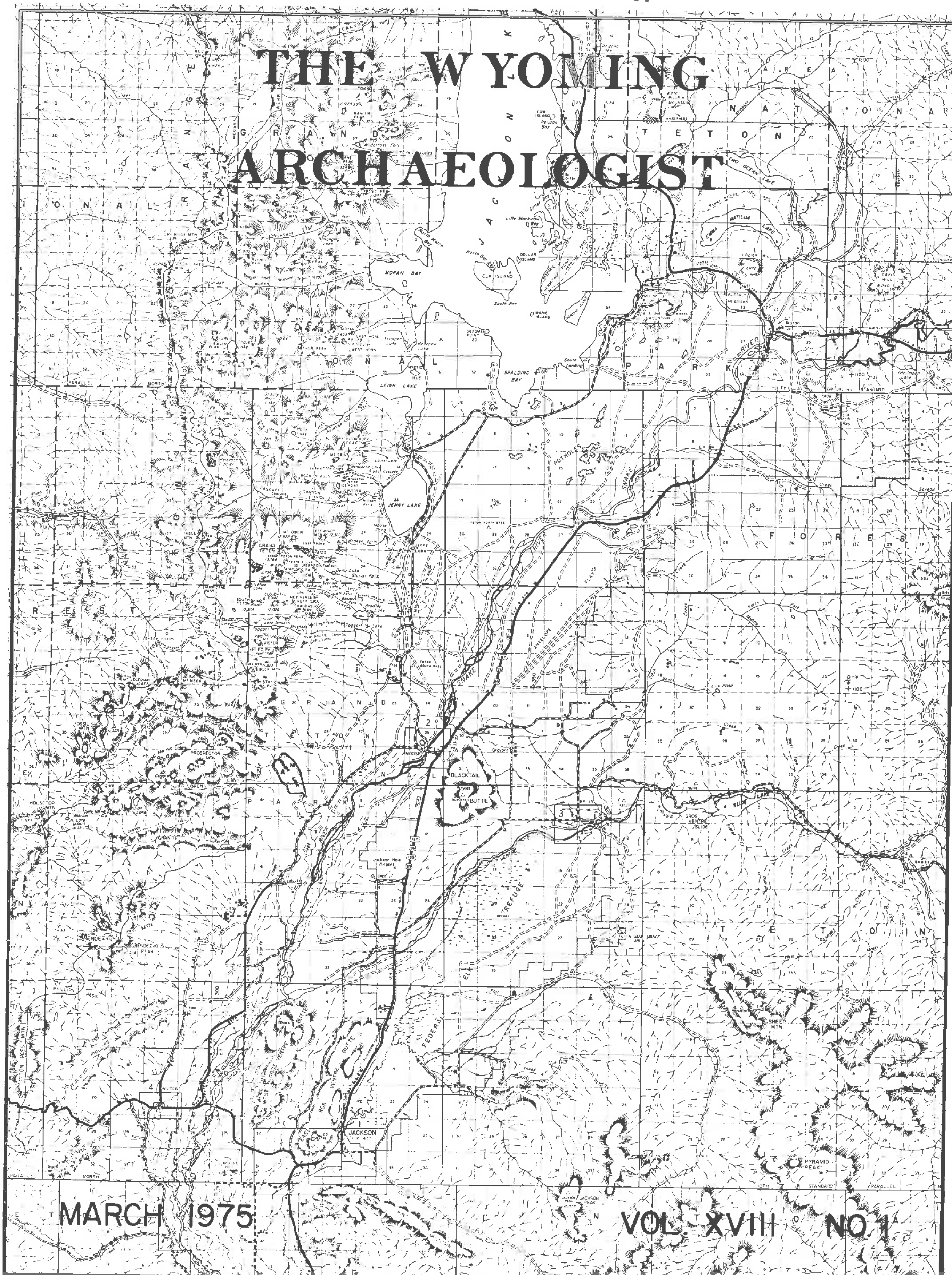
THE WYOMING ARCHAEOLOGIST



MARCH 1975 VOL. XVIII NO. 1

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EDITOR'S NOTES

A most delightful anthology was received from Schocker Books, 200 Madison Avenue, New York 10016 who publish paper backs on Archaeology. Titled Conquistadors Without Swords, by Leo Deuel, 645 pp, price $7.50 paper. Beginning in Peru, with original narrative by Alexander Von Humbolt, the book moves northward to the Isthmus, the Mexican plateau, Mayaland, North America proper, and finally to Polar regions. Prefacing each area selected is an essay devoted to background and interpretation, followed by the dramatic, eye witness story by the first discoverer. These narratives, chosen for their intrinsic importance and secondly for readability, give a very vivid and coherent story of Indian America.

Unlike the Old World where written records added so much information to archaeological research, tne New World, sealed off by vast oceans from the main stream of mankind and lacking these written records, is having to write its archaeological history with the spade and trowel. Never before the Conquistadors had entire civilizations so suddenly and wantonly been destroyed. Thus the New World archaeologists are the new conquistadors without swords.

Leo Deuel, born of Swiss parentage, has lived in Europe, Australia, Latin America and the Near East. He holds a masters degree from Columbia and a Ph.D (Philosophy) from Zunich. You will be interested in reading his previous book Testaments of Time concerning the fascinating search for lost manuscripts and records.

AN ARCHAEOLOGICAL SURVEY OF THE JACKSON HOLE REGION, WYOMING

by

CHARLES M. LOVE

A Thesis

Submitted to the Department

of Anthropology and the

Graduate School of the University of Wyoming

in Partial Fulfillment of Requirements for the Degree of

Master of Arts

University of Wyoming

Laramie, Wyoming

July, 1972

ABSTRACT

LOVE, CHARLES M., An Archaeological Survey of the Jackson Hole Region Wyoming, M.A., Anthropology, July, 1972

An archaeological survey of the Jackson Hole Region in northwestern Wyoming reveals about 9,000 years of probable seasonal habitation at elevations from 6,000 to 11,000 feet. Local climate and recent geological events including glaciation, faulting, loess deposition and development of terraces have been significant determiners of site locations. A number of obsidian and ignimbrite quarries were located and several others are postulated. At least four steatite localities were utilized. The funneling effect of mountain passes on game may provide a procurement method for subsistence at high elevations. A mixed economy was probably most prevalent with perhaps some emphasis on bison and other large game animals. Prehistoric travel routes through the region are manifest, and direction of population movement along them seems determinable.

ACKNOWLEDGEMENTS

I would like to express my appreciation to the Personnel of Grand Teton National Park, Teton National Forest, and the National Elk Refuge for permission to collect samples, to travel in restricted areas, and for cooperation in other aspects of the survey. Special gratitude is due to Mr. W. C. "Slim" Lawrence, Mr. Otto Nelson, Mr. Wesley Goetz, and Grand Teton National Park for opening up their collections for study. Without having gone out personally with Mr. Nelson and Mr. Goetz, the sections on the Gros Ventre and National Elk Refuge areas would have been greatly reduced. My greatest and most heartfelt thanks goes to my wife Karen and some thirteen unpaid friends who at different times were nearly broken under overburdened packs in order to bring materials out for study.

I am appreciative of Dr. William Mulloy, Dr. George Gill, Dr. Brainert Mears, and Dr. Gary Wright for critically reviewing the manuscript. Special thanks is due my thesis and graduate advisor Dr. George Frison, for not only carefully reviewing the thesis but for his guidance throughout my graduate program. I am indebted most to my father, Dr. John David Love, whose exploratory and curious nature has implanted the seeds of inspiration for this and other projects. A number of site locations and collections have come from him.

