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APPENDIX C

TABLE OF CONTENTS

WYOMING
ARCHAEOLOGICAL SOCIETY, INC.

February, 1980

Fellow Members:

Arrangements for the State Meeting in April, are progressing nicely, and I have additional information to pass along.

First, we have a Chairman for the Credentials Committee. Please, send the names of your voting delegates and alternates to: Gerald Carbone, P. O. Box 338, Sheridan, Wyoming, 82801. By sending the names of your selections beforehand, some of the problems may be eliminated.

Friday evening, April 25, the pre-meeting will be held at the Sheridan College. Pre-registration will be from 6:00 p.m. to 7:00 p.m., with the meeting to follow.

Saturday, April 26, we will meet at the College again. Registration will be from 8:00 a.m. to 10:00 a.m. Following the Business Meeting, Dr. Chuck Reher will present his students with their papers. As soon as the information is available, the topics will be furnished to each Chapter.

Saturday evening, 7:00 p.m., the banquet will be held at the Sheridan Center. Our own Dr. George Frison will be the Guest Speaker, and I'm certain that he will have an extremely interesting presentation. The buffet will be Baron of Beef, plus two other meats. The price for the banquet is $6.50, and registration is $2.50, for a total of $9.00. These prices are somewhat less than what is available in Casper, and a most welcome surprise.

Sunday morning, 9:30 a.m., the Wyoming Archaeological Foundation Meeting will be held at the Sheridan Center.

In closing, may I pass a thought along to you with regard to the complaints that the State Society is lax in doing for the Chapters. Before we can furnish answers to the problems, we must first define the State Society -- is it not local chapters who have banded together to form the State Society? So, perhaps before the State Society can provide, we may have to create contributing steam at the local level. Give it some thought.

Looking forward to seeing you in Sheridan.

GROVER

EDITOR'S NOTE

TO ALL WYOMING ARCHAEOLOGICAL SOCIETY MEMBERS:

THE ARCHAEOLOGIST is being printed in its present form to conserve paper and reduce excessive postal rates. By conserving paper and space, we leave more room for those articles the members are going to send.

Somehow, the 1979 issues advanced from Volume XXII to Volume XXIII. In 1964, we went from Volume VI to Volume VIII. Do you suppose those Romans are telling us to count in our own language? Metrics anyone?

As the expense of being redundant, I ask for any communications with articles or reports for publication in THE ARCHAEOLOGIST. Material seems to dribble in about the time it's required, but a backlog awaiting publication would be a most welcome change.

THE EDITOR

* *

ARCHAE ANNIE

Archae Annie includes some excerpts from a Puyallup, Washington, writer's letter and a pertinent article about Resources Protection Act, P. S. 96-95.

Any information, or comments, will be welcomed and passed on to the writer.

Archae Annie
P. O. Box 703
Saratoga, Wyoming 82331

".....I am working on a book that pertains to my ancestors, the Indians of the west. Now, this book was going to be sort of a definitive history of one nation, the Sioux, but I got sidetracked. Now the book has evolved into a 'detective story' of sorts that gets more involved with each passing week. And because I need certain information pertaining to Wyoming, I am turning to you for help.

".....imagine a mythical 'line' running north and south in Wyoming, with Medicine Mountain on the north (east of Bighorn Lake), Moneta in the center of the line, and Baggs on the south. Upon that 'line' will be found some of the answers that I need in order to get on with my book. Now, can you give me the names and addresses of Wyoming agencies that can tell me what, if any, Indian 'ruins' might lie upon that imaginary line?

" There is a so-called 'prayer wheel' (Medicine Wheel) upon the north, at Medicine Mountain. And somewhere near Baggs there is another. In between these there should be other 'ruins' of some sort. If not, then many of the now-dead elders of my own people did not know that country like they claimed to have known it. Quite frankly, I honestly believe that they knew Wyoming!

" What I am trying to pin down is locations of ancient, round, stone, 'silo' shaped ruins. They would have been about thirty to forty feet in height, about thirty feet in diameter. Also, they would be about 700 years old (A.D. 1250 - 1300).

" There is an outside chance that such ruins could be in a square shape, with about the same dimensions as listed. Most archaeologists, ranchers, and prospectors would not give these ruins a second glance -- as they tend to pass them off for some type of fortifications erected by pioneers in the West, which they are not.

" Oh.....should you know the exact location of that 'medicine wheel' near Rawlins, I would appreciate having the information, as I plan on a trip through Wyoming this coming spring and I will make it a point to stop off and photograph the ruin."

* * * * * * * * * * * *

ARTICLE:

ARCHAEOLOGICAL PROTECTION IS EASIER UNDER NEW STATUTE

A recent law provides the Bureau of Land Management and other federal land managers with a strong legal position from which to curtail the illegal removal and excavation of cultural resources from public lands.

The new law, Archaeological Resources Protection Act, P.L. 96-95, was signed by the President October 31, 1979. It strengthens the policy of the United States to protect archaeological resources and sites on public lands by providing stiff penalties to those found guilty of excavating, removing, transporting or selling these resources without a permit.

According to Richard E. Fike, BLM archaeologist in Utah, this act will help to protect the many archaeological resources on public lands in Utah. He also pointed out that the new law does not repeal the Antiquities Act of 1906. The Antiquities Act remains a viable statute which can be invoked for violations not covered by the recent act.

While an individual cannot be prosecuted under P.L. 96-95 for collecting arrowheads on the public lands, such activity is still illegal under the Antiquities Act, said Fike.

A person convicted under the new law could be fined up to $20,000 or imprisoned for two years, or both. In the case of a second or subsequent violation and conviction, a person could be fined up to $100,000, or imprisoned for up to five years, or both.

The new law also provides that one-half the fine, but not to exceed $500, may be paid to any person who furnishes information which leads to the finding of a civil violation, or the conviction of a criminal violation. Also, any vehicles and equipment which were used in connection with the violation may be confiscated by the United States upon conviction.

ANOTHER U. F. O.

This is from Red Fork of the Powder River, and was found on the surface. The scale at the bottom of each photograph is in centimeters.

SITE 48LN74

A Hunter-Gatherer Base Camp
in the Upper Green River Basin

by Gary M. Brown
Arizona State University

ABSTRACT

Site 48LN74 is an extensive habitation site situated between the wings of a semi-stabilized parabolic sand dune. It was occupied repeatedly during the Middle and Late Plains Archaic, and Late Prehistoric periods. There is considerable evidence that the site was used as a base camp by local hunter-gatherers in the Upper Green River Basin, southwestern Wyoming. The evidence consists of survey data and subsurface testing of horizontally-stratified deposits, including Archaic materials and a large sample associated with Late Period occupation at the site. Cultural ecological data on the latter component indicate intensive use of the site during the late spring-early summer by Late Prehistoric peoples practicing a mixed subsistence strategy.

INTRODUCTION

Archeological surveys of land rights-of-way for Stauffer Chemical Company's proposed Moxa Arch Pipeline have helped in developing a substantial body of data on the prehistory of the western Green River Basin in southwestern Wyoming. The areas surveyed are located between the Green River and Hams Fork in an arid uplands dissected by intermittent drainages that have carved much of the expanse between the two rivers into a mosaic of low benches and buttes separated by basins and ephemeral streams. One focus of archeological investigations has been the Opal Bench study area 25 miles east of Kemmerer. Data collected on this part of the project have already been reported in some detail (Brown 1978b). The present paper is an effort to summarize some of the information generated through study of one of the Opal Bench sites, 48LN74, and to pursue in more depth certain aspects of the analysis not justified as cultural resource management.

Site 48LN74 is a large multi-component habitation site situated in a slight depression embraced by the wings of a semi-stabilized parabolic sand dune. The dune is one of several such features scattered across the top of a mesa that rises above Opal Bench (Figure 1). The site is an open camp on ground as high as any in the area, yet its particular location does not offer much of a view. Elevation at the site is 2,070 meters above sea level (6,792 feet). The maximum size of 48LN74 is 210 meters north-south by 240 meters east-north. There is a recognizable "core area" comprising approximately 11,000 square meters on the windward side of the sand dune where evidence of domestic activity is concentrated (Figure 2).

Cultural resources at 48LN74 consist of extensive surface and subsurface deposits. Twenty-one fire hearths are exposed on the site surface and three additional hearths were excavated in test pits. The site surface contained 126 stone tools which were either analyzed in the field or collected for lab analysis. One hundred and nine additional tools and 3,264 pieces of lithic debitage, plus a sizable though fragmentary sample of faunal remains were excavated and analyzed (Brown 1978b: Appendix, pp. 116-168). The sample of surface material had been biased due to collecting by artifact hunters. Subsurface cultural deposits in parts of the site also were disturbed by pothunting.

Archeological investigations at 48LN74 consisted of intensively surveying the locale, drawing a topographic site map with a plane table alidade, mapping and collecting artifacts found on the site surface, and subsurface testing to decide on a feasible plan for mitigation of impact. Five test pits were excavated, but cultural deposits greater than 20 centimeters in depth were found only in the first unit. Although it is clear that cultural materials of similar depth and density extend over a wide area in the central part of the site, our research design aimed at archeological resource preservation precluded excavation of a larger sample. Instead, construction plans were modified so that only surficial deposits on the southwestern edge of the site would be impacted, and subsequent testing was oriented around clearance of this area.

In sum, the bulk of material culture collected from 48LN74 is derived from a single two-by-two meter test pit excavated to a depth of 65 centimeters below the present ground surface. No in situ cultural materials were encountered deeper than 55 centimeters below ground surface.

THE OPAL BENCH STUDY AREA

Opal Bench is an erosional surface extending 20 kilometers east from the Hams Fork River to a broad intermittent stream valley known as Whiskey Basin. The bench is bordered on the south by an intermittent tributary of the Hams Fork named Sevenmile Wash and by lowlands on the north. The bench is defined by 30-60 meter bluffs (100-200 ft.) with the elevation at the rim ranging between 2,030 and 2,075 meters above sea level (6,650-6,800 ft.). Site 48LN74 is located near the east end of Opal Bench overlooking Whiskey Basin and Whiskey Buttes to the southeast (Figure 1). Hams Fork is the nearest permanent water source at a distance of six miles to the southwest. The Green River is nearly twice that distance to the northeast. Seasonal water supplies such as snowdrifts, ephemeral springs and seeps, and interdunal ponds were probably vital water sources to Opal Bench inhabitants during much of the year.

The climate of the Green River Basin is unpredictable. Summers are warm and dry while winters are cold and wet, but unseasonal changes in the weather can be expected at any time. Annual precipitation ranges between six and twelve inches; mean January temperature is around 16 degrees Fahrenheit; mean July temperature is 68 degrees. There are extremes, however, of -30 degrees and 98 degrees Fahrenheit for Kemmerer and -29 degrees to 98 degrees Fahrenheit for Rock Springs (Metcalf 1977: Table 2,

p. 10). Opal Bench is about midway between these two cities at a comparable elevation. The effect of wind chill factors in the Green River Basin is so great that effective wintertime temperatures sometimes drop well below the measured minimums.

The top of Opal Bench is primarily sagebrush flats which give way quite abruptly to steep talus slopes where the underlying sedimentary rock is exposed in scarps and outcrops along the edge of the bench. Bedrock consists mainly of sandstone, shale and lacustrine chert. The Green River Basin was once inundated by an extensive lake which deposited trona, oil shale, fossiliferous limestone and chert in its lacustrine facies during oscillation of the lake level and shoreline (Wolfbauer 1973). Subsequent erosion of the resulting formations has littered Pleistocene terraces and other erosional surfaces in the Green River Basin with lag pebbles and river cobbles left by ancient drainages.

The Opal Bench area is exceptionally rich in both primary and secondary chert deposits. Quartzite cobbles are also abundant. In addition, obsidian pebbles occur in Pleistocene gravels on terraces west of the Green River (Love 1977:21). Although small and hard to reduce, the obsidian pebbles are of high quality volcanic glass. There is good evidence they were exploited as raw material for projectile point manufacture during the Late Prehistoric period (Charles Love, personal communication). All of these lithic resources were utilized by prehistoric inhabitants of 48LN74.

