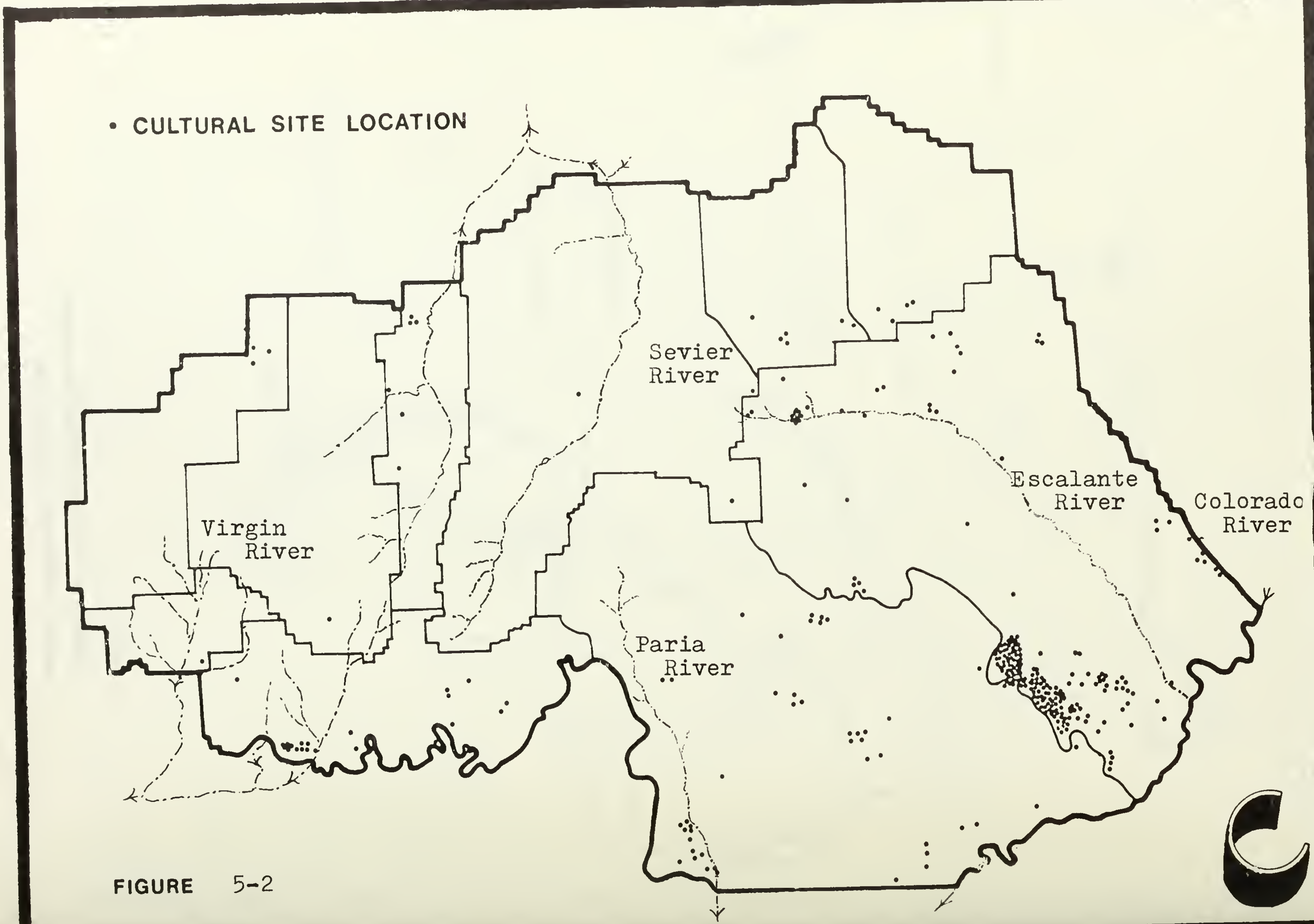


FIGURE 5-2

oriented archeologists with temporal diagnostics of historic sites necessarily reduces the information potential of those sites.

An additional data gap related primarily to the SCP is the biased nature of the sample area designations as they were initially delineated by the Forest Service related to coal presence. The survey failed to adequately sample, within the one percent strategy, the full range of ecosystems, elevations, and rainfall isohyets of the entire project area. Thus, any statement of general area-wide use is limited.

PART B: AERC'S RECOMMENDATIONS

As has been suggested in Part A of this chapter, the sampling procedure's inadequate accounting of differing cultural-environmental adaptive strategies can be attributed to its generalized emphasis on vegetation. However, the data collected through the RG-II survey and the supplementary RG-I data research project do provide a basis for developing recommendations for future research in the project area.

The recognition of resolvable problems in the prehistory of the area has been an important result of AERC's participation in this project. Research approaches for dealing with these cultural-spatial problems can be divided into two major thrusts, one dealing with improvement of the sampling procedures and the other with specific problems to be approached.