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CHAPTER I

INTRODUCTION

Located immediately south of Yellowstone National Park in Wyoming, Jackson Hole is a north-south flat-bottomed valley some 50 miles long and up to 15 miles wide. The startling, fault-block Teton Range borders the entire length of the valley on the west and the smooth alluvial valley floor gently tilts toward it. The rolling Mount Leidy Highlands and Gros Ventre Range quickly rise on the east and southeast respectively. To the northeast lie the Pinyon Peak Highlands, the Washakie Range, and beyond them the layered, volcanic Absaroka Range. Jackson Hole pinches down into the Snake River Canyon to the south, where the latter river has been superimposed across the Snake River Range (Fig. 1). The elevation of the valley floor slopes evenly from 6,000 feet at the south end to 6,800 feet at the north end. This plain is broken in several places by lumpy buttes, rising up to 1,200 feet above it and affording excellent views of the valley. The converse of these seems to be a fault trough underlying the north central part of Jackson Lake.

The surrounding mountainous elevations vary considerably, though the lowest natural passes for even questionable access routes to the valley are the nearly 8,000 foot Hoback Rim and the 7,500 foot Taylor Creek divide. Precluding the rugged Snake River Canyon, all other access routes are passes between 8,000 and 10,000 feet. Much of the mountainous country is above an approximate 10,500 foot timberline. Jackson Hole then, is effectively ringed by mountains, which would tend to concentrate regular prehistoric population movements into the area through the lowest and/or most advantageous passes.

Perspective

The primary reason for the choice of this particular survey area is that previously there has been no systematic archaeological investigations of any kind within it. Local collections for the most part are small and from a very few specified sites known to the public. The study area is large and both flat and mountainous, and presents more than the usual logistical challenge for local collectors. As a result, time-depth knowledge of prehistoric occupation of the region has been almost nil.

A second reason, enhancing the importance of the first, is that the Jackson Hole area was sparcely and permanently settled rather late, the town of Jackson incorporating in 1920. At present there are still a few of the second generation white settlers living in the valley, and the writer was fortunate to have enlisted their aid and cooperation in this survey. Their knowledge of the valley and surrounding mountains is especially important because public travel in the study area was

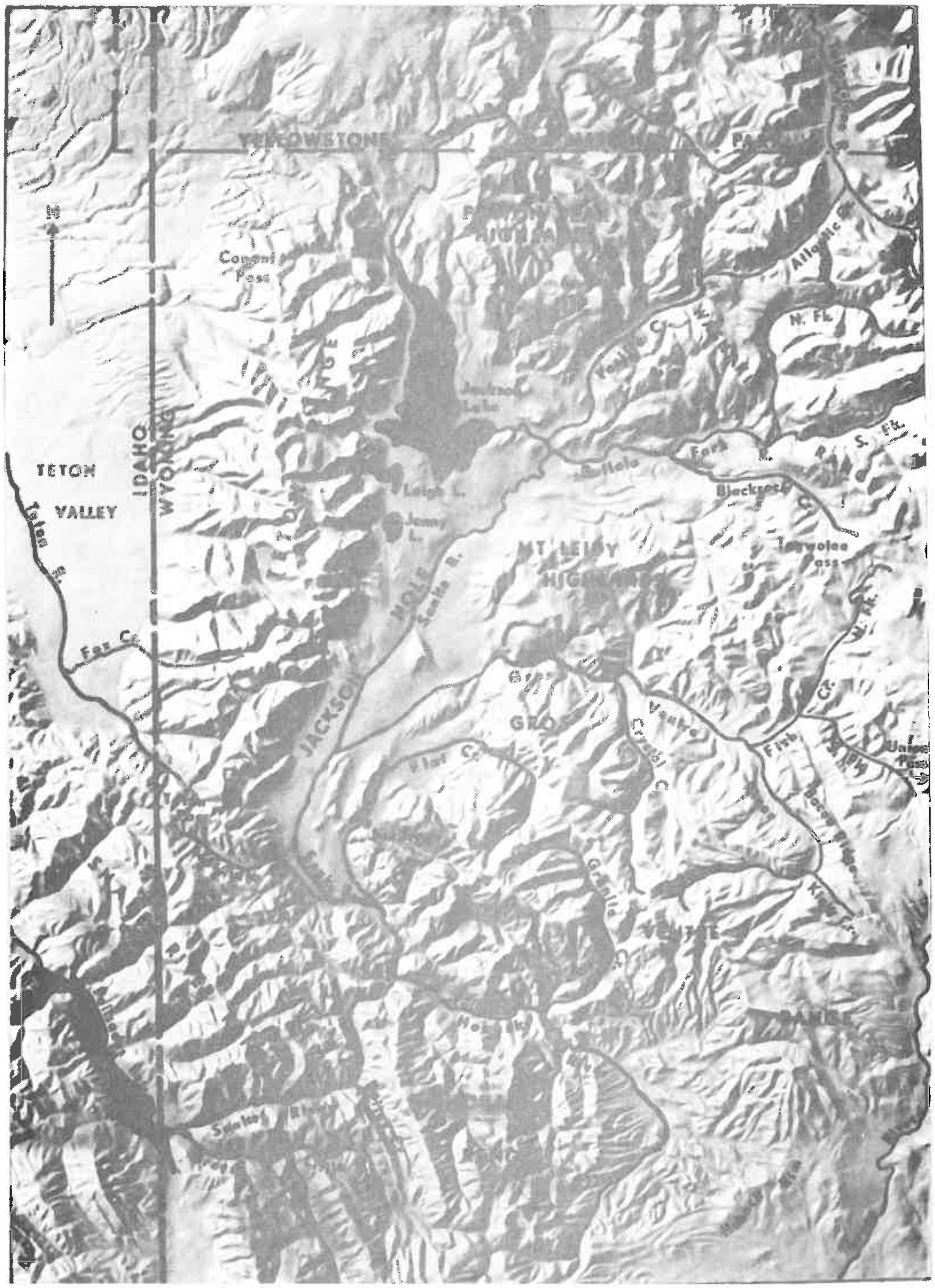


Figure 1. The archaeological survey area in northwestern Wyoming.

restricted at an early date. In 1929 the forerunner of Grand Teton National Monument was formed and effectively limited access to the Teton Range and the western part of the valley floor. Most of the remaining flat-lands were annexed when the national monument became a national park in 1950. A large segment of the southeastern part of Jackson Hole was further removed from public consumption between 1913 and 1927 by the accumulative formation of the National Elk Refuge. Teton National Forest borders Jackson Hole on the north, east and south. Targhee National Forest abuts Grand Teton National Park on the west and Teton National Forest on the north and south (Fig. 2). The revolving administrations of these federal lands has tended to prevent cumulative archaeological information from forming within each of their respective jurisdictions. Private land constitutes less than 4% of Teton County and its concentration and population is located primarily in the southern end of Jackson Hole. Outlying ranches exist in Grand Teton National Park, both national forests, and along the Buffalo Fork and Gros Ventre Rivers. Thus the information available from the "old timers" is most important because of their experience and travel throughout the area prior to federal control.

The third reason for this survey is that the Jackson Hole - Teton area has become an increasingly high-use region for the nation's tourists (Grand Teton National Park recorded over 3 million visitors in 1971). Pressure for facilities to accommodate these people both on and off federal lands is growing with the usual developmental results. Since previous public and federal archaeological awareness has been slight, much stands to be lost without a systematic collection and analysis of site locations.