Vegetation on the Opal Bench sage flats contributes to a low profile, homogeneous landscape dominated by tall sage (Artemisia tridentata). Co-dominants include rabbitbrush (Chrysothamnus viscidiflorous), horsebrush (Tetradymia glabrata), shadscale (Atriplex confertifolia), tansy mustard (Descurainia sp.), and various species of phlox (Phlox) and bunchgrasses. The most common grasses are steppe bluegrass (Poa sandbergii), Indian ricegrass (Oryzopsis hymenoides), and needlegrass (Stipa comata). Less frequent on the sage flats are frigid sage (Artemisia frigida), hopsage (Grayia spinosa), prickly pear cactus (Opuntia polyacantha), and various species of desert buckwheat (Eriogonum).

The flora of dune fields and colluvial slopes around Opal Bench are more varied. While vegetation on slopes tends to be more sparse than the flats, in dune areas it is much denser than either flats or slopes. The sandy eolian deposits at 48LN74 are dominated by tall sage and bunchgrasses. The most common grasses on the site are steppe bluegrass and Indian ricegrass with giant wild rye (Elymus cinereus) on the north side of the parabolic dune. Co-dominants are rubber rabbitbrush (Chrysothamunus nauseosus), hopsage, frigid sage and tansy mustard; in addition, chenopods, amaranths, shadscale and prickly pear were also observed.

Like the flora of the Green River Basin, the fauna is composed of a limited number of species. The most common big game animal is certainly the pronghorn (Antilocapra americana). Mule deer (Odocoileus hemoinus) and elk (Cervus canadensis) inhabit the high country surrounding the Basin, and prior to heavy exploitation during historic times probably occurred with frequency in the Basin itself. Another large mammal observed near the Green River is moose (Alces americana), but they did not inhabit the Northwestern Plains prehistorically (Frison 1978:275). Wild horses (Equus caballus) are very common in the Green River Basin, and their Pleistocene predecessors may once have been equally abundant. Both cottontails (Lepus capestris) and jackrabbits (Lepus sylvaticus) are common, especially the jackrabbit.

The main predator in the ecosystem, besides human beings, is the coyote (Canis latrans). There is a variety of small mammals, birds, reptiles, insects, and--in the rivers and streams--both fish and shellfish. A representative sample of fauna observed on a survey project close to Opal Bench (McGuire 1977:4-5) includes, in addition to species already mentioned, chipmunk (Eutamias sp.), badger (Taxidea taxus), black-tailed and white-tailed prairie dog (Cynomus ludovicianus and C. leucurus), ground squirrel (Citellus richardsonii), skunk (Spilogale sp.), pygmy field mouse (Microtus pauperimus), great blue heron (Ardea herodius), mallard (Anas platyrynchos), blue-winged teal (Querguedula discors), morning dove (Zonaidura macraura), yellow-headed blackbird (Zanthocephalus zanthocephalus), western meadow lark (Sturnella neglecta), house finch (Carpodacus mexicanus), brewer sparrow (Spizella breweri), sage sparrow (Amphispiza nevadensis), sagehen (Centrocercus urophasianus), species of hawk (Accipiter), sandswift (Holbrookia maculata), and desert short-horned lizard (Phrynosoma ornatissimum). I would add kangaroo rats (Dipodomys sp.) to this list.

PROBLEM ORIENTATION

Some of the more characteristic geographic features in the Upper Green River Basin are localized sand dune fields. The well-drained sandy soils associated with dunes support a variety of plant life which contrasts with the generally homogeneous basin environment. In fact, most dune areas in the Green River Basin are fairly well-stabilized by vegetation. Tall sage, greasewood, hopsage, rabbitbrush, horsebrush, chenopods, amaranths, tansy mustard, prickly pear cactus, and bunchgrasses are locally abundant in dune fields.

Plant variety provides both humans and other animals with a number of species that might be exploited. A diversified flora (and associated faunal communities) are probably primary factors influencing the unquestionable correlation between prehistoric habitation sites and semi-stabilized sand dunes in southwestern Wyoming. This association between prehistoric camps and Basin dune areas is not a new observation (see for example, Love 1977; Metcalf 1977). Within close proximity to the Opal Bench study area, the dune-camp association ranges from approximately half of the total sites recorded on large-scale surveys (Dibble and Day 1962:12; Treat 1978) to 17 sites in a sample of 19 (Davis 1977: 22). On the Opal Bench project, five of the 11 sites investigated are located in dune areas; all five of the campsites recorded are thus situated (Brown 1978b: Table 1, p. 46). Moreover, I have investigated dune sites east of Opal Bench that cover nearly one-fourth of a square mile (160 acres).

The lack of a particular resource of singular importance in dune fields implies that a particularistic explanation of the prehistoric focus on dune habitats in the Green River Basin is inadequate. The variety of human activities evident at such sites, and use by both Archaic and Late Period peoples also suggest that a single explanation might account for only a particular site. Dune fields, for example, frequently contain topographic features that can be and were used by prehistoric hunters to trap and kill game

(Frison 1974, 1978:187). But the number of dune encampments in the Green River Basin, and intensive reoccupation of many such sites call for a general explanation. The diverse plant and animal communities, topographic relief of the dunes, and loose sandy substrates are seen here as contributing factors in the prehistoric selection of dune fields for habitation by human groups. The loose eolian sand in the dunes is easily excavated for pit hearths, roasting pits, etc., and contrasts markedly with the hard gravelly substrates that dominate much of the area. Moreover, loose sand is an ideal occupational substrate for many activities, such as stone core reduction (because it reduces flake breakage following detachment). Sand is less well suited for animal butchering or food preparation. The dunes offer some topographic relief which blocks wind and visibility, but are not pleasant places to be when the wind blows. Such limited shelter would provide little protection from freezing winter weather, and there would probably be a tendency to locate winter camps in lowlands and drainages.

Even late in the spring, snowdrifts and interdunal ponds associated with dune fields could be utilized for water. At the Killpecker Dunes, on the east edge of the Green River Basin, buried snow and ice lenses are sometimes preserved on the lee slope of sand dunes with moist overlying sand insulating the ice pack throughout the entire year (Steidtmann 1973). Both surface and subsurface ice packs provide potential for refrigerated food storage. Unfortunately, such features would not be preserved to contribute to the archeological record. The scarcity of recognizable food storage features on the Northwestern Plains poses a problem for the archeologist attempting to explain human subsistence in this harsh environment (see Frison 1978:345, 358-360).

In addition to explaining sand dune adaptation, southwestern Wyoming archeology is confronted with serious interpretive problems. The strong Basin winds frequently mix strata at multi-component dune encampments. The effects of "trampling" in loose eolian substrates, whether prehistoric or modern, also displaces artifacts and affects preservation of particular data classes in differing ways (Gifford 1978). As a result, many dune sites lack clear-cut stratigraphy and in situ cultural layers. Maintenance of chronological control in excavating and analyzing archeological materials from such sites is problematical at present. In addition, evidence of house floors or simple structures such as brush or hide shelters would not easily be preserved in such a depositional regime.

To conclude, particularistic explanations for the problem of prehistoric dune habitation in southwestern Wyoming do not seem appropriate. I propose, instead, that sand dunes simply comprise a comparatively diverse and productive ecological niche in a macroenvironment which tends to lack these qualities. Dune habitation is an effective adaptation to resource redundancy.

ARCHEOLOGY OF 48LN74

Difficulties involved in interpreting archeological data from multi-component dune sites have been discussed. Site 48LN74 is a relatively well-preserved dune encampment which has been moderately impacted by artifact hunting and wind deflation. Additional damage has resulted from the bulldozing of two dirt roads through the middle of the site along north-south and east-west axes. The roadcuts were useful, however, for inspection of sand dune deposits.

Because of the preservation of substantial <u>in situ</u> cultural deposits, 48 LN 74 can contribute significantly to interpreting dune occupations in the Green River Basin. The present paper is aimed at understanding two aspects of the adaptive process of dune habitation: human subsistence and settlement at dune camps. Only a small fraction of the cultural material at 48 LN 74 was sampled; interpretations are therefore preliminary, though hopefully testable. However, the available evidence does seem compatible with dune encampments elsewhere in southwest Wyoming.

Although 48 LN 74 has been undergoing physiographic changes, the parabolic sand dune has evidently been a meaningful factor in deposition of cultural debris throughout the site's occupations. It is regarded as the key variable in the site's location. From the association of older diagnostic materials on the deflated southwest of the site and greater wind deposition to the northeast, I infer that the dune has gradually migrated to the northeast. This interpretation of the site's horizontal stratigraphy is corroborated by the present orientation of the parabolic dune with its slipface to the northeast. It also accounts for the existence of extremely concentrated surface materials, including several deflated fire hearths and a number of Archaic projectile points, on the windswept gravels on the south of the site. The association of charcoal stains with clusters of fire-cracked rock suggest use of pits with these features, pits that cannot be detected today. The present gravels must have been covered by a substantial eolian substrate during Archaic times, as the northeastern half of the site is covered today.

The parabolic dune is presently quite stable, but some eolian deposition is occurring. Geomorphological observations of the roadcuts and test pit profiles indicate that continual windblown deposition has created the present sand dune. In contrast to the active mixing of sand and artifacts by wind action at most sites in the study area, illuviation of silts and clays into the eolian deposits at 48 LN 74 has stabilized much of the archeological material. The topography of the parabolic dune has apparently also been instrumental in controlling winds at the site.

A varied assemblage of projectile points was collected at 48 LN 24 (see Plate 1). There are both diagnostic and undiagnostic dart and arrow points. Specimen "b" is a McKean stemmed, indented-base point similar to the Hanna projectile point type (Wheeler 1954), but the particular variant is distinctive enough and examples so common in the Green River Basin that a local manifestation of the McKean complex is probable (cf. Treat 1978). A similar stemmed, indented-base point was found on another of the Opal Bench sites (Plate 1, specimen "a"). The specimen from 48 LN 74 is a dorsally thinned quartzite flake with only two thinning flakes removed from the ventral face. The resultant transverse cross section is plano-convex. Specimen "c" is a stemmed biface, also of quartzite, and similar in form to specimens "a" and "b". The base is slightly concave. Whether it is a knife or a projectile point preform is uncertain, but morphologically, it is unquestionably McKean.

Radiocarbon dates of McKean assemblages on the Northwestern Plains range between

2950 and 1150 B.C. (Frison 1978:53-56) and thus are associated with the Middle Plains Archaic period (Frison 1978:50). Additional evidence for a Middle Archaic component is provided by specimen "e", a small McKean lanceolate, and specimens "d" and "f" which appear to be atypical Middle Archaic forms. One of the more distinctive points in the collection is "k", a chert point with shallow side notches and a broad concave base giving it an earred form and Middle Archaic appearance. Like most of the points collected, however, it does not conform to a recognized "type".

With the exception of "c", the stemmed biface, all of the Middle Archaic projectile points are associated with the deflated locus on the south-central part of the site (see Figure 3). Additional Archaic materials were found in this locus; however, specific typological assignments could not be made for several of the dart points. Specimen "g" is a large, side-notched triangulate point which appears to be within the range of variation of both Early and Late Plains Archaic projectile point styles. It may be Besant, suggesting a Late Archaic date, but the time depth of large side-notched point forms during Archaic times makes classification of atypical specimens tenuous. Similar problems exist with certain stemmed dart points. Specimen "h" is probably an Archaic point. Asymmetry of the blade margins appears to be due to resharpening, indicating (secondary?) use as a knife; thus, there is some possibility that it is not a dart point at all.