Improvement of sampling procedures has already been discussed at length. In general, it can be said that broadly based designs are generally inadequate for dealing with specific problems of cultural or environmental differences. Thus, structuring of the design beforehand to answer specific problems is necessary unless a complete (approaching 100%) sample is proposed. Even if problem oriented, the sample at a 1% level can be criticized as being below the level of confidence for developing any statements, as well as for establishing a data base. It is recommended that in future sample surveys, one or more problem oriented research designs be utilized as guides in structuring any given project.

The second area of recommendations is an outgrowth of recognition, in the field and in laboratory analyses, of specific problems that should be scrutinized in planning any future work in the area. The problems of Paleo Indian activity zones and differing Pueblo-Fremont horticultural use have been previously noted. Additional problems that should bear scrutiny are summarized below.

Lister (1964) stated a major problem related to the extent and nature of Anasazi-Fremont interaction in the Kaiparowits Plateau region. Sufficient data to make substantive comments on her statement were not developed during the Class II survey, although additional information on the problem was obtained. It is felt that a summary of all archeological work performed in the Kaiparowits area should be undertaken with the nature of Anasazi-Fremont interaction in mind. Once definitive correlations concerning these interactions are developed, testing of those hypotheses on existing or future data could be undertaken.

A second research problem that appears to be feasible in the area is delineation of the spatial relationship between the White Dog (Basketmaker II) phase of the Anasazi and the following Basketmaker II and Pueblo I phases (Lipe 1970). The general lack of recorded Basketmaker III sites in the Glen Canyon as well as in the SCP area indicates some change of emphasis in resource utilization by that cultural group. Aikens (1966) postulates continued habitation of the Virgin-Kayenta region by Basketmaker II oriented horticulturalists until the Pueblo II period, but clear evidence of those peoples is not apparent in previous research, including our own. The resolution of this multifaceted problem of cultural growth in the project area should be the basis of an ongoing research design utilized by all archeologists working in the area.

The extreme diversification of ceramics and the correlations between lithic types and those ceramics is a pressing problem. Technological diversification implies social diversification and material remains indicate a non-homogenous population or set of populations without strong socio-political control and devoid of extensive cultural contact. The delineation of these populations and the means of field recognition of the diagnostic artifacts for each group demands prompt attention.

Two final research problems relate to topographic and geomorphic factors. Two geomorphic features have been less than satisfactorily assessed in the survey. Mountainous terrain rising above the pinyon-juniper ecozone has proved most difficult to survey because of inaccessibility and excessive ground cover. The second feature which complicates an adequate field survey is the alluvial depth on flats and meadows. Surface surveys on these features rarely recover sites, but the presence of adjacent sites on ridges and terraces and the ever present probability of past alluvial deposition masking earlier cultural features indicates a potential loss of information. Both high altitude terrain and alluvial flats should be evaluated through special research designs which could provide the archeologist with the bases for better understanding how to determine the cultural resource potential and presence in these difficult types of terrain.

GLOSSARY

Aeolian Deposit - An accumulation of organic or inorganic material deposited by wind action.

Alcove - A niche or arched opening in a cliff that can function as a shelter.

Alluvial (Alluvium) Deposit - An accumulation of organic or inorganic material deposited by water action on or at the base of a slope.

Artifact - A single, portable man-made or man-altered object; usually culturally diagnostic.

Bedrock - Solid rock surface exposed by erosion and/or removal of all upper strata.

Bench - An elevated flatland (very large terrace) of ground or rock with a steep slope at the back.

Burial - Cemetery or disturbed interment in a shallow hole or in a rock cleft.

Ceremonial Site - A site exhibiting multiple dwelling structures of religious function characterized by religious art and/or kivas.

Cist - Storage pit in the ground usually lined with rock slabs.

Colluvial (Colluvium) Deposit - Rock detritus accumulated on or at the base of a slope.

Cove - Flatland within a "U" shaped hill or cliff formation.

Cultural Resources - Physical remains of human activity over fifty years old.

Desert Pavement - Hardpan floor of desert.

Drainage Channel - Seasonal wash or river bed.

Extended Camp - A non-architectural site of varying size, exhibiting hearths or fire pits; ceramics; lithic and grinding tools, especially non-transportable materials.

Historic Site - A site exhibiting artifacts that post-date the first Mormon settlements in Utah in 1847.

Hunting Site - A location characterized by projectile points or point fragments only.

Kill-butchering Site - A location with points or point fragments and knives, choppers and/or scrapers.

A location characterized by the predominance of butchering tools, including knives, choppers, utilized flakes and/or scrapers.

Lithic Scatter Site - Characterized by the presence of flaked tools, chips, cores, or flakes only.

Multiple Habitation - Multiple structures that would accommodate more than one family.

Petroglyph - Figures, symbols, or scenes pecked or etched in rock.

Pictograph - Figures, symbols, or scenes painted on rock.

Plateau or Mesa Top - A raised flat or level summit.

Playa - Flat desert floor area that does not drain; a dry lake bed.

Prehistoric Site - A site dating from any time prior to contact with Europeans or their descendants.

Protohistoric Site - A site exhibiting both prehistoric artifact types and European artifact types acquired through trade.