The writer's purpose is not only to survey the descirbed area but to relate the site locations, quarried materials, prehistoric access, and flora and fauna to the "recent" geology and resultant topography. Geological events have proceeded at a rapid pace throughout the region, and so much datable activity has taken place in the last 20,000 years that early inhabitants certainly would have been both directly and indirectly affected by these events.

Two major assumptions have been made. The first of these is that prehistoric occupation of the region was seasonal. The reasoning behind this would be discussed under climatic considerations. The second assumption is that prehistoric populations on foot would travel most frequently into, out of, or through this region by the easiest topographical routes. Travel along these routes might be affected by seasonal weather, quarriable materials, game availability, and physiographic barriers.

Geology

Of particular interest are some of the major geologic events forming the past and present Jackson Hole topography. While the mountains to the south, east, and northeast are quite a bit older in their initial formation, the Teton block began rising

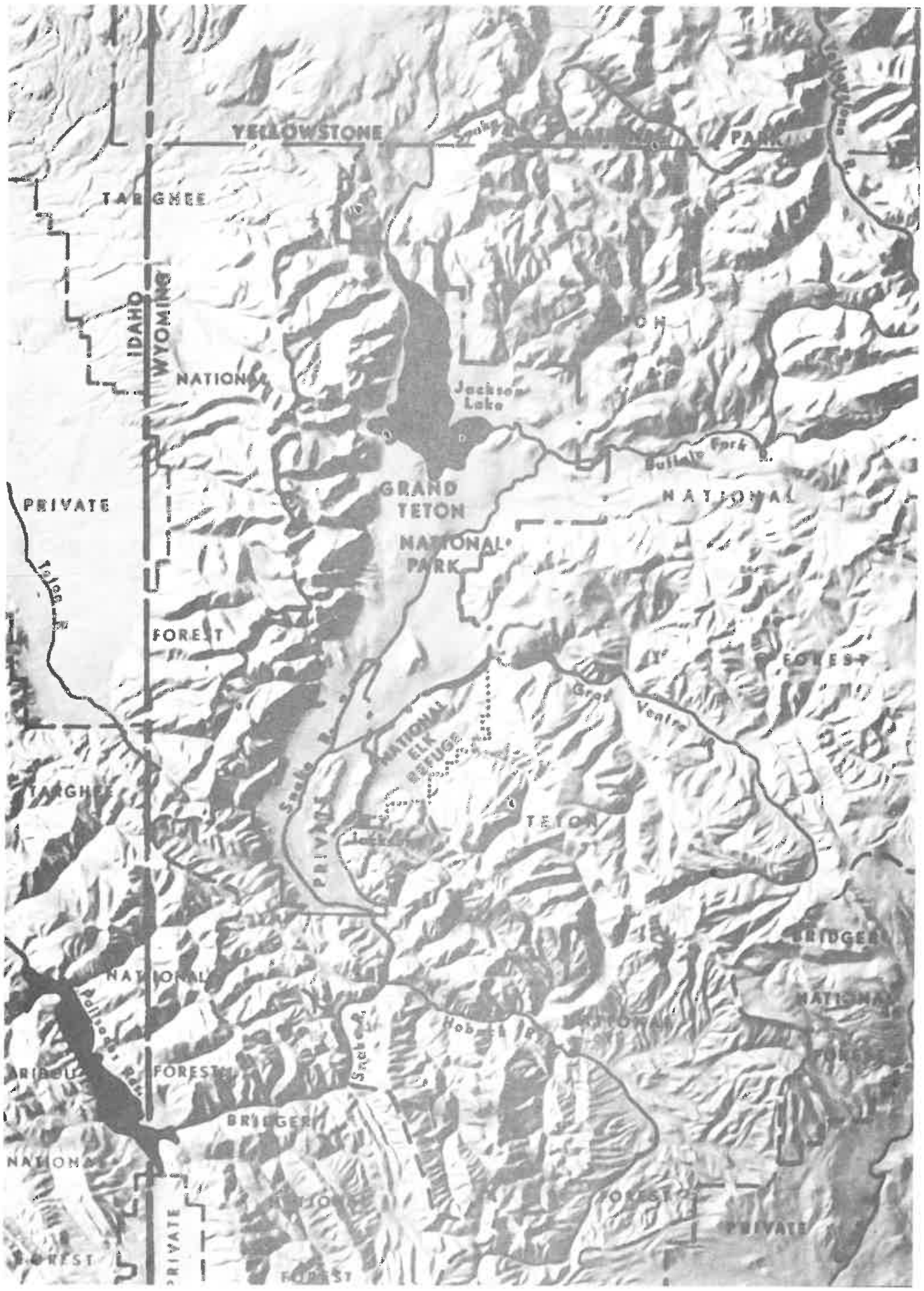


Figure 2. Land ownership in the survey area.

in Pliocene times (Love 1956) and has continued to do so. Simultaneously the floor of Jackson Hole has down-dropped and tilted towards the west, the eastern "hinge line" running along the foot of the bordering eastern mountains. Pliocene and Pleistocene volcanic extrusions in the Yellowstone area intermittently reached the Teton Range, enveloping the extreme northern end. Some of the flows on the west flank of the Tetons ultimately reached the southern end of Teton Valley. Outwash from glacial maxima and other streams have brought vast amounts of Cretaceous-derived quartzite gravel into Jackson Hole. This deposited gravel forms the valley floor plain at nearly the gradient of the major drainage, the Snake River.

From about 19,000 B.P. to 13,000 B.P. loess was blown in from the west (Love 1965) and deposited over most of the region in an uneven blanket up to 50 feet thick. Smaller amounts of loess have been deposited since. While slope wash and active stream erosion have eliminated specific parts of this loess cover, the last glacial maxima of the Pinedale provided for its general demise on the valley floor. This last "ice age" saw mountain glaciers advance to the floor of Jackson Hole for the final time from several canyons in the Teton Range. A major ice mass coalesced from several valley glaciers in the north end of the range and collectively filled up and scoured out the Jackson Lake basin. The farthest advance formed the Burned Ridge Moraine, and in retreatint to the present Jackson Lake shore, left a region known as the potholes. Snails from pond deposits overrun by a momentary ice advance at this Jackson Lake Moraine date about 9,000 B.P. (Love 1965). Outwash streams from the Jackson Lake Moraine progressively shifted from the southwest near the Tetons toward the present outlet of the lake on the east, due to an apparent "sag" in the floor of Jackson Hole near the present mouth of the Buffalo Fork River. These migrating meltwater channels destroyed most of the loess cover west of the present Snake River. Several other Teton-originating glaciers formed semi-circular moraines with enclosed lakes on the floor of Jackson Hole. By contrast, glaciers never reached the flats from the Gros Ventre Range to the southeast, and no glaciers apparently formed in the Mount Leidy Highlands. Instead, five or six large alluvial fans were actively developed at the mouths of the eastern drainages which destroyed or covered much of the loess remaining on the eartern floor. These major fans nearly overlap, and are largely characterized by dense, hard, quartzite cobbles with little or no surface soil development. The quartzite cobbles have been eroded from several conglomerate formations located to the north and east.