Typological discrimination between late Late Archaic and early Late Prehistoric projectile points is difficult in the Green River Basin. This is partly because projectile point styles vary locally from the better documented typologies that were obtained elsewhere on the Northwestern Plains during this transitional horizon. If the change from atlatls (spear-throwers) to bows and arrows is regarded as diagnostic of the Archaic-Late Prehistoric transition (cf. Frison 1978:67), then specimens "l" and "m" would appear to be Late Plains Archaic. The fact that "some of the corner-notched dart points (on the Northwestern Plains) were simply reduced in size for use with the bow" (Frison 1978:62) makes distinguishing small dart points from large arrow points rather arbitrary. Frison's general statement seems to apply very well to the projectile point chronology which is beginning to emerge for southwestern Wyoming (see Metcalf 1977; Brown 1978b:12-17).

Specimens "o" and "p" are good examples of smaller Late Prehistoric corner-notched arrow points. They are very common in the Green River Basin, and apparently postdate a wider and much thicker corner-notched point in southwestern Wyoming which may be associated with the atlatl-bow transition. The technological change in projectiles and concomitant morphological changes in projectile points during the Archaic-Late Prehistoric transition are thought to begin around A.D. 500 on the Northwestern Plains (Frison 1978:62). Specimen "n" is probably another Late Archaic corner-notched dart point. It was found on a limited activity site 75 meters west of 48LN74 (Brown 1978b: 52). Specimen "q" is a small side-notched arrow point, probably of late Late Prehistoric date (i.e., second millenium A.D.).

In addition to Archaic and Late Prehistoric components at 48LN74, there may be a brief Paleo-Indian occupation. Two undiagnostic projectile point midsections were found near a heavy concentration of fire-cracked cobbles. Technological and morphological attributes of the two specimens ("s" and "t") compare well with those of Late Paleo-Indian projectile points, but the fragments are not suitable for typological assignments. Specimen "t" exhibits parallel-oblique flaking on one side, less patterned flaking on the opposite face. Specimen "s" is a reworked projectile point midsection with blade morphology similar to "t". Although not strictly diagnostic, reworking broken projectile points into functional tools is a Paleo-Indian trait (Frison 1978:78). Both of the point fragments from 48LN74 have thick, bi-convex to lenticular cross sections, and their occurrence within 10 meters of each (cf. Figure 3) strengthens the argument for a Late Paleo-Indian occupation. Unfortunately, the locality is deflated and there is probably little in the way of buried cultural materials.

The two Late Archaic corner-notched dart points from 48LN74 were found in the southwest part of the site and may be associated with the fire hearth and light lithic scatter in that locality. With the exception of "c" and "h", all additional Archaic projectile points were recovered from the south-central locus (Figure 3). There are several deflated fire hearths exposed in this locality and a high density of ground stone (Figure 4). Grinding stones are characteristic of the Archaic (Zeimens et al. 1979:21) and first appear regularly as formal tools (metates and manos) in McKean assemblages of the Middle Plains Archaic (Frison 1978:47). Although no complete grinding stones were found at 48LN74, all suitable specimens indicate a ground stone assemblage which employed thin, roughly shaped sedimentary rocks, pecked and flaked around the margins to form lightweight metates between 15.35 and 31.25 millimeters thick (0.6 to 1.2 inches) (Brown 1978b:118-28). There are both bifacial and unifacially ground metates. Unmodified river cobbles were used as one-handed manos.

Many of the grinding stone fragments from 48LN74 are fire-fractured and several metate fragments are additionally blackened or oxidized on one side. Although hearths and fire-cracked rock features in the south-central locus were too badly deflated (and potted) for excavation and testing hypotheses, it is plausible that metates were used as both grinding and cooking slabs in processing and preparing plants as food. I have seen many similar features at campsites in the Green River Basin and Red Desert. Mulloy (1958) speculated that metates were intentionally destroyed on the Northwestern Plains when a site was abandoned. An alternative hypothesis that could be tested on sites where preservation permits is that grasses were scorched on heated slabs to separate seeds from chaff, and grass seeds were subsequently milled on metates to render them digestible for human consumption.

A number of investigators have attempted to explain the enormous quantities of fire-cracked rock found in southwestern Wyoming campsites. Love notes (1977:18) that quartzite cobbles were carried as far as one mile to sites where they were heated and disposed of as fire-fractured fragments. The great amount of fire-cracked quartzite found in the Green River Basin implies that such debris does not represent a specialized activity, but rather a general approach to the cooking of food. The use of heated rocks by Plains Indians has been documented ethnographically, and includes both boiling and roasting plant or animal foods (Lowie 1954:26). Because of this functional diversity, the identification of fire-cracked rock on an archeological site offers no more information than the obvious: that people cooked food at their campsites. A hypothesis to account for fire-cracked fragments of tabular rock in association with fire hearths has been offered to explain their occurrence in the southcentral locus at 48 LN 74, but data do not permit a test of the idea at this particular site. There are also small scatters of fire-cracked cobble fragments in this locality.

The entire surface of the central site area is littered with angular chunks of fire-cracked quartzite derived from heated cobbles. Features interpreted as game-roasting pits were excavated during subsurface testing of this part of the site. These features are discussed in the following section.

FAUNAL REMAINS

Subsurface testing was initiated at 48 LN 74 by opening a two-by-two meter square for excavation in the center of the site against the windward slope of the parabolic dune (see Figure 2). Assumed cultural deposits were well covered by loose, loamy sands held down by shortgrass. Erosion and pothunting had revealed dense deposits of cultural debris buried in adjacent parts of the locus. The potted backdirt contains huge amounts of lithic debitage and fire-cracked quartzite cobbles, soil stained with charcoal and ash, butchered and unbutchered animal bone, and stone cores and tools. Undiagnostic projectile point tips found in the backdirt appear to be broken from small triangular arrow point preforms. The proximal end of a small, partially side-notched preform with concave base, broken in manufacture, was recovered in Test Pit #1, further suggesting that shallow cultural deposits in this locus are a Late Prehistoric phenomenon.

Large volumes of domestic debris similar to that observed in the potted area were unearthed in Test Pit #1. Beneath 10 centimeters of loose sandy surficial sediments, cultural depostis appeared as in situ material and features contained in a fairly compacted sand matrix partially cemented by percolation of finer sediments into the subsurface illuval zone (cf. Young and Singleton 1977:12; Brown 1978b:6, 67). Two large pits filled with organic, dark grey soil mixed with charcoal, ash, fire-cracked cobbles, butchered animal bone, and lithics were encountered. Both features were located in corners of the two-by-two meter square. The immense quantity of cultural material overlying and associated with the pits precluded expanding the excavation area to include more of the activity area.

Feature 1.2 in the southeast of the unit had been dug out for reuse at least once, and thus represents a minimum of two separate operations. The two stratigraphic units thus created within Feature 1.2 indicate that, during any one episode, the fire pit was over 65 centimeters across (probably much larger) and 35 centimeters in actual depth (see Figure 5). The minimum capacity of the pit, then, is 150 liters (5.2 cubic feet). It was classified as a meat roasting pit on the basis of large amounts of burned, butchered, and/or otherwise broken animal bones found in the pit (cf. Brown 1978b:132-153).

Fire-cracked rock concentrated in the features and overlying fill was apparently derived from cobbles exploded by extreme heat. Presumably, cobbles were heated, then added to pits such as Feature 1.2 to generate prolonged heat for roasting meat which also was placed in the pit. Whether the hot rocks and meat were buried in greens and/or earth is not known. Roasting pits at the bison-processing and camp area of the nearby Wardell site were sealed beneath a layer of flat rocks and soil (Frison 1973).

Although stratigraphy in Test Pit #1 was too ephemeral to trace depositional units across the whole square and demonstrate relationships among features, the evidence available suggests that the three features in Test Pit #1 are associated with a single extended occupation. The two large fire pits and a smaller pit filled with fire-cracked rock are associated with stratigraphic unit A and were dug into unit B (see Figure 5). The features first were delineated as pits at about 10 centimeters below ground surface. Dotted lines on the profile indicate differential charcoal content in the matrix. The terminal depth of unit A is probably influenced by subsurface migration of charcoal particles and other small items as predicted by ethnoarcheological observations of human and post-occupation processes affecting permeable site substrates (Gifford 1978:82). The stratigraphic situation was further confused by intrusion of the pits into buried cultural materials. The oldest cultural level defined was located between 45 and 55 centimeters below ground surface.

Feature 1.3 is a shallow pit in the northwest corner of Test Pit #1 which contained several kilograms of fire-cracked quartzite cobbles. Only some sparse charcoal and bone chips, plus lithic debitage, was retrieved in the feature. In contrast, the fill in Features 1.1 and 1.2 was heavily stained, though actual charcoal inclusions were few. The larger charcoal fragments observed show that sage had been used as fuel. Numerous fragments of bone and fire-cracked cobbles were found in the two features. The spatial relationships between artifact densities and faunal remains support the stratigraphic inference of probable contemporaneity of all three features.

Feature 1.1 is considerably smaller and shallower than the roasting pit (Feature 1.2). It consists of a basin-shaped pit slightly over 12 centimeters deep and well over 75 centimeters in diameter (cf. Figure 5). The feature is interpreted as a fire hearth used for domestic purposes such as heating of rocks and coals for the proposed roasting operation in Feature 1.2.

Although direct association between the features in Test Pit #1 cannot be demonstrated, their inferred functional differences can best be explained in terms of a single operation. Such an explanation has been offered for clearly associated "tri-hearth" features frequently found in the Red Desert of southern Wyoming (Brown 1978a:42-46). Globular and bell-shaped pits up to 75 centimeters in actual depth appear to be associated with plant-roasting operations there. "Cheno-ams" (Chenopodium and/or Amaranthus spp.) and fragments which appear to be grass glumes have been tentatively identified in flotation samples from Red Desert "tri-hearths", while some of the features contain faunal material (Western Wyoming College site files). Available radiocarbon dates on Red Desert "tri-hearths" are A.D. 835±60 and A.D. 575±70 (Michael Metcalf, personal communication). The Red Desert roasting pits (see also Frison 1978:355) are characterized by highly oxidized sides which differ from those investigated in the Green River Basin.

The postulated function of "tri-hearth" features involves use of a shallow hearth to heat coals and stones, a larger pit for the actual roasting operation, and a refuse pit where debris was contained when other features were cleaned for re-use (cf. Frison 1978:228). The lack of oxidized pits at 48LN74 implies that few, if any, coals were used in the roasting operations there. This would explain both the immense yields of pure charcoal (sage and greasewood) from Red Desert "tri-hearths" (Brown 1978a:26-29) and the far greater amounts of fire-cracked rock associated with food-preparation features in the Green River Basin.

Test Pit #1 yielded 71 fragmentary skeletal elements, 253 unidentifiable bone chips, 13 fragments of mammalian teeth, two pieces of eggshell, and three worked bone specimens (Brown 1978b:132-153). Ten percent of the material is burned and only a few bone chips calcined. This suggests that burning of bones was incidental and meat was not wasted. All bones were broken, however, and most of this damage does look intentional. Breakage patterns seem to represent non-stylized breaking to facilitate consumption (e.g., dismembering units and retrieving marrow) rather than butchering *per se*. It is likely that such treatment of bones has eliminated much evidence of previous butchering processes.

Identification of species from the fragmentary faunal remains was problematical. Tooth fragments and part of a rib from Feature 1.2 were positively identified as bison (cf. *Bison bison*). Numerous other bone fragments recovered from both Features 1.1 and 1.2 fit within the bison-elk size range. One large browser molar excavated in Feature 1.1 is almost certainly elk (*Cervus canadensis*). A segment of probable elk rib was also recovered. There is a preponderance of bone from mature animals in the deer-antelope size range. The cumulative weight of "probable" antelope identifications (*Antilocapra americana*) is overwhelming, but this does not exclude the possibility of deer as well. A distal shaft fragment of a butchered femur, probably deer (*Odocoileus* sp.), was found in the fill overlying the feature defined in Test Pit #1. As mentioned above, only a few bone chips were found in Feature 1.3.

The thickness of eggshell fragments associated with Feature 1.2, and size of the egg(s) inferred from shell curvature, compare well with hatched eggs found in a sagehen nest (*Centrocerous urophasianus*) near the site. The association of one burned shell fragment within the roasting pit fill and one unburned piece near the pit are good indications that the eggshell is both cultural and coeval with the roasting operations. Longbone fragments from a bird in the sagehen size range also were retrieved within Feature 1.2, but could not be conclusively identified as to species. Given the Basin environment, it seems likely that both the eggshell and bird bone are sagehen.