Quarry Site - A lithic mine showing presence of hammer-stones, flakes, cores, and unfinished tools.

Residual Soil - Residue from extensive erosion action.

Ridge - Line along the top of a range of hills between the sloping sides.

Rim - The outer edge of a ridge, ledge, or plateau.

Rock Shelter - A small or large rock overhang used as a protective dwelling; characterized by the presence of artifacts and smoke-blackened rock overhang.

Saddle - The extended depression of a ridge between two higher points along the ridge.

Seep - An area of subsurface drainage from porous soil, rocks, or cracks.

Single Habitation - Small structure such as a pithouse that would accommodate a single family.

Site - Locus of human activity identified by a minimum of four flakes within a five meter radius, from documents or by archeological techniques.

Storage Shelter - Usually a small uninhabitable shelter with basketry or pottery, grinding tools, and food remnants.

Surround - An enclosure or barricade for capturing game animals.

Temporary Camp - A small site exhibiting no architecture; characterized by a hearth or fire pit, lithic and small grinding tools, and ceramics.

Terrace - A flat narrow shelf of ground or rock extending along a slope; especially a former shoreline of a river or lake.

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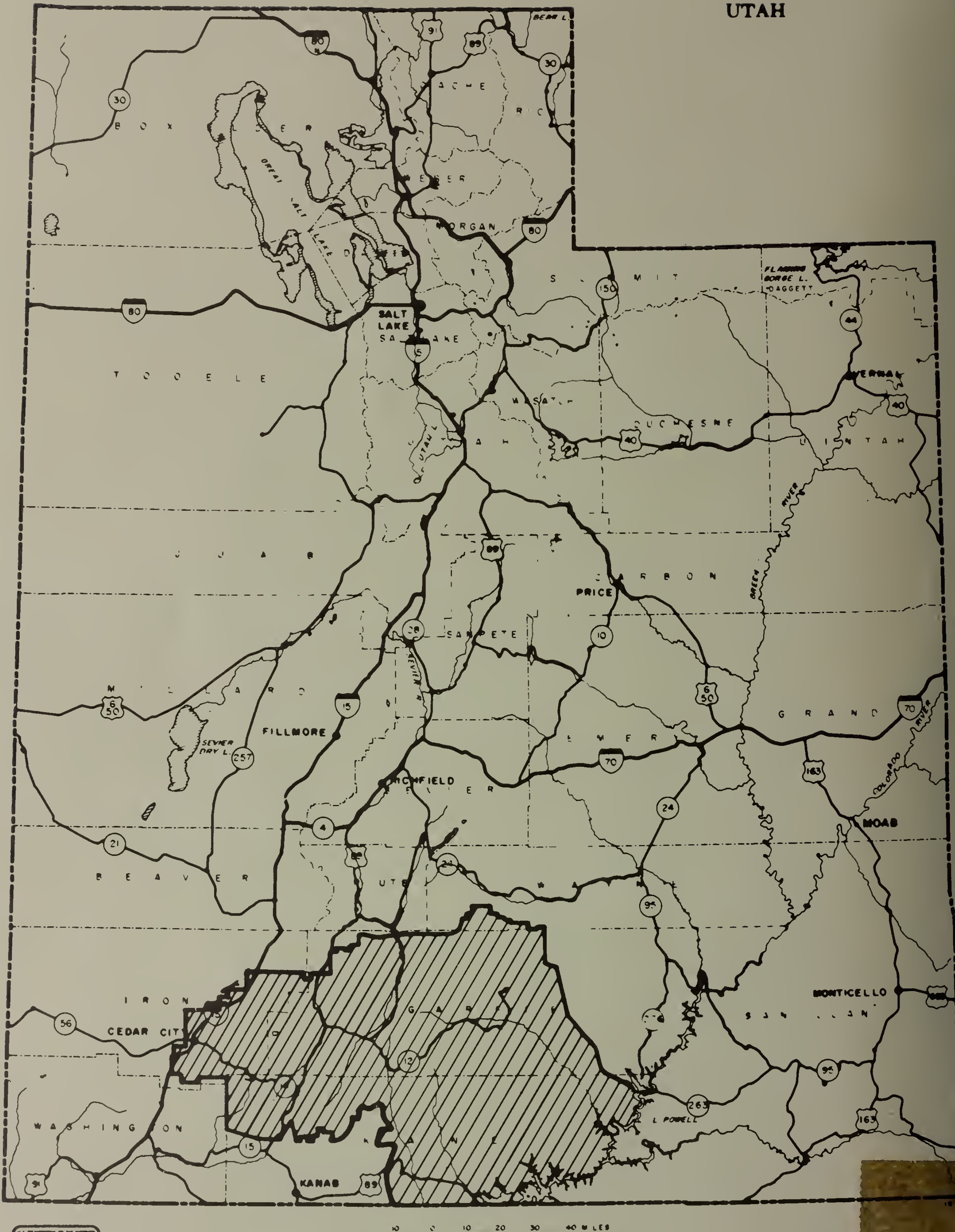

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