Only two terrace studies have been made in Jackson Hole to date and both of these have dealt with the Snake River only (Love 1956; Walker 1964). Three major terraces characterize the banks of the Snake for much of its length south of Jackson Lake. Near the Burned Ridge Moraine they cut through more than 200 feet of glacial outwash, while in southern Jackson Hole, less than 25 feet is all that remains of the middle terrace. The dates on the terraces of the Snake appear to be related to the waning stages of the last Pinedale ice advance onto the valley floor. The highest terrace (T 3) emanates from the edge of the Burned Ridge Moraine. This then dates the build up of the maximum outwash plain at sometime post loess deposition but pre 7,000 B.C. As the ice receded to the position of the Jackson Lake Moraine, the outwash plain beyond the Burned Ridge Moraine was cut into by the river, forming what is now the highest terrace. As the ice receded further and the Jackson Lake Moraine was breeched by the Snake, potential for a new base level caused the cutting of the second terrace (T 2). As the ice melted from the Jackson Lake basin, the upper Snake River and several Teton tributaries passed into Jackson Lake and emanated essentially load-free. The continued down cutting would have been facilitated by the high stream volume coupled with a lack of stream load. This seems to have diluted the Buffalo Fork and Gros Ventre Rivers enough to enable down cutting to take place. The conclusion is therefore the formation of T 2 has taken place since the Jackson Lake Moraine was breeched, that is, since 7,000 B.C.

The lowest or 10 foot terrance (T 1) as reported by Walker (1964) may be related to the Temple Lake glaciation. Again, continued down cutting would have been facilitated by an increase in stream volume with a lack of stream load.

Lastly a terrace higher than T 3 does exist south of Blacktail Butte, but its origins may not be related to the Snake River cycles. This will be discussed under recent faulting.

Other terraces exist on the Buffalo Fork and Gros Ventre Rivers, and a variety of smaller stream courses. No detailed work has been accomplished fixing the various dates of formation. These other stream courses with terraces emanate primarily from mountains bordering Jackson Hole on the east. Archaeologically all of these terraces have tremendous dating and time-depth potential.

The present stream pattern on the valley floor appears to be actively adjusting to current crustal movements. The afore-mentioned sag at the conjunction of the Buffalo Fork and Snake Rivers has caused huge meanders in the Snake in that area. While all other valley floor streams flow in a south or southwest direction, Spread Creek flows northwest off its huge alluvial fan towards that sag. The Gros Ventre River in central Jackson Hole may be flowing along a shallow graben between Blacktail Butte on the north and some low white hills on the south. There is growing evidence that the highest apparent river terraces here are actually fault scarps. Loess covers this terrace to depths of over 20 feet in some places. More will be said about this terrace later. Prior to the possible graben, the Gros Ventre River may have detoured around the north end of Blacktail Butte on its way to the Snake.

North of Jackson, a 200 foot scarp which cuts the 13,000 year old loess has caused Flat Creek to be diverted southward so that it does not meet the Snake River for 15 miles. The rerouting was also partially blocked by the Cache Creek alluvial fan, and a large cattail swamp and fertile lowlands was formed. The diverting fault scarp and nearby Miller Butte provide superb vantage points.

The main Teton fault system has also been active with displacements cutting the recent glacial debris by as much as 200 feet. The southern two thirds of the valley floor is tilting westward at a rapid enough rate to cause the entire Snake River floodplain to shift westward. The streams reaching the flats from the Tetons in this area are lower than the Snake River and flow parallel to it for as much as 10 or 15 miles before joining. They are never more than two miles away from the Snake for the entire length of their valley course. At present, dikes prevent the Snake River from migrating towards the lowest part of the valley.

In the southern end of the valley, the Hoback fault has been equally active, and has cut the loess and down dropped the eastern side of the valley floor over 50 feet (Love 1956; 1962). This has caused Flat Creek to remain on the east side and the Snake River to flow east to meet it.

Other lesser faults have been active throughout the region, though few if any have direct bearing on site locations. In a general way, active and inactive faults provide the loci for a multitude of springs. Some of them flow hot water.

Landslides in this active region have been the source for a series of geologic features as well as catastrophic events. A complete treatment of landslides in the Teton National Forest can be found in Bailey (1971).

A late Pleistocene landslide in the Snake River Canyon near Bailey Creek dammed such a long-lived lake that it was nearly filled with gravel before the dam eroded through. The river then cut immediately through its own fill, leaving remnants of it as a 200 to 400 foot terrace above the river in several parts. These terraces provide the largest of the few flat areas within the Snake River Canyon. Tributary streams also built deltas into the old lake, several of which are still visable and would have made excellent camp spots.

White landslides have rarely impeded the Snake and Hoback Rivers, the Gros Ventre has had more than its share. Many slow landslides have taken place throughout much of the Gros Ventre Canyon length, but only a few have been fast enough to impound lakes. A prehistoric slide several miles from the mouth of the canyon backed up a lake some 300 feet deep. Sediments from a delta built into it from a gully have been carbon dated at 5,000 years (Love, personal communication). By about 1920 a landslide had finally dammed Upper Slide Lake, which is now nearly filled with sediment. Tributaries have built a series of deltas into it. This does not appear to have been the first lake in this area, however. Dry Dallas Creek from the north had built its present delta inside a gully cut into a much older delta whose sloping surface is over 20 feet higher than the present lake level.

The well known Lower Slide Lake originated from a large landslide in 1925. Two years later the top part of the slide saturated and washed away. The resultant flood covered the Gros Ventre flood plain with fresh cobbles and debris all the way to the Snake River.

Upstream on the Gros Ventre River where it bends north (Fig. 1), the writer found varved sediments in connection with what must have once been a more active slide from either Sportsman's Ridge on the west or Bacon Ridge on the east. The present swamp at the Darwin ranch in the same area appears to be a filled lake bed, originally formed from additional slides off these two ridges. No slides appear farther upstream.

According to Bailey (1971) landslide release in all of this region cannot be correlated with climatic stages. All have been triggered by fortuitous geological circumstances. The writer feels more evidence is necessary before such a conclusion could be drawn. There is the possibility that an increase in slide activity might result from the onset of a wet climatic period. Two major slides have been dated at about 3,000 B.C.: the afore-mentioned Gros Ventre slide and one on the Yellowstone River below the town of Gardiner.

Geological Conclusions

The preceeding discussion has been a brief summary of the geological events and features which have had specific bearing on site locations in some way. Geological detail of selected sites discussed later shall take place within this broad reference. Most of the recent geology in the Jackson Hole region has yet to be studied. The primary use of geology has been an attempt to determine where sites of certain time periods could or could not exist. For example, it would be surprising to find any sites at all on the Gros Ventre floodplain due to the wash in 1927. On the other hand, if ice were on the floor of Jackson Hole about 7,000 B.C., what is the chance one would discover a Folsom point in a glaciated canyon at 9,000 feet? Remnant terraces in the steep-walled Snake River Canyon are the most reasonable places to camp at any time, provided they have been there long enough. By contrast it would be difficult to camp on the lowest terrace of the Snake prior to Temple Lake glaciation. Curiously, in no case was archaeological material found indicating an age greater than the theoretical or determined geological age of the surrounding deposits. This does not mean there were no problems, however. Specific sites yielded unusual geological questions, and these will be discussed in site context.