The nesting season for sagehens in Wyoming is May-June; egg-laying may begin as early as late April, but is intense during the first weeks of May (Bailey and Niedrach 1965: 281; Davis 1889:150). Assuming the avian remains from Feature 1.2 do not represent a species with reproductive scheduling greatly different from sagehens, a late spring and/or early summer operation of the roasting pits excavated at 48LN74 seems to be a reasonable conclusion. No other evidence of seasonality was recovered at the site.

In addition to subsistence and seasonality data, analysis of the faunal materials from Test Pit #1 produced evidence of bone tool use at 48LN74. Besides one abraded and polished bone fragment, a bone flake was excavated in Feature 1.2. The specimen is clearly a flake struck from a prepared objective piece. Cortex is present on the striking platform and there are two previous flake scars on the dorsal side (Brown 1978b: 150). It appears to be a unifacial reduction flake (cf. Frison 1968) detached from a fairly massive bone shaft. Test Pit #1 also produced a bone tool made from a massive medial shaft fragment (cf. bison or elk). A rather blunt acuminate working edge was created at the intersection of opposed spiral fractures (Brown 1978b:44). The working edge is heavily worn at the tip indicating the tool was used as a scraper with its non-beveled cortical edge down. The tool appears suitable for use on concave objects, perhaps to scrape marrow from bone cavities. A grooved anvil stone made from a quartzite slab offers indirect evidence of bone tool use. It was evidently employed in sharpening bone or antler for use as awls or pressure flakers.

LITHICS

A large lithic sample was collected at 48LN74. The total sample consists of 235 stone tools and 3,264 pieces of debitage, plus a judgmental surface collection of 54 additional flakes to expand the sample of raw lithic material. The system employed in the classification and analysis of the lithics recovered has been described in detail in the original report (Brown 1978b:29-36). Briefly, the system was designed to integrate experimental and analytical methods for examining lithic assemblages, and to maximize technological data from the study of lithics. Special attention was paid to the debitage analysis since waste flakes are, in many respects, more useful in reconstructing site activities than the tools themselves. The sample of tools from an archeological site is affected by differential discard biases as well as biases introduced by recovery techniques and surface collecting by artifact hunters.

The overwhelming majority of debitage collected at 48LN74 is local quartzite and chert. To demonstrate this, a second analytical system was devised for geologic description of raw material used in lithic production (Brown 1978b:36-43). Sorting of chert types could, in most cases, be done visually because of the distinctive characteristics of most Opal Bench cherts and many other lithic resources brought into the area prehistorically. This approach is inadequate for tracing raw material to a particular outcrop, but Love (1977) points out that "because of the nature of most chert outcrops in the mountain and basin sedimentary sequence (of the Green River Basin), the term 'source area' may be more appropriate than 'quarries'" (p.21). This is certainly true of the Opal Bench area where eroded chert beds are extensively exposed in resistant Eocene sedimentary formations, and vast areas are littered with broken up lacustrine chert plates. Love defines "quarries" as "small localized outcrops of a consistently excavated material" (p. 21). As defined, no quarry sites were recorded in the Opal Bench study area, though chert (and quartzite) procurement activities are evident in many places in and around Opal Bench. Love's comments on explication of source areas seem very appropriate to the study of chert procurement in the Opal Bench study area; his work with lithic resources in the Green River Basin (Love 1976, 1977) was essential to my own research.

No formal functional analysis was attempted on the Opal Bench lithics. Observed edge damage was noted and the morphology of tool edges described. Such specimens were inspected with a 10x hand lens. In most cases, discrimination between utilized and non-utilized flakes could be accomplished with confidence. Use-wear was also observed on the platform edge of a number of flakes. Most of these are bifacial reduction flakes which appear to be re-sharpening flakes from stone knives. One re-sharpening flake associated with the features excavated in Test Pit #1 was matched with a biface from the same level which had been severely dulled by use-wear, thus supporting the validity of the analytical methods employed (see Plate 2). The re-sharpening flake scars superimposed on the biface are identical to those created by the second of two bifacial re-sharpening techniques defined by Frison at the Ruby site (1971: Fig. 5, p. 84). Manufacture damage from bifacial thinning of the tough Opal Bench cherts made interpretation of edge damage difficult on many biface fragments and thinning flake platforms (see also Sheets 1973).

One of the primary aims of the system employed for debitage analysis is distinguishing core reduction from bifacial and unifacial tool production activities. These three general stoneworking processes produce different classes of waste flakes (see for example, Tixier 1974; Frison 1968, 1971; Crabtree 1972). In order to separate the Opal Bench debitage into technologically meaningful categories, attributes were defined which relate to specific aspects of lithic reduction (Brown 1978b:32-35). Less attention was given to superficial attributes such as presence or absence of cortex. Such a distinction is not of great value in analyzing lithic reduction systems oriented around use of pebbles and cobbles. In fact, the analysis showed that more of the bifaces produced at 48LN74 were made from cores (pebbles, cobbles and sedimentary chert plates) than flakes. Hence, the distinction between core reduction and biface production involves technological attributes rather than whether or not cortex is present. "Decortication" was defined to explicate a process (cortex removal) and not simply used to indicate the presence of cortex on flakes (Brown 1978b:33).

A controlled sample of 2,547 pieces of debitage was excavated in Test Pit #1 (see Table 1). Of this material, 98 percent came from the first 40 centimeters of deposition, and approximately two-thirds was recovered in stratigraphic unit A, a yield of about 1,700 lithics in approximately 1,000 liters of matrix (35 cubic feet). The fill also contained an enormous amount of fire-cracked rock, as well as 24 flake tools, 28 flaked stone and three ground stone artifacts, and a great deal of faunal material (Brown 1978b: 128-151). Besides the debitage, lithics from this provenience are as follows: one retouched flake, 24 flake tools, five cores and three core tools; two gravers, three perforators, one biface and four biface fragments; four biface blanks, two preforms, three nodules of tested lithic material, and three ground stone fragments. Also in unit A, four fragmentary worked stone specimens were excavated which have been bifacially ground and polished. They were produced from soft oolitic chert which was found also in an unmodified state in the site area. The material is an attractive cream colored chert spotted with large tan to brown oolites. The pieces appear to be broken pendant blanks or similar ornaments.

About half of the debitage from stratigraphic unit A, roughly 850 flakes and shattered fragments, appeared to be associated with the "tri-hearth" feature in Test Pit #1; the other half occurred in loose windblown fill overlying the features. Of the total 2,547 pieces of debitage excavated in Test Pit #1, 1,504 could be analyzed; the balance is mainly small flake fragments lacking the striking platform or other diagnostic morphological features. In the analyzed sample, 67.7 percent is core reduction debitage; 32.3 percent is tool production and retouch waste (see Table 4). Most of the latter third are bifacial reduction flakes (24.9 percent of the total diagnostic sample). In addition, it appeared that a greater portion of the undiagnostic debitage are small bifacial thinning flake fragments. These are more fragile than most core reduction debitage, and consequently stand less of a chance of being preserved as complete analyzable specimens. I would estimate that nearly equal numbers of core reduction and tool production waste are present in the sample from Test Pit #1.

Numerically, the most significant class of tool production activities reflected in the debitage sample is production of bifaces. Bifacial reduction flakes make up 75.2 percent of the tool production waste and 95.0 percent of the tool re-sharpening waste. Further, many of the retouch flakes are pressure flakes and edge preparation debitage from bifaces. The same emphasis on bifaces is evident in the sample of flaked stone tools (see Table 2). Excluding cores and core and flake tools from the tool sample, 62 of the 69 artifacts (89.9 percent) in the formal tool category are bifaces or biface fragments, i.e., blanks, preforms, knives and projectile points. In addition to the 19 preforms and blanks, many other "biface fragments" seem to be roughed-out items broken in manufacture; however, unless the fragments were clearly eliminated from a biface production sequence, they were simply classified as "bifaces" in Table 2.

There are two fundamental methods by which bifaces were made at 48LN74: retouching flakes and reducing cores. Some of the stages and variety in techniques used to retouch flakes into bifaces are illustrated in Plate 3. The cobble reduction method frequently employed in the Green River Basin to produce bifaces has been discussed by Clark (1966). Essentially, this involves alternate flaking of selected flat cobbles to remove cortex and regularize the margin of the objective piece. Artifacts broken or discarded at this point in the production process are known as blanks (Sharrock 1966:39-46). Preforms are bifaces that were formed during one or more sequences of secondary retouch (Crabtree 1972:89), implying that, at this stage, a particular end-product is discernible (see also Bradley 1975:6).

Most tool stone in the Opal Bench study area occurs as rounded quartzite cobbles, lag pebbles of semi-translucent chert and chalcedony, and tabular fragments from broken up beds of laminated sedimentary chert. Bifacial reduction of these flat rocks is an efficient method of both producing a biface and reducing a core into flakes that can be retouched or simply utilized as flake implements. The number of unbroken, non-utilized bifacial thinning flakes recovered at 48LN74, ideal for retouching into projectile points or simply using as cutting tools, seems to provide an index of the area's lithic resource abundance. In fact, only 25 of the 1,529 analyzable flakes (1.6 percent) excavated in Test Pit #1 showed evidence of utilization or preliminary retouch.

Despite the vast number of flakes not utilized at 48LN74, the largest class of tools is made up of debitage with varying use-wear and little or no intentional modification prior to utilization. Flake tools comprise 59.0 percent of the artifacts in the sample of 149 flaked stone tools collected at 48 LN 74 (cf. Table 2). Due to problems identifying utilized debitage in the field, including the surface collection probably biases the sample. Of the 62 flaked stone tools excavated in the five test pits, 40 are pieces of utilized lithic waste (67.7 percent).

In addition to bifaces, formal flaked stone tools from 48 LN 74 include two gravers, three perforators and two side scrapers (see Plate 4). Gravers and perforators were produced through minor retouch of a fortuitous projection on a core reduction flake and by regularizing the acuminate working edge. All examples were recovered from Test Pit #1. The scrapers were made by unifacially flaking a quartzite cortical flake to form a plano-convex or keeled cross section, then secondarily retouching one of the margins into a rounded working edge with intermediate edge angle. Identical side scrapers have been collected from other sites in the Opal Bench study area (Davis 1977).

The three core tools collected at 48 LN 74 are ordinary multi-directional cores that show edge damage on one or more flaked edges. Several other cores had battered edges that appeared to be damaged by unsuccessful reduction blows, but the specimens referred to as "core tools" have crushing and step-flaking which may have been caused by use in butchering activities. The "chopper/pounders" are quartzite cobbles with either uni-directional or bi-directional flaking at one end and evidence of repeated percussion at the opposite, unflaked end (see Plate 5). Their specific function is unknown. Crushing of the flaked working edge suggests heavy use on a stone anvil. Battering of the opposite end is certainly caused by percussion against stone. The cobble tools could be used to pulverize a variety of plant and animal products or for shaping sandstone slabs into metates.

Primary deposits of lacustrine chert in the Opal Bench study area produce a variety of opaque fossiliferous cherts in the Bridger Formation. Based on color, color patterns, types of inclusions, texture, and cortex, a group of local Opal Bench cherts was described in the Moxa Arch report (Brown 1978:38-39). The Opal Bench fossiliferous cherts range from white or cream to dark brown. The lighter and darker varieties are homogeneous in color, but mottled tan and brown chert is prevalent in our archeological samples. The mottled tan and brown chert grades into banded chert of the same colors. Unlike Flaming Gorge tiger chert (Love 1977:23), the Opal Bench banded tan and brown chert is not colored by weathering effects after the stone is fractured: it is colorfully banded on freshly flaked surfaces. A single biface fragment of Flaming Gorge tiger chert was found on the surface at 48 LN 74 (Brown 1978b:121) indicating movement 50 miles from the southeast. Both it and a number of pieces of Opal Bench chert exhibit a greasy luster indicative of heat alteration (Crabtree and Butler 1964).

All of the Opal Bench chert is fossiliferous, but fossils are most common in the homogeneous tan to light brown type. Such fossils include algae, ostracods, marine snails, broken shell fragments, and, in one case, a fish scale.

Another local chert which is quite common in the Opal Bench collections is a stromatolitic (algalitic) chert referred to by Love (1977:24) as Whiskey Buttes chert. Small eroded pebbles of this material were found in excavations at 48LN74 indicating a fairly wide natural distribution on Opal Bench and across Whiskey Basin. Whiskey Buttes chert is distinguished by "well preserved convoluted and lacy algal structures" enclosed in a quartz matrix which ranges in color from milky white or clear to semi-translucent blue (Love 1977:24). Heat treatment experiments were conducted with a sample of Whiskey Buttes chert provided by Love to test his hypothesis that the quartz interstices changed from clear to white or blue upon heat treatment. This sounded plausible since a correlation in the Opal Bench lithics had been noticed between (1) clear and white interstices on cortex and rough reduction debitage, and (2) bluish to deep blue interstices on fine retouch debitage and pressure flakes. Experimental results indicate that this color variability is more likely an index of how far inside a weathered nodule of Whiskey Buttes chert a flintknapper was working than whether or not the stone had been heat treated (Brown 1978b:42-43). Such an index may be of utility in demonstrating the form in which Whiskey Buttes chert traveled in the Green River Basin. Completed tools have been found as far from the Whiskey Basin source area as the Eden-Farson site, across the Green River 40 miles to the northeast, where a Whiskey Buttes chert end scraper was recovered (Love 1977: Fig. 13, p. 27).

An additional lithic resource of considerable importance to Opal Bench stoneworkers occurs as weathered lag pebbles of semi-translucent chert and chalcedony. Although they are hard to distinguish in the scattered gravels around Opal Bench due to their nondescript external appearance, the fine cryptocrystalline stone was sought out for use in pressure flaking projectile points. It is proposed as an index of both group mobility and selective use of local lithic resources that none of the 14 projectile points recovered at 48LN74 are made of local opaque chert (cf. Table 2). At the same time, 58.1 percent of the excavated debitage sample and 42.0 percent of the flaked stone tools are of Opal Bench fossiliferous chert (Tables 5 and 6). It is clear from the raw material frequencies that local opaque chert and quartzite were deemed adequate for much flintknapping work, but that fine cherts (the semi-translucent varieties) and chalcedony were preferred for production of pressure flaked tools. The correspondence between McKean projectile points and use of quartzite (see Plate 1) is typical of the Green River Basin. In contrast, all of the diagnostic Late Plains Archaic and Late Prehistoric projectile points from 48LN74 are of semi-translucent chert, chalcedony or obsidian. The Opal Bench opaque cherts are simply not brittle enough to facilitate good pressure flaking.

The only common nonlocal chert encountered in the Opal Bench study area was an opaque greyish-green to green chert (Bridger Formation) derived from a source area west of the confluence of the Blacks Fork and Hams Fork drainages near the town of Granger. This material has been described and referred to as Church Buttes chert (Brown 1978b:39-40). The quantity of cortex and core reduction waste, as well as cores found on the Opal Bench survey indicate nodules were carried up to 30 miles northeast of the Church Buttes source area. Twenty-four pieces of distinctive milky white moss agate also derived from the Church Buttes area, comprise most of the agate encountered at 48LN74. The only other identifiable cherts traces outside the Opal Bench study area were several flakes of Laney Shale opaque grey chert (Green River Formation) from a source area along the Green River approximately 50 miles north of Opal Bench (Love 1977:23) and the Flaming Gorge tiger chert already mentioned which apparently was introduced to the cultural deposits at 48 LN 74 as a knife. Surface crazing and luster of most of the Laney Shale opaque grey chert flakes suggests that this material may have been transported in the form of heat treated blanks. Although source areas could not be determined, much of the chalcedony and miscellaneous opaque chert (most of which has been retouched) is thought to be nonlocal material. Both semi-translucent chert and chalcedony lag pebbles are so widely dispersed in the Green River Basin that archeological specimens cannot be reliably sourced.

All of the obsidian with cortex is derived from secondary deposits, the only known source area being that identified by Love (1977:21-22) on the western terraces of the Green River to the immediate east of the Opal Bench study area. The pebbles are generally less than five centimeters (two inches), yet methods of both core reduction (bipolar percussion?) and bifacial flaking to produce blanks for projectile point manufacture are evident in Love's samples of flaked obsidian pebbles from the Green River source area (Western Wyoming College surface collections). Ten obsidian flakes and flake tools were collected at 48 LN 74 which display dimpled waterworn cortex identical to samples from the Green River gravels (see Love 1977: Fig. 8, p. 21). Due to variability in the internal appearance of the pebble obsidian, the source for 15 additional obsidian specimens cannot be determined.

Pebble obsidian from 48 LN 74 ranges from nearly translucent black to lustrous opaque greyish-black or jet black; four cortical flakes of mottled black and reddish-brown "mahogany" obsidian were retrieved in Test Pit #1. All 25 specimens of volcanic glass were either excavated in Test Pit #1 or surface collected in the center of the site, the locus which I have argued postdates the Archaic site components, thus supporting Love's belief that systematic exploitation of the Green River obsidian pebbles is a Late Prehistoric phenomenon, possibly related to reduction in projectile point size (and hence, the value of small pebbles for manufacturing points) with the Late Period shift to arrow points. Such a pattern in lithic exploitation may have antecedents in the intensified procurement of semi-translucent chert and chalcedony lag pebbles which, I suggested above, may distinguish Late Archaic and Late Prehistoric projectile point assemblages from those of the McKean complex which seem biased toward quartzite for production of points.

SUMMARY AND CONCLUSIONS

This report on the preliminary investigations of site 48 LN 74 has touched on some of the methodological and interpretive issues in southwestern Wyoming prehistory, and offered tentative solutions to a few of the problems. The impact of proposed construction at the site has been minimized by re-routing the pipeline right-of-way; a valuable resource has thus been preserved for future investigation.

In the present study, an effort was made to deduce testable statements; data relevant to further testing of my hypotheses are available at 48 LN 74 as well as many similar sites in the Green River Basin. In addition to specific hypotheses, some thoughts which address broader issues of adaptive process in southwestern Wyoming were offered. One set of problems of both particular and general interest involves selective use of sand dune fields for habitation by hunting and gathering groups. This rather widespread phenomenon during the Archaic horizon of western North America has been noted in differing environments--for example, the Plateau Southwest (Irwin-Williams 1973; Reher and Witter 1977). Such a pattern of land use persists into the Late Prehistoric period in southwestern Wyoming, as does a basically "Archaic" hunting and gathering subsistence strategy.

An important variable in Southwestern Archaic settlement patterns on the Lower Chaco River, New Mexico, is the diversity of plants that inhabit certain topographical features (Reher and Witter 1977). The variety of vegetation and associated faunal populations in dune fields is proposed here as the independent variable in accounting for prehistoric dune occupations inthe Green River Basin. Additional factors, such as sand's amenability to digging and construction of domestic features, and relative relief in the Basin's monotonous topography, were mentioned above.

Dune habitation would appear to be an effective adaptation to resource redundancy in the Green River Basin and elsewhere. At a camp such as 48LN74 women and children would be situated close to a variety of plant resources, while men could travel in pursuit of more mobile, unpredictable prey. A common hunter-gatherer site location strategy is "...to place the base camp near the secure resources and to widen its catchment by establishing satellite extraction camps near the more mobile, high-prestige resource" (Jochim 1976:63). A model of this sort is probably applicable to the Green River Basin.

Analysis of subsistence data from 48LN74, even on the temporal plane of a single component, indicates that dune inhabitants employed a mixed subsistence strategy differing sharply from the specialized economy of historic equestrian Plains Indians. The faunal remains from Test Pit #1 indicate bison, elk, sagehens (and sagehen eggs), and probably deer and antelope both, were exploited during a late spring/early summer occupation at the site. In contrast, there are numerous fire-cracked grinding stones, many associated with hearths on the south of the site, which I suggested are plant-processing features.

Subsistence studies in southwest Wyoming require more intensive and rigorous analysis of food preparation features. They are encountered regularly in the Green River Basin, but have seldom been described in functional terms. A typology for dealing with the ubiquitous hearths and fire-cracked rock features is needed for comparison with particular manifestations. Hearths such as those described in this report clearly are specialized features that warrant detailed analysis. The extensive use of heated rocks probably reflects the lack of wood more substantial than sage and greasewood to provide coals for extended cooking operations. Simply noting that numerous fire-cracked rocks were found on a site tells us little of human subsistence, except that sustenance was a major concern.

Finally, it is sites such as 48LN74 where these kinds of features are found in a suitable state of preservation for determining the relationship between feature characteristics and function that can be used to model hunter-gatherer subsistence in the Green River Basin. Investigators must be alert to the need for recovery and publication of subsistence data from in situ contexts. Evaluating the common disturbed sites in the Green River Basin depends upon comparative studies with more reliable data. Only in the light of typologies and models can poorly preserved habitation sites contribute to our understanding of prehistory. Because periodically unstable dune areas are subject to mixing or deflation of sand deposits, the great quantity of poorly preserved dune encampments so affected are numerically important to a comprehensive understanding of prehistoric hunter-gatherer subsistance and settlement.

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REFERENCES CITED

Bailey, Alfred M. and Robert J. Niedrach
1965 Birds of Colorado, Vol. 1. Denver: Museum of Natural History.

Bradley, Bruce A.
1975 Lithic reduction sequences: a glossary and discussion. In Lithic technology: making and using stone tools, edited by Earl Swanson, pp. 5-13.

Brown, Gary M.
1978a Archeological investigations on Colorado Interstate Gas Company pipelines: survey and mitigation. Western Wyoming College Occasional Papers, No. 15.

1978b Archeological survey and testing on the Stauffer Moxa Arch Pipeline: the Opal Bench study area, Lincoln County, Wyoming. Western Wyoming College Occasional Papers, No. 16.

Clark, J. Desmond
1966 Notes on industries from Pine Spring (48SW101) and other sites from southwestern Wyoming. University of Utah Anthropoligical Papers, No. 77, Appendix, pp. 211-215.

Crabtree, Don E.
1972 An introduction to flintworking. Occasional Papers of the Idaho State University, No. 28.

Crabtree, Don E. and B. Robert Butler
1964 Notes on experiments in flintknappings: heat treatment of silica materials. Tebiwa 7(1):1-6.

Davis, Oliver
1889 Nests and eggs of North American birds. Chicago: Nann and Adair.

Davis, William E.
1977 Archeological survey and analysis of the Stauffer Pipeline project. Western Wyoming College Occasional Papers, No. 13.

Dibble, David S. and Kent C. Day
1962 A preliminary survey of the Fontenelle Reservoir, Wyoming. University of Utah Anthropological Papers, No. 58.

Frison, George C.
1968 A functional analysis of certain chipped stone tools. American Antiquity 33(2):149-155.

1971 The buffalo pound in Northwestern Plains prehistory: Site 48CA302, Wyoming. American Antiquity 36(1):77-91.

Frison, George C.
1973 The Wardell Buffalo Trap, 48 SU 301: communal procurement in the Upper Green River Basin, Wyoming. University of Michigan, Anthropological Papers of the Museum of Anthropology, No. 48.

1978 Prehistoric hunters of the High Plains. New York: Academic Press.

Frison, George C. (Editor)
1974 The Casper site: a Hell Gap bison kill on the High Plains. New York: Academic Press.

Gifford, Diane P.
1978 Ethnoarcheological observations of natural processes affecting cultural materials. In Explorations in ethnoarcheology, edited by Richard A. Gould, pp. 77-101. Albuquerque: University of New Mexico Press.