Climate

Jackson Hole can be considered a closed valley. The high surrounding mountains in this temperate climate impose comparatively harsh conditions upon the valley. At least two isohyetal maps have been prepared, covering most of the study area, and these agree only on a very broad scale (Carter and Green, 1963; Mundorff, et al., 1964). In both cases a pronounced rainshadow effect by the Tetons can be seen. Important is the fact that high precipitation does reach the valley floor near the base of the Tetons. This dwindles very rapidly within several miles to the east. The vast majority of the precipitation falls in the form of snow during the months between October and May, though occasional heavy spring and fall rains do occur. Scattered thundershowers are common in summer months. Extremes in temperature on the valley floor range from occasional 90s in the summer down to an occasional 40 degrees below zero or more in the winter. The mean yearly temperature is 37° F.

The valley traps cold air easily and maintains significantly colder temperatures than surrounding regions. The mean monthly temperature in the town of Jackson averages 3° F. colder than the "open" valley across the Tetons to the west, though the elevations are the same. Perhaps a more important difference lies in the number of days between significant frost temperatures during the summer. The Idaho side of the Tetons averages nearly two months (53 days) longer between frost temperatures than does Jackson Hole (U.S. Weather Bureau 1959-1969).

The high precipitation in the surrounding mountains would severely limit foot travel to Jackson Hole before May, and hinder it much beyond September. The large runoff from the deep snowpack in this area also creates extremely high levels in the major rivers, starting in May and gradually receding throughout July and August. Feasibility of prehistoric crossings of these will be discussed in the section on travel routes.

The history of climates in Jackson Hole can only be discovered through the indirect effects of it. The geologic record has yielded a climatic sequence only in a general way. Regional summaries for this section of the Rocky Mountains can be found in Richmond (1956; 1970) Love (1956; 1968). No recent pollen profiles have been made for the survey area, though the closest one has been done by Baker (1970) south of Yellowstone Lake. The climatic implications of this will be discussed under the floral section.

In two localities within the survey area, remains of trees have been found above the present timberline. It is not known whether these reflect an "altithermal". Weathering rates at high altitude are so rapid that it appears doubtful wood could survive as long as 4,000 years. No other evidence, such as buried or active caliche zones were observed. It seems probable that the effects of a slightly depressed precipitation rate might be masked in this intermontane valley by the overall normally high rainfall. The altithermal, if it existed in Jackson Hole, has left presently undiscovered evidence.

Flora

The vegetation in Jackson Hole is directly controlled by precipitation, elevation, exposure, and geology. Conclusions by previous researchers of floral zones in this area have depended upon the outlook of the observer. Loope (1971) developes a useful comparative analysis of the forest based on tree communities. A ramification of his study has tremendous potential importance for archaeology in the region, as he and Oswald (Quoted in Loope, 1971) have dated major forest fires in selected areas back as far as A.D. 1640. Houston (1968) explains several classifications of vegetation and various community zones with an eye toward moose habitat. Bailey (1971) sees four ecological zones roughly correlated with elevation. Love (1971) correlates the quality and frequency of certain species with specific rock formations or derivatives from them. Among these are specific types of berry bushes.

While most of the mountainous regions have mixed lodgepole-spruce-fir cover, the valley floor displays distinct zones depending upon the precipitation and geology. The outwash glacial gravels of most of the Jackson Hole floor are extremely porous and the low retention of rainfall allows little other than sparse grasses and sagebrush to survive. Only the river bottom lands contain extensive stands of cottonwoods, willows, and their associated shrub communities. By contrast pine communities exist on old and new valley floor moraines. These deposits are mixed with enough clays to retain the lesser moisture falling on the valley floor, and allow extensive forests to survive across Jackson Hole. The best examples of this are the lodgepole and spruce-fir forests on both the Burned Ridge and Jackson Lake moraines, and on Timbered Island, an older morainal remnant. All local moraines reaching the valley floor from the Tetons have extensive stands of pine, spruce, and/or fir, although this is largely aided by the higher rainfall nearest the mountains. Why moraines in the Gros Ventre and Flat Creek canyons are barren may be due to strong compositional differences in the glacial debris. The proportions of granitic and volcanic rocks is quite small, and the lodgepole pine and subalpine fir seem to prefer them (Loope 1971).

The lower pine timberline on the west bordering mountains is in sharp contrast to the sketchy lower timberline on the east bordering ranges. Dense stands reach the valley floor on the west, and on the east the conifers slowly become dense up to a thousand feet off the flats. This is probably due to both the sedimentary substrata and the lack of rain. In many areas aspen border the pine-spruce-fir forests. Aspen, a prime habitat for deer, is common in central and southern Jackson Hole. However, the stands thin rapidly north of the Jackson Lake moraine. Perhaps they have not had time to gain a substantial foothold.

Sagebrush may have been a recent arrival to certain parts of the valley floor. Some local residents are able to remember when primarily grass existed south and east of Blacktail Butte instead of sagebrush. Ancient irrigation ditches in the area attest to a time when the first settlers were raising hay, but it is not known whether the land was cleared of sagebrush first.

Above timberline, typical alpine flora persists. The dominant plants involve the sedge-grasses and a wide variety of high altitude flowers. Lichens and mosses are also common. Miles of meadows of these stretch over the Pliocene erosion surface in the Gros Ventre Range, making prime summer range for bighorn sheep. Much smaller and more truncated surfaces exist in parts of the Teton Range. In the survey region these are the only two mountain ranges which exhibit alpine conditions.

Most, if not all of the plants containing some edible portion which habit the Central Rockies are available in the survey area. The most common bulk foods might be the cattail and various berries. The most abundant wild berries, some in several varieties, are huckleberries and currants. Several of these occur more commonly on specific deposits or formations than on others. Notably huckleberries are partial to granitic and ghyolitic sources, and hence the various moraines and bedrock outcrops are chosen (Love 1971). Raspberries are prone to broken rock slopes of the Bighorn Dolomite and the Tensleep Sandstone. Gooseberries prefer the Tensleep Sandstone and the rhyolites (Love 1971). Starting about mid-July, gooseberries begin ripening, and other species successively ripen from that time through September.

Roots and tubers such as the elk thistle (Cirsium foliosum), and spring beauty (Claytonia lanceolata) are common, especially the latter as it follows retreating snowfields all summer. Several "watercress" varieties abound along soggy bottom lands. "Pinon" or limber pine are also available and constitute the one reported evidence of actual plant utilization by prehistoric populations. An observant local resident discovered a series of trees which were crudely chopped, then green-bent for their cones. These are located in Gunsight Notch, north of Upper Slide Lake on the Gros Ventre River. Complete and detailed lists of edible plants can be found in Craighead, Craighead, and David (1963), and in Harrington (p967).

At present very little information exists on vegetational shifts since glacial times in the survey region. Nearby, Baker (1970) has cored a pond near the southeast arm of Yellowstone Lake and discovered timberline conditions existed there for quite some time prior to 9,500 B.C. After that time the present floral concentrations have persisted with slight modifications. It may be coincidence that the two dated paleolandslides on the Yellowstone and Gros Ventre Rivers occurred at the same time spruce-fir increases are noted, ca 3,000 B.C. The spruce-fir pollen increases occur from 3,000 to 800 B.C., suggesting the moister conditions of the Temple Lake Stade. Restricted deposition occurs between 8,000 and 3,000 B.C. coupled with a high of lodgepole pine pollen concentrations. Baker (1970) feels this may be the expression of the altithermal in this area since the spruce-fir may have migrated upslope during this time.