Irwin-Williams, Cynthia C.
1973 The Oshara Tradition: origins of Anasazi culture. Eastern New Mexico University Contributions in Anthropology 5(1):1-28.

Jochim, Michael A.
1976 Hunter-gatherer subsistence and settlement: a prediction model. New York: Academic Press.

Love, Charles M.
1976 An archeological reconnaissance of the Sublette region, Wyoming. Western Wyoming College Occasional Papers, No. 4.

1977 Geological influences on prehistoric populations of western Wyoming. Wyoming Geological Association Guidebook, Twenty-ninth Annual Field Conference Publication, pp. 15-29.

Lowie, Robert H.
1954 Indians of the Plains. New York: Natural History Press.

McGuire, David J.
1977 Archeological investigations on the Texas Gulf Subsidence Monitoring System, Sweetwater County, Wyoming. Western Wyoming College Occasional Papers, No. 14.

Metcalf, Michael D. (Editor)
1977 An archeological sampling survey of the Sweetwater-Kemmerer and Hanna-Atlantic Rim coal ES areas. Western Wyoming College Occasional Papers, No. 10.

Mulloy, William
1958 A preliminary historical outline for the Northwestern Plains. University of Wyoming Publications 22(1).

Reher, Charles A. and Dan C. Witter
1977 Archaic settlement and vegetative diversity. In Settlement and subsistence along the Lower Chaco River, edited by Charles A. Reher. Albuquerque: University of New Mexico Press.

Sharrock, Floyd W.
1966 Prehistoric occupation patterns in southwest Wyoming and cultural relationships with the Great Basin and Plains culture areas. University of Utah Anthropological Papers, No. 77.

Sheets, Payson D.
1973 Edge abrasion during biface manufacture. American Antiquity 38(2): 215-218.

Steidtmann, J.R.
1973 Ice and snow in eolian sand dunes of southwestern Wyoming. Science 179, 796-799.

Tixier, J.
1974 Glossary for the description of stone tools with special reference to the Epipaleolithic of the Maghreb. Newsletter of Lithic Technology: Special Publication, No. 1.

Treat, Patricia A.
1978 Archeological investigations in Lincoln and Sweetwater Counties, Wyoming. Paper presented at the Twenty-sixth Plains Anthropoligical Conference at Denver, Colorado. November, 1978.

Wheeler, Richard P.
1954 Two new projectile point types: Duncan and Hanna points. Plains Anthropologist 1(1):7-14.

Wolfbauer, Claudia A.
1973 Criteria for recognizing paleoenvironments in a playa-lake complex: the Green River Formation of Wyoming. Wyoming Geological Association Guidebook, Twenty-fifth Annual Field Conference Publication, pp. 87-91.

Young, Jack F. and Paul C. Singleton
1977 Wyoming general soil map. University of Wyoming Agricultural Experiment Station, Research Journal 117.

Zeimens, George, Danny Walker, Thomas K. Larson, John Albanese, and George W. Gill
1979 The Dunlap-McMurray Burial (48 NA 67), Natrona County, Wyoming. Wyoming Archeologist 21 (4): 15-40.

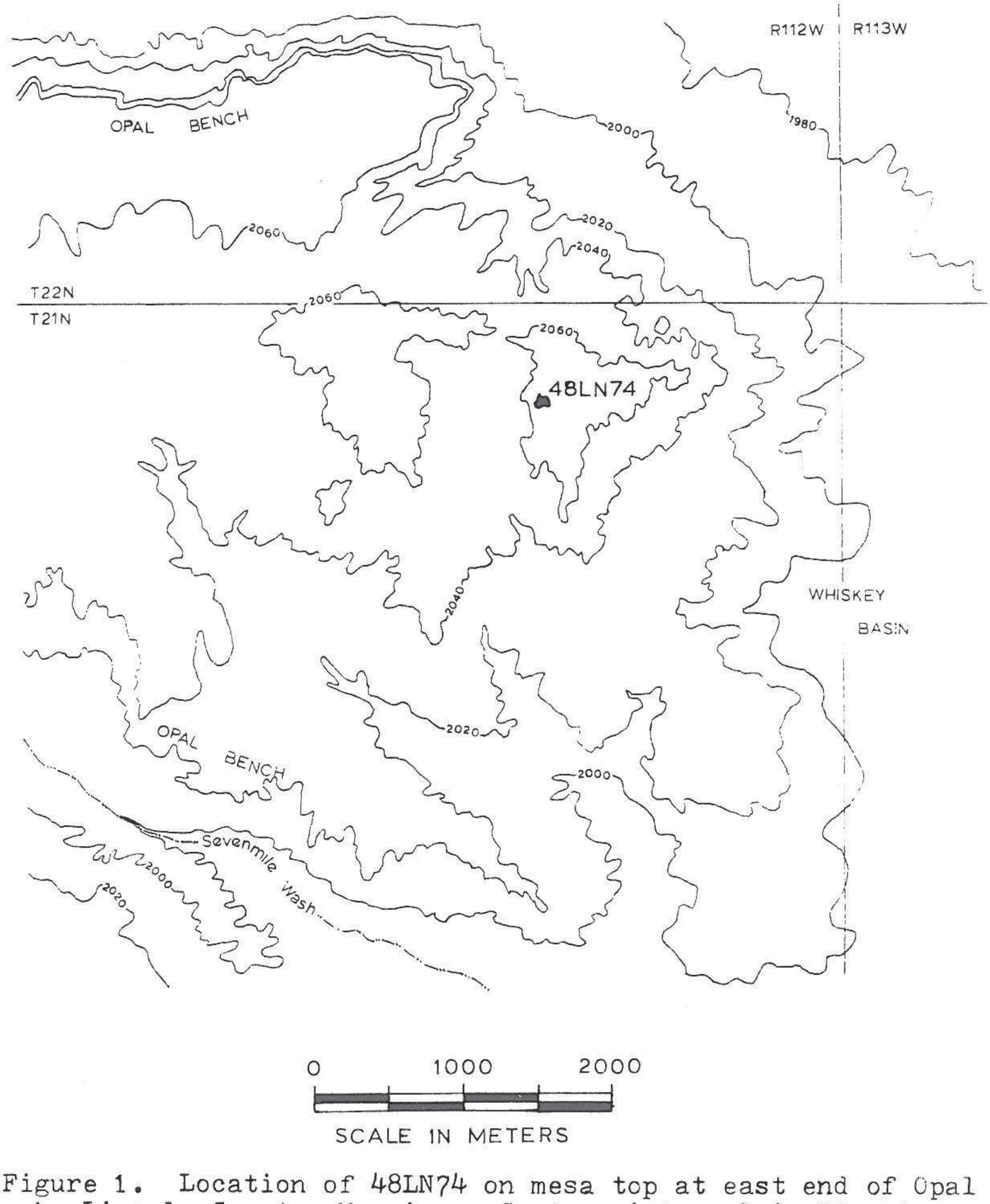

Figure 1. Location of 48LN74 on mesa top at east end of Opal Bench, Lincoln County, Wyoming. Contour interval is 20 meters (65.6 feet). Reduced from U.S.G.S. "Fontenelle SE" (1969).

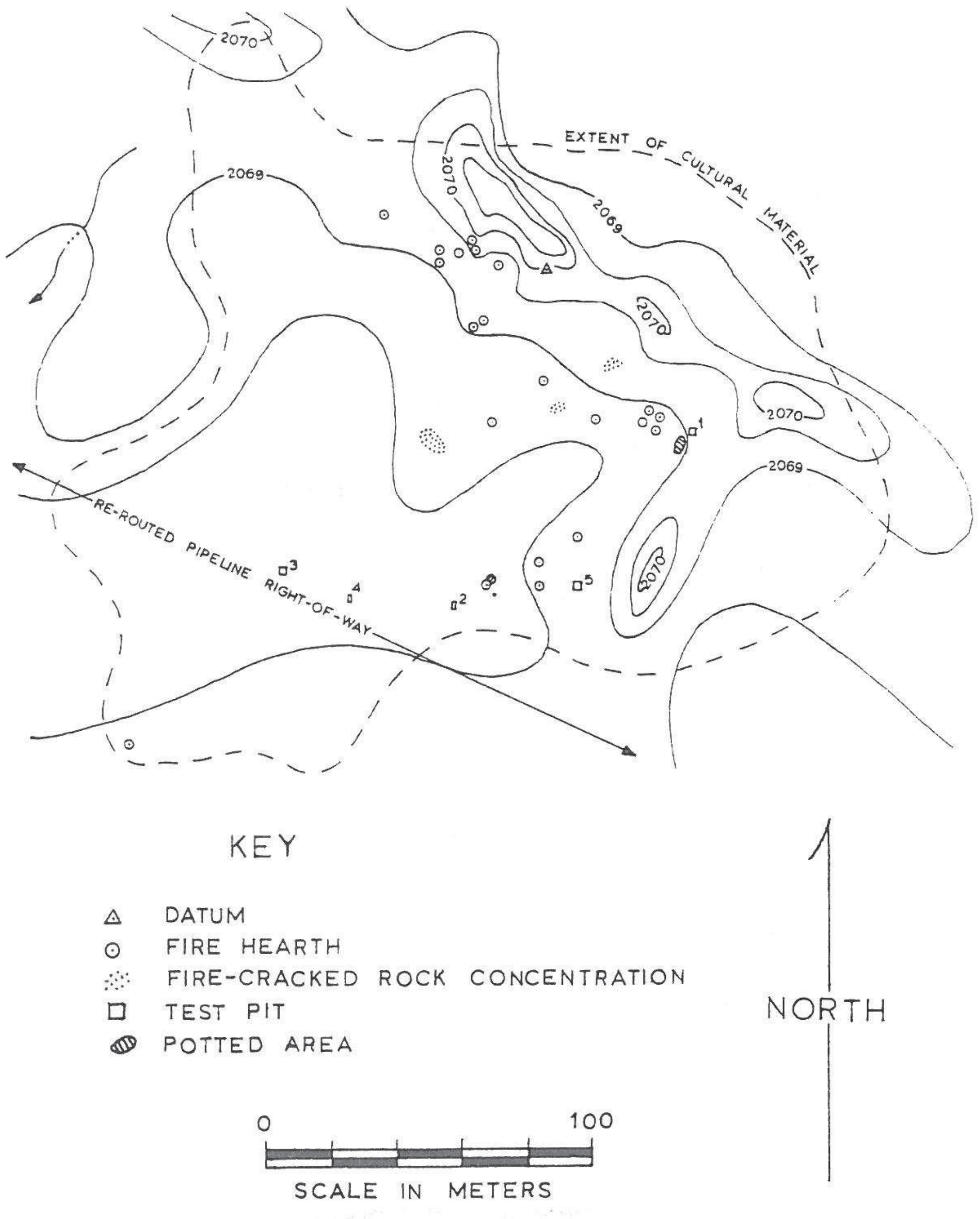

Figure 2. Topographic site map of 48LN74, Lincoln County, Wyoming. Contour interval is 0.5 meter (1.6 feet). Reduced from plane table site map (Brown 1978b: Fig. 4, p. 61).