In Jackson Hole, evidence exists that these life zones may have shifted upward a little at certain times in the past. While no data involving dating of these shifts has been collected, the evidence lies presently in the observation of dead stumps above the present nearby timberline. Of the two areas exhibiting this situation, one is on the east rim of Sheep Creek Canyon near its divide in the Gros Ventre Range. The other was reported to be on the divide southwest of Thor Peak in the Teton Range (Dudley Hayden, personal communication). Dead trees also exist above timberline in the Absaroka Range to the northeast (Love, personal communication). Again, the writer questions the survival of wood for over 4,000 years in the environment above 10,000 feet.

Fauna

Little work on the arrival of certain game species to Jackson Hole has been attempted. Geologically, all animal and fish species would have had to migrate into the valley via the mountain passes or the Snake River Canyon. At least one major period of glaciation completely filled Jackson Hole and part of the Snake River Canyon with ice some 80-100,000 years ago (Love 1965). Some researchers feel this may have been as recent as 32,000 years ago (Richmond 1965).

Though present big game animals consist of bison, elk moose, mule deer, antelope, and bighorn sheep, several appear to be of recent adaptation. The moose has been notably missing from the detailed journals of several early explorers to the mountain west, in particular Lewis and Clark, W. P. Hunt, and Osborne Russell. Houston (1968) records the progressive historic sightings of moose from Yellowstone to the Teton region up to 1867. He concludes that moose were not in Jackson Hole until after that time. Hence as a game animal for prehistoric populations in this region it can be discounted.

Elk (*Cervus canadensis*) have been known as a plains animal for a long time, and their near complete adaptation to the mountains seems to have taken place by hunting pressure since the settling of the plains by whites. Wilson Price Hunt saw elk in Jackson Hole in 1811, and Osborne Russell in 1834 mentions concentrations of them not only in the valley but throughout parts of Yellowstone as well. Anderson (1958) traces the historical sightings of elk and their migration routes from

W. P. Hunt to the present. It would appear that bands of elk had established migration routes across the Yellowstone-Snake-Gros Ventre-Green River area for a long time prior to white settlement and that they may well have some time-depth in the survey region.

Antelope (Antilocapra americana) have shared a similar historic sighting pattern as the elk in the survey area. Migration from the Green River down the Gros Ventre River was witnessed by the first generation of settlers in Jackson Hole until general hunting pressure curtailed most of it by about 1900. Only recently have antelope bands begun migrating along the same route in any numbers. Their time-depth in Jackson Hole may be similar to that of the elk.

The mule deer (Odocoileus hemionus) too has a long historical record of sightings. White its habitat overlaps that of the elk somewhat, it is not as gregarious nor as migratory an animal. As a dispersed prehistoric game resource, it may have enjoyed less concentrated hunting pressure than the more social elk and bison. Its time-depth in Jackson Hole is unknown.

Bison remains are common in Jackson Hole. It is the only non-domestic and non-introduced animal whose bones are found with any time-depth and frequency. Bison bones have been found in a pre-loess context north of the town of Jackson (Love, personal communication), in an archaeological context dating A.D. 1480 $\pm$ 115 at the Goetz site on the valley floor, and with shells dating 11,940 $\pm$ 500 years at Astoria Hotsprings in the Snake River Canyon (Ives et al. 1964). The variant of the latter has not been established. Most of the bison remains discovered to date have been in the Gros Ventre River valley. Other concentrations have been located in the National Elk Refuge and near the town of Jackson. Five skulls were taken from a ditch near a big seep not far from the Snake River in southern Jackson Hole. Several of these skulls were examined and no evidence of prehistoric butchering techniques could be positively identified on any of them. No bison remains are reported to have been found west of the Snake River. It would appear that most of the bison were coming into Jackson Hole via two possible routes along the Gros Ventre River. The most important of these was probably from the Green River basin to the southwest. The other route may have come from the Wind River drainage. The bison too were historically sighted early in Jackson Hole and the Buffalo Fork River was aptly named. Their occupancy may have been regulated by migration.

The distribution of bighorn sheep (Ovis canadensis) presents curious ramifications for the Jackson Hole region. A detailed chronology of sightings throughout Wyoming can be found in Honess and Frost (1942). Nearly all the historical records show that it too was well adapted to Wyoming basin life. Bighorn sheep petroglyphs from Cedar Canyon, Henry's Fork and Blacks Fork rivers in southwestern Wyoming, Twin Creeks area in Central Wyoming, and Medicine Creek in northeastern

Wyoming support this contention (Schuster, personal communication). A few accounts mention its presence in the northwestern mountains, and none bothered to record it for the survey area. Honess and Frost (1942) made a two year study of the bighorn's summer and winter ranges in the Gros Ventre mountains, and concluded that it had been there in scane numbers prior to about 1900. Part of their reasoning is as follows:

> Further proof that the Gros Ventre River Valley was not a natural winter range is found in the fact that no indications of the past presence of the Sheepeater Indians has been found there. In the Wind River Mountains, Bighorns, Absarokas and Beartooth Mountains, in all areas in northwestern Wyoming where mountain sheep were known to have ranged extensively, there can be found the paintings, arrow head chippings, campsites and remains of ambushments and pens used in hunting sheep, which are the marks of an interesting vanished race. Therefore, it seems probable that the Gros Ventre sheep were originally pushed either north from the Wyoming Range or west from the Wind River Mountains, in the late 1880's or 1890's (1942: p. 45).

Honess and Frost were not looking for prehistoric remains. Figure 17 of their illustrations was taken overlooking a large and immediate prehistoric campsite which they failed to notice. The sites discovered in the bighorn's summer and winter range will be discussed in a later section. Indirect archaeological evidence suggests that the bighorn may have been hunted in this region for as long as 5,000 years, and perhaps longer.

In conclusion, it can be seen that there was certainly enough big game to be had in the Jackson Hole region for prehistoric hunters. The game density does not appear to have been anywhere near as high as it was historically in the Wyoming basins, yet there was plenty for numerous small bands to easily survive a summer or a trip through the area. Since much of the game with potential time-depth in Jackson Hole was migratory, this may have helped determine the travel routes for prehistoric populations as well as the length of time they spent in the survey region.

Method of Investigation

Permission was obtained from all the federal agencies and private landowners to collect materials from their respective properties during the summer of 1971. A site was defined by the prescence of material evidence of prehistoric activity. They ranged from a handful of related flakes to stone circles and barricaded cave structures. More than half of the sites recorded required backpacking to make surface collections and descriptions. The on-site sampling method concentrated on both the variety of cultural materials and their statistical inter-relationships. The writer has taken the liberty to plot the accurate position of all of these sites on topographic quadrangles which will remain the thesis given to the Department of Anthropology at the University of Wyoming. Qualified researchers in archaeology may apply to the head of the department to see these maps and the site reports. Also on the maps are locations of sites not visited, but referred to by local residents. The exact locations and descriptions of these will be recorded at a later date. Throughout the text of this thesis, reference in general terms will be made concerning the locations of the most important sites to prevent potential vandalism. The writer guesses that the sites discovered, reported, and visited represent a cross section of less than 5% of those probably in existence.

CHAPTER II

TRAVEL ROUTES AND BARRIERS

Foot travel into Jackson Hole from a random direction is strenuous during the summer months, and hopefully unnecessary at any other time. While a great many "random" passes have evidence of use, the main travel routes were wisely picked. If travel is from either the Wind River or Green River Basins to the east and southeast, the easiest routes involve major river courses and moderate mountain passes. If travel is from the west, short and steep mountain passes are the rule. Both the Snake and Hoback Canyon routes are difficult and would require more than the usual motivation. Evidence in terms of sites indicates all the routes to be discussed were used to one degree or another. With the exception of the Gros Ventre River valley, few of these routes would be adaptable for long prehistoric summer camps. In other words, the writer feels most of these routes were used strictly as immediate pathways.

Wind River Basin Route

From the Wind River Basin a comparatively easy route into Jackson Hole can be followed by ascending the Wind River to what is now the vicinity of Togwotee Pass (9,600 feet), and then descending Blackrock Creek to the Buffalo Fork River. A branch of this major route can be followed by ascending either Warm Springs Creek or Little Warm Springs Creek, both tributaries to the Wind River, to Union Pass (8,500 feet). One can then go either to the Green River Basin by that river, or descend westward down the South Fork of Fish Creek to the Gros Ventre River and then into Jackson Hole. A second branch from the main route forks south at Togwotee Pass and descends the grassy parks of the North Fork of Fish Creek to the Gros Ventre River (Fig. 1). A major site is located in the headwaters of that creek south of Togwotee Pass.

The limitations to this major route and its branches center around the amount of winter snow and the time of thaw in the springs. The assumption made of course is that more and longer-lasting snow means less attraction for prehistoric peoples. Togwotee Pass receives as much snow as parts of the higher Tetons, but Union Pass to the southeast receives about two-thirds as much. The much longer but somewhat drier Union Pass alternative might be more attractive for spring and later fall travel, while the more direct Togwotee Pass would be a speedy summer and early fall route.

Green River - Gros Ventre River Route

Another major travel route from the Green River Basin to the Gros Ventre River only necessitates corssing the low divide (8,600 feet) between the upper reaches of both rivers in the vicinity of Kinky Creek. The "great bends" of both rivers approach each other at this point and the divide is about 10 miles across (Fig. 1). The indication is that the main travel route actually went along Bacon Ridge or Bacon Creek to the east, instead of using the Gros Ventre valley in this area. The river in this stretch is meandering and swampy and if the present mosquito population is indicative of those in the past, a higher, breezy ridge may have been very attractive. While the Gros Ventre River is travelable on both banks below the mouth of Kinky Creek, landslides and jackstrawed trees plague the western and southern side of the valley throughout its entire length.

A great deal of varied game habitat exists in the spacious lower Gros Ventre valley, and it presently supports elk, deer, antelope, moose, and bighorn sheep in large numbers. The great majority of the bison skulls found by local residents come from this area, suggesting it may have been a popular bison habitat as well. The number of sites visited and reported for this area alone hint at its prehistoric popularity. In fact, this large interior valley could well have been the object of hunting forays itself, since access from the Green River Basin is easy and game may have been as plentiful as in Jackson Hole proper.

Hoback Route

From the southeast, access to Jackson Hole could be gained from the Green River Basin in a circuitous way over the Hoback Rim (Fig. 1). While the Hoback Basin was probably a good hunting area, it leads to no easy route to Jackson Hole. There is evidence that the Hoback Canyon was indeed traveled, but the extent to which this was a major route is unknown. The lower 15 miles or more is particularly rugged, with cliffs, river crossings, steep slopes, extensive talus cones, and avalanche debris to negotiate most of the way. It was not necessary to reach the Snake River before turning north to Jackson Hole, however. Some use may have been made of the rugges Granite Creek canyon and/or Little Granite Creek as alternative bypasses, but evidence is needed to bear this out.

Snake River Canyon Route

Travel to Jackson Hole from Starr Valley and points southwest was possibly through the Snake River Canyon, although the Little Greys River - Bailey Creek route would be far more easy to negotiate (Fig. 1). The surrounding vertical country is not conducive to alternative routes. A hot spring on the south side of the Snake River three miles below the Hoback River confluence is the only site reported in this vicinity. The major difficulty with this particular access route is the Snake River itself. If the Snake River Canyon route is chosen, travel would have to be on the south and east side during the first half of the summer because of the tremendous danger in river crossing. In late summer this might be accomplished safely in a few places about 5 miles below the Hoback River confluence. Travel on the Little Greys River - Bailey Creek route is much easier and eliminates the steepest canyon travel on the lower Snake. Other difficulties involving the Snake River will be related shortly.

Conant Pass Route

The last and perhaps the most important major route into Jackson Hole lies at the north end of the Teton Range. Conant Pass (8,500 feet, Fig. 1) near the headwaters of Berry Creek and Conant Creek is easily accessible from both sides and requires only one or two short "uphills" from either direction. The long meadows and present timber pattern represent no challenge. Conant Pass is also in immediate proximity to a large rhyolitic flow with an ignimbrite base (a welded tuff or obsidian-like vitrophyre). This outcrops in several convenient places and was quarried extensively. A conglomerate bearing various kinds of excellent chert and quartzite also outcrops in this area. Worked materials from all these outcrops have been scattered profusely along several miles of the route. The region to the west of this pass is the entire flatland drainage of the Henry's Fork and Snake Rivers, which stretches almost unbroken into central Idaho. To the east this route emerges into Jackson Hole at what was prior to 1912 the upper end of Jackson Lake. Here a large braided delta had been built into the lake since glacial times by the Snake River. The river is at its smallest in Jackson Hole at this point, and would have been the least hazardous to cross. From the private collections available, this delta was the area of the largest, most extensive, and deepest sites in the entire Jackson Hole region. It was inundated by 40 feet of water when Jackson Lake Dam was constructed in 1916. Since that time the delta's periodic exposure has been taken advantage of continuously by local collectors.

The delta was probably a natural stopping point for groups coming from the west and probably the east. The only direct route through northern Jackson Hole with a minimum of difficulties appears to be the Togwotee Pass to Conant Pass possibility. Perhaps this major route's single overwhelming advantage was that of an easy Snake River crossing. Outside of the Gros Ventre River Valley, this pathway seems to have more profuse and concentrated worked materials than any other locale in the Jackson Hole region.

The Snake River Barrier

In connection with this route and all others, the Snake River is the single most important barrier to east-west travel through Jackson Hole. It emerges from Jackson Lake much larger than when it entered due to the meltwater streams from the Teton Range. Four miles downstream it is joined by the Buffalo Fork River, an effective barrier itself in the first two months of summer. In the south central part of Jackson

Hole, the Gros Ventre River joins the Snake. The Gros Ventre River drains an area roughly twice the size of the Buffalo Fork. Anywhere below Jackson Lake however, the Snake presents a formidable barrier to a foot traveler from May to August. In late summer the Snake can be carefully crossed only where it breaks into several channels in the central and southern part of the valley. The channels are large, seift, and continually shifting, and the result is not only a travel barrier, but an intermittant swampy buffer zone which breeds intolerable numbers of mosquitos throughout the summer. Historic attempts to negotiate this river in a variety of places have frequently met with problems. The Astorians referred to it as the Mad River (Irving 1928) and had difficulties crossing it with horses in late September. As an ex-river boatman who has floated the Snake from the Buffalo Fork to nearly the Wyoming state line, the writer would like to underscore the importance of this barrier to foot travel.

Other Travel Routes

In spite of the Snake River barrier there are several other access routes. Evidence exists for one or two possibilities from the Yellowstone country to the north. Travel may have come up the Yellowstone River from Yellowstone Lake, ascending Atlantic Creek to Two Ocean Pass where there are reported sites in the meadows, and then descending Pacific Creek to Jackson Hole. A site was located at Enos Lake, a few miles off this route. The upper Snake River has headwaters in this area, and there is an ignimbrite quarry downstream on Mount Hancock, indicating some travel in this direction. Historic travel has been frequent along this route but just how often prehistoric populations used it is unknown.