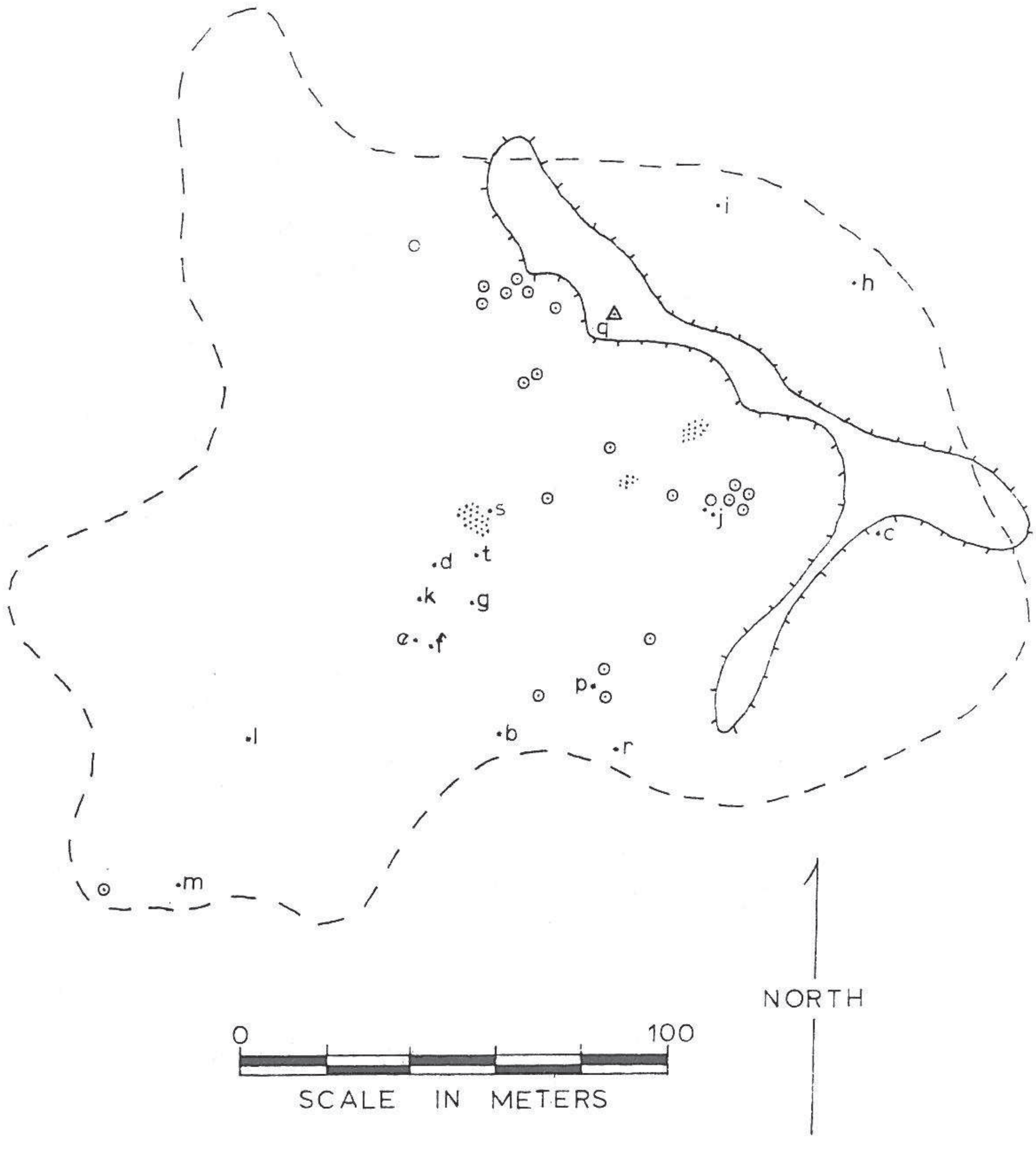

Figure 3. Proveniences of projectile points on site surface at 48LN74. Letter designations are keyed to Plate 1. See key on Figure 2 for additional symbols.

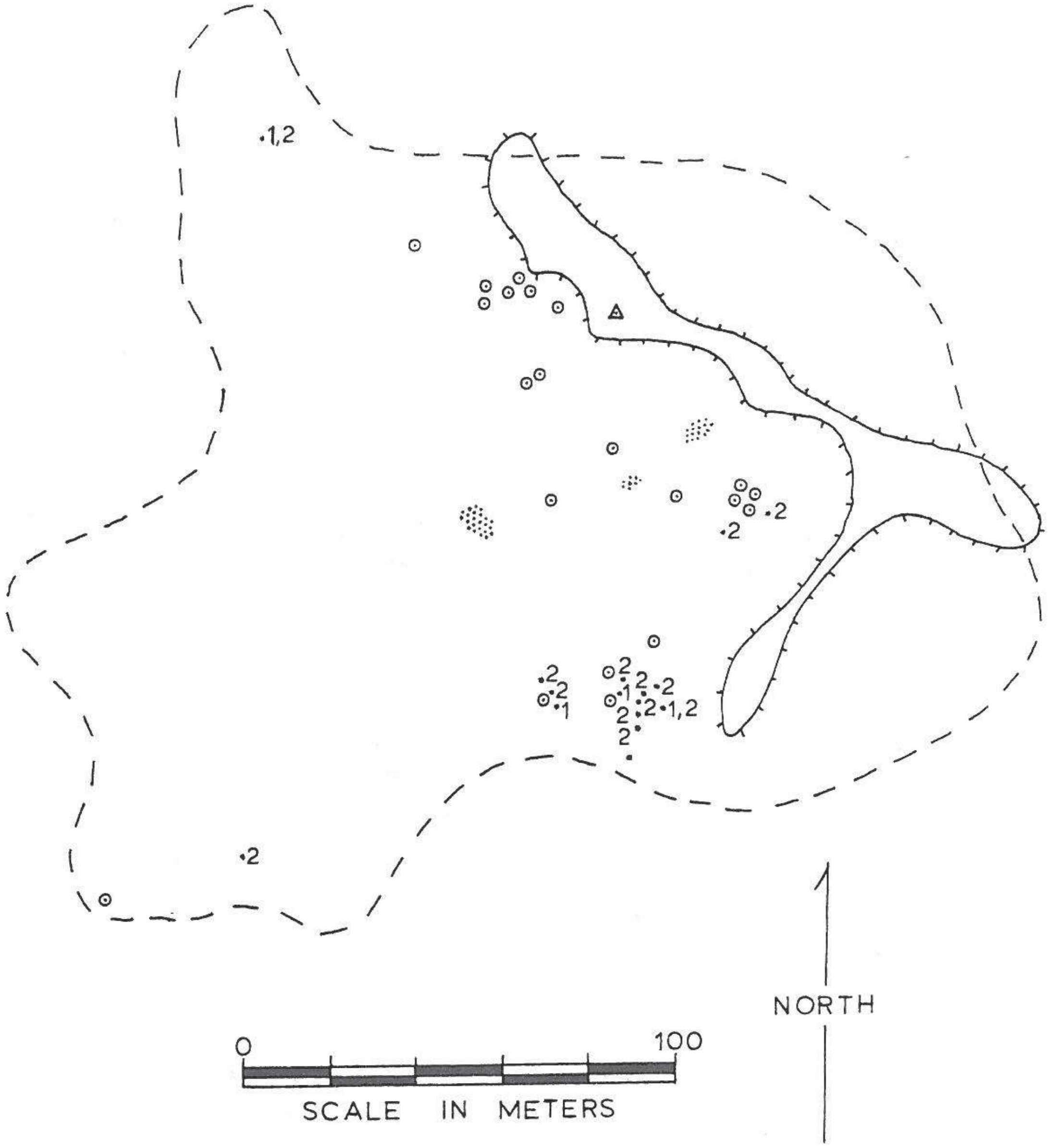

Figure 4. Proveniences of ground stone artifacts on site surface at 48LN74. Number one represents mano fragments, two represents metate fragments. See key on Figure 2 for additional symbols.

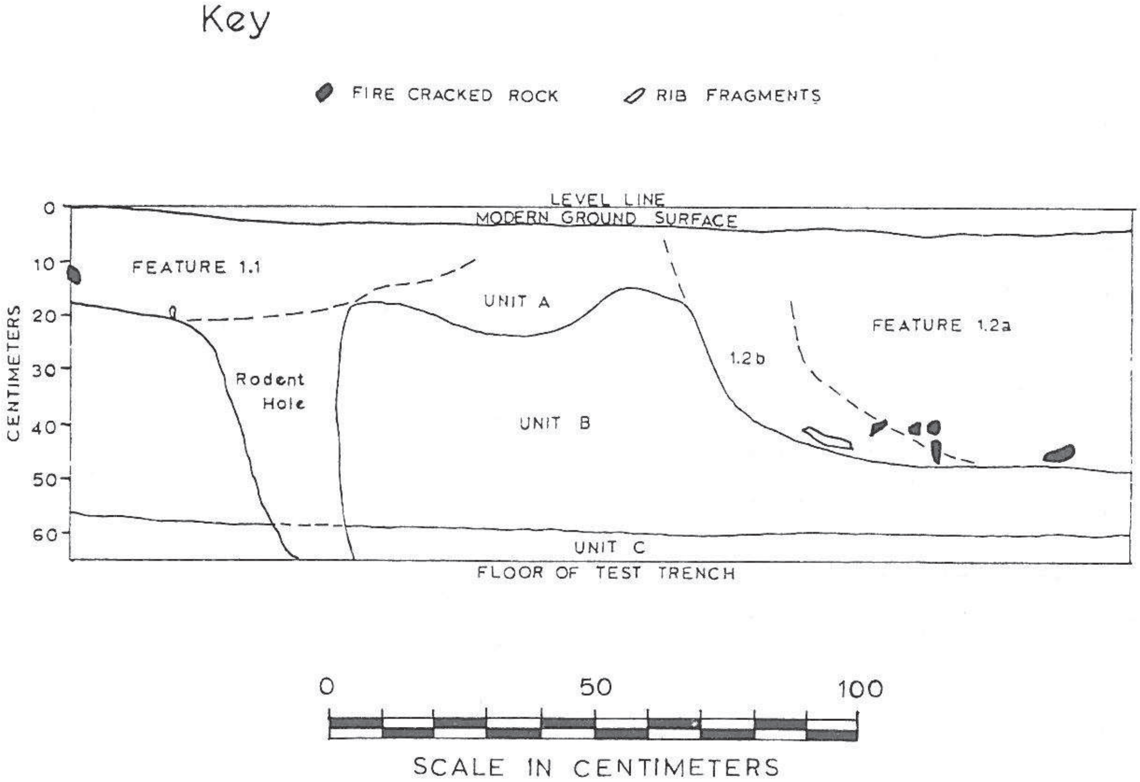

Figure 5. Profile of east wall, Test Pit #1 at 48LN74. Features 1.2b and 1.1 were dug into stratigraphic unit B. Feature 1.2a was re-excavated into 1.2b.

Both strata A and B consist of medium coarse angular, yellowish-brown sand with no micro-stratigraphy visible in profile or observable during excavation. Division between the two units is based on deteriorated charcoal staining most of the upper stratum. Both layers contain cultural deposits. Stratigraphic unit C is compacted, silty, and sterile.

	Quartzite	Opal Bench Fossiliferous Chert	Church Buttes Chert	Miscellaneous Opaque Chert	Whiskey Buttes Stromatolitic Chert	Miscellaneous Stromatolitic Chert	Semi-Translucent Chert	Moss Agate	Chalcedony	Green River Pebble Obsidian	Miscellaneous Obsidian	TOTAL
Primary Decortication Flake	24	4		9			3					40
Secondary Decortication Flake	60	190	5	38	7	2	29	3	11	3		348
Core Preparation/Rejuvenation Flake	4	112	3	7	6	3	15		3		3	156
Core Reduction Flake/Blade	38	251	12	18	21	7	15	4	3		2	371
Shatter	39	46	4	4	6			1			2	102
Unifacial Reduction Flake		3										3
Bifacial Reduction Flake	6	202	12	46	6	5	43	4	12			336
Retouch Flake	1	40	4	16	1	2	36		7		1	108
Unifacial Re-sharpening Flake		2										2
Bifacial Re-sharpening Flake		23		8			4		3			38
Undiagnostic Debitage	108	711	28	89	16	11	58	8	11		3	1043
TOTAL	280	1584	68	235	63	30	203	20	50	3	11	2547

Table 1. Typological data for excavated debitage from Test Pit #1 (0 - 65 cm below ground surface) tabulated by debitage type and raw lithic material.

	Quartzite	Opal Bench Fossiliferous Chert	Church Buttes Chert	Miscellaneous Opaque Chert	Whiskey Buttes Stromatolitic Chert	Miscellaneous Stromatolitic Chert	Semi-Translucent Chert	Moss Agate	Chalcedony	Green River Pebble Obsidian	Miscellaneous Obsidian	TOTAL
Core Tool		1	1	1								3
Chopper/Pounder	8											8
Flake Tool	10	49	5	10	1		1	1	1	7	3	88
Retouched Flake	2						1					3
Bifacial Blank	5	4			1		1	1				12
Preform		3					3		1			7
Biface	7	12		6		1	2	1				29
Projectile Point	3			4			3		3		1	14
Graver		2										2
Perforator		3										3
Side Scraper	2											2
TOTAL	37	74	6	21	2	1	11	3	5	7	4	171

Table 2. Flaked stone tools from 48LN74 tabulated by tool type and raw lithic material (excavated and surface samples combined).

	Quartzite	Opal Bench Fossiliferous Chert	Church Buttes Chert	Green River Pebble Obsidian	Meta-Sandstone	TOTAL
Tested Lithic Material	5	4				9
Core	15	11	1	2		29
Hammerstone	2				1	3
Abrader	1					1
Mano Fragment					7	7
Metate Fragment					15	15
TOTAL	23	15	1	2	23	64

Table 3. Additional stone tools from 48LN74 (see Table 2) tabulated by tool type and raw material type (excavated and surface samples combined).

	Number of Specimens	Percentage of Sample
Primary Decortication Flake	40	2.7
Secondary Decortication Flake	348	23.1
Core Preparation/Rejuvenation Flake	156	10.4
Core Reduction Flake/Blade	371	24.7
Shatter	102	6.8
Unifacial Reduction Flake	3	0.2
Bifacial Reduction Flake	336	22.3
Retouch Flake	108	7.2
Unifacial Re-Sharpening Flake	2	0.1
Bifacial Re-Sharpening Flake	38	2.5
TOTAL	1,504	100.0

Table 4. Frequency of debitage types in analyzed sample excavated from Test Pit #1 (cf. Table 1).

	Number of Specimens	Percentage of Samples
Quartzite	172	11.4
Opal Bench Fossiliferous Chert	873	58.1
Church Buttes Chert	40	2.7
Miscellaneous Opaque Chert	146	9.7
Whiskey Buttes Stromatolitic Chert	47	3.1
Miscellaneous Stromatolitic Chert	19	1.3
Semi-Translucent Chert	145	9.6
Moss Agate	12	0.8
Chalcedony	39	2.6
Green River Pebble Obsidian	3	0.2
Miscellaneous Obsidian	8	0.5
TOTAL	1,504	100.0

Table 5. Frequency of raw lithic material in analyzed debitage sample from Test Pit #1 (cf. Table 1).

	Number of Specimens	Percentage of Samples
Quartzite	60	28.3
Opal Bench Fossiliferous Chert	89	42.0
Church Buttes Chert	7	3.3
Miscellaneous Opaque Chert	21	9.9
Whiskey Buttes Stromatolitic Chert	2	1.0
Miscellaneous Stromatolitic Chert	1	0.5
Semi-Translucent Chert	11	5.2
Moss Agate	3	1.4
Chalcedony	5	2.3
Green River Pebble Obsidian	9	4.2
Miscellaneous Obsidian	4	1.9
TOTAL	212	100.0

Table 6. Frequency of raw lithic material in flaked stone tool sample from 48LN74 (cf. Table 2).

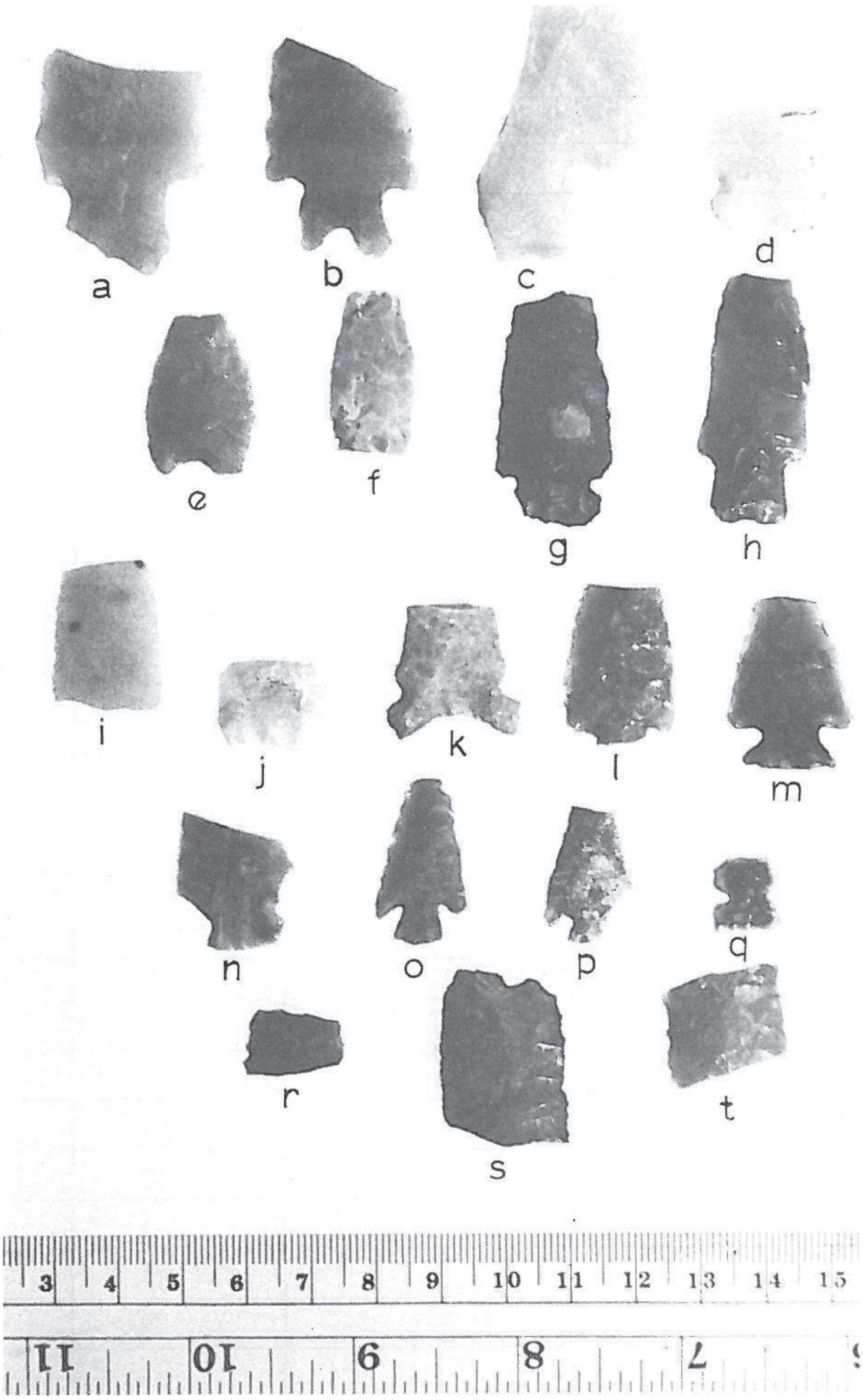

Plate 1. Projectile points. Specimen "a" was surface collected at dune camp near 48LN74; "b" is from lithic scatter on slope 75 meters west of 48LN74; the other 18 points are from the surface collection at 48LN74.

Plate 2. Chert knife broken during re-sharpening. Three re-sharpening flake scars are superimposed over the dulled edge. The flake scar at left has been matched with a re-sharpening flake excavated in the same stratigraphic level (Test Pit #1). The biface fragment was apparently amputated from the knife by end shock during re-sharpening of the opposite blade margin.

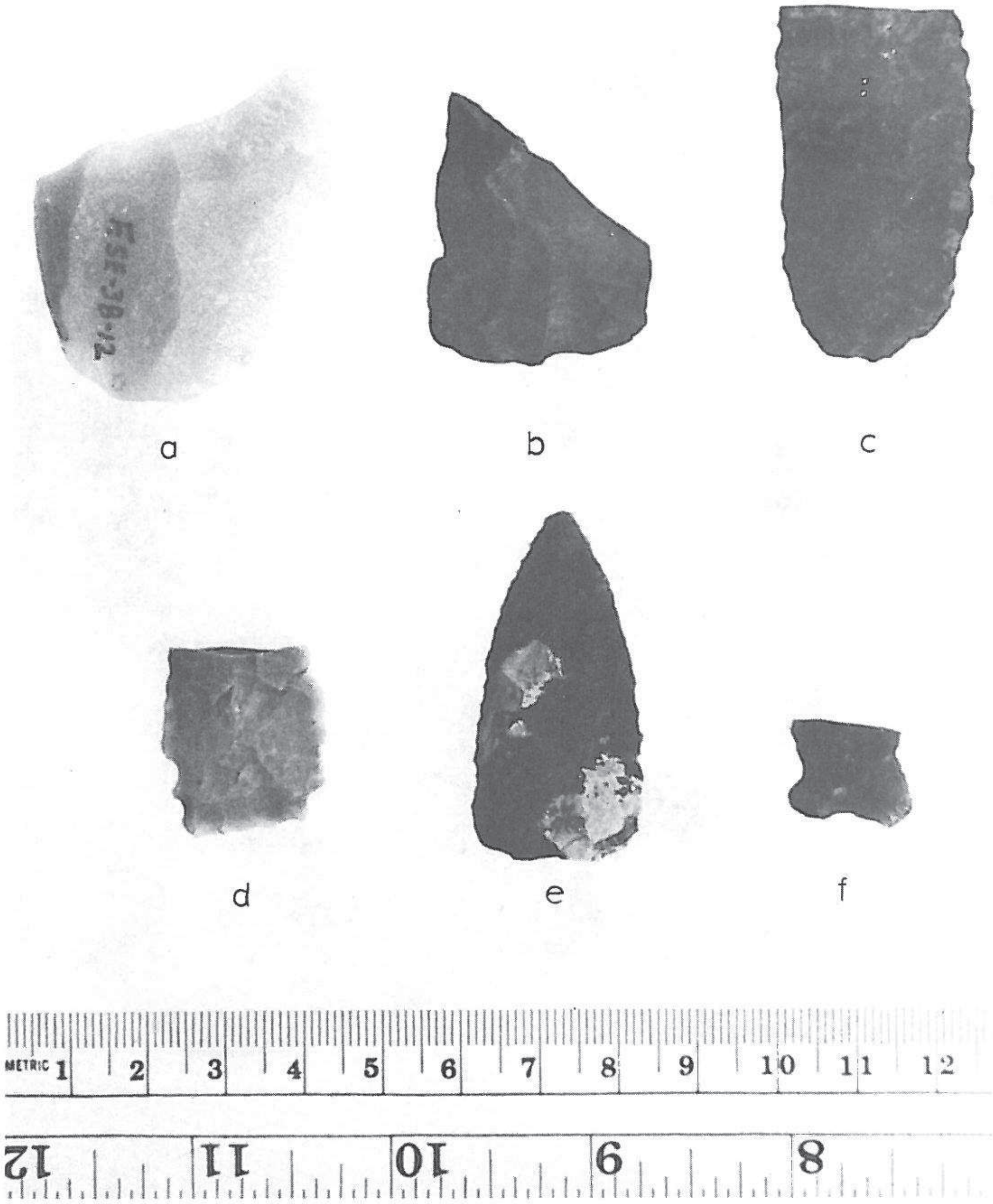

Plate 3. Bifacial reduction techniques on flake blanks. Specimens "a" and "b" are bifacially retouched blanks from 48LN74; "c" is a knife preform from Test Pit #1 which was matched with associated thinning flakes (note remnant platform at right side of base); "d" is a projectile point preform from site 400 meters west of 48LN74; "e" and "f" are preforms from 48LN74. Specimen "a" is quartzite, others are chert.

Plate 4. Flaked stone tools from 48LN74. Specimen "a" is a quartzite side scraper collected on site surface; remaining three tools are chert perforators from Test Pit #1.

Plate 5. Quartzite cobble tool from 48LN74. Bidirectionally flaked working edge (top) and unflaked battering edge (bottom) at opposite ends of the cobble.