Several other mountain passes have been used. Perhaps Teton Pass (8,600 feet) in southwestern Jackson Hole is the most important. Though it is quite steep, there are quarried obsidian vents not far from it as well as near the eastern base. The pass allows travel out of southern Jackson Hole to the northwest. The Mosquito Creek divide (8,300 feet) is the next pass to the south, and allows travel to either the southwestern Swan and Starr valleys or to Teton Valley to the northwest. Glacial gravels in lower Mosquito Creek contain cobbles of obsidian from an unlocated source. Phillips Pass (8,900 feet) north of Teton Pass would likewise allow travel to Teton Valley. There is a reported but unlocated obsidian source near it, and obsidian materials from the area seem to indicate some use of the pass.

Drawbacks to these three routes include the Snake River barrier and the effects of its floodplain. Aside from the difficulty in river crossing, the low-lying area between the base of the mountains and the river necessitated extensive and arduous clearing of mosquito-infested willow swamp by local ranchers prior to exploitation. If a river crossing were not attempted, a rather restricted use of Jackson Hole would ensue, for little flat land exists west of the Snake, save the area immediately south of Jackson Lake. Difficulty is encountered in north-south travel on this side however. The rain shadow effect and glacial debris allow a thick forest to survive on the valley floor, and travel can be a nightmare of willow swamps, hummocky hills, and old jackstrawed timber.

Lack of the normal component of forest fires during the last 70 years has presently added to the difficulties of backwoods travel, both on this side of the Snake and in other areas. It would be assumed that use of certain prehistoric travel routes might be influenced by the age of a forest or the stage of reforestation of a burned area. Tremendous fires were known in early historic times whose presence or absence in an area greatly affected the inhabitant's movements.

The writer would like to postulate a theoretical travel route into Jackson Hole. This is the Taylor Creek divide (7,500 feet) just south of Mosquito Creek (Fig. 1), the lowest non-riverine route possible into the region. This would allow access from Swan and Starr Valleys to the southwest, emerge on the floor of Jackson Hole where Snake River channels are potentially traversable, and is in prosimity to the Mosquito Creek Obsidian-bearing gravels. At present no reports of sites in this area have been obtained, and no traverse of the pass has been made.

Other access routes exist in the mountains surrounding Jackson Hole. Nearly every mountain pass reported or visited had some form of artifact materials associated with it. That these were all used at one time or another is obvious, but that they were actual travel routes is quite another matter. There is reason to believe that some of the other mountain passes were game "funnels" and were hunted as such. These will be discussed in site context. Other passes may have been used as a sporadic camp for a small group off on a hunting or gathering tour. Some of them represent no small amount of work to reach. In almost all cases, materials found in these scattered passes include obsidian and chert. The reason the obsidian and chert sources have been mentioned in conjunction with the major travel routes is that they represent a traceable material which constitutes a sizeable fraction of the artifacts and debitage collected. The amount of obsidian in all the region's sites suggests prehistoric emphasis on its collection, and most of the obsidian quarries presently known in the region are very near actual or potential access routes.

CHAPTER III

MATERIALS

The artifactual raw material is easily broken down into seven types. In descending order of frequency in sites they are: Precambrian quartzite, obsidian and related volcanic glasses, chert and agate, Tensleep quartzite, basalt, silicious tuff, and soapstone. Their relative abundance in sites is not always related to proximity of source areas. The high altitude sites in the Gros Ventre Range are important in this regard, for there are no source areas high up. This resulted in a curious selection of what was carried and how far. The quarry sites visited in the survey region probably represent at least several of the major extraction areas. There are reports of a number of others which were not visited, and undoubtedly there are many more which have simply evaded detection.

Precambrian Quartzite

Two genetically different kinds of quartzite appear in the survey area. The more common of the two is a hard, dense, resilient form whose multicolored varieties are composed of strongly welded usually fine-grained quartz sand. While the quartzite is originally Precambrian in age, it was eroded and deposited in Cretaceous and early Tertiary conglomerates. These formations in northern and eastern Jackson Hole have yielded these cobbles through Pleistocene erosion, and they form the floodplains of all the major rivers and many of the streams on the valley floor. The largest cobbles rarely exceed 18 inches in length. This quartzite seems virtually ubiquitous though it understandably does not occur in the central and southern Tetons, the Gros Ventre Range, or the Snake River Range. While this material is certainly the most accessible, it was not used in proportion to its avaiability. The problem with it appears to be its hardness. Flake tools seem to be the easiest made from it and by contrast very few finished or refined pieces were discovered. Collections from Jackson Lake by W. C. Lawrence are an exception however, and this will be discussed in the section on local collections. There were no quarry areas found or reported for the Precambrian quartzite.

Tensleep Quartzite

The less common Tensleep quartzite is much different in occurrence, texture, hardness, and color. The most common color is light tan to tan, but it comes in varying shades of grey, white, green and pink pastels. It is pure quartz, lightly welded, and often coarser grained than much of the Precambrian quartzite, and its form is never in river-worn cobbles. Sizes range up to irregular boulders three or more feet in diameter, and always it is associated with much older lag glacial debris. Problems occur in trying to identify the source formation and the outcrops from which the material was carried by ice. Mostly by default it seems that the Tensleep Sandstone is the only formation pure enough to match the low grade metaquartzite.

There are five known areas where the Tensleep quartzite was quarried extensively. Four of these are near springs within the National Elk Refuge. The glacial source for the metaquartzite boulders for this area could easily have been major Tensleep outcrops in the lower Gros Ventre valley. A major glacial advance down this valley would scatter the Tensleep quartzite over much of the National Elk Refuge upon spreading out or meeting ice on the floor of Jackson Hole. However the fifth quarry is on the south end of Blacktail Butte, northwest of the National Elk Refuge but five miles directly west of the mouth of the Gros Ventre canyon. While a tiny patch of bedrock Tensleep outcrops on Blacktail Butte, it cannot account for the distribution and volume of the quarried Tensleep glacial boulders. The only other Tensleep north or "up-stream" from this butte are some minor outcrops in the north end of the Tetons. These are too far away to account for the percentage of Tensleep in the protected glacial debris on Blacktail Butte. The only alternative at present, and not a satisfactory one at that, is to assume these are glacially realted to the large outcrops near the mouth of the Gros Ventre canyon. It should be understood this idea conflicts with present information about ice flow on the valley floor.

The Tensleep quartzite is found in irregular sandy-surfaced cobbles and boulders, and when broken exhibits a weathering rind of as much as half an inch of rotten sandstone. Inside the weathered zone is one or two liesegang rings up to an inch thick, usually green but occasionally pink. The majority of the interior is a uniform tan to grey. A flake found in a site may be identified by its color as to what part of the core it may have come from.

The outstanding property of this material is that it is far more easily worked than the hard quartzite for macro tools, and it is not so brittle as obsidian. A soft quartzite cobble takes little strength to break, and exceptionally sharp and durable flakes can be produced with hard hammer retouch. Accurate soft hammer work on the flakes is also easy. The drawback to the material lies in attempting pressure flaking, for it is usually too coarse grained for small flakes to carry very far. Resharpening a large hardhammer flake is about the limit of pressure retouch. Parts of bifaces made with soft hammer retouch were found which exhibited varying degrees of pressure retouch. The best refined implements found of this material consisted of partial bifaces and the hafted end of an unknown tool. All other tools made of this kind of quartzite are retouched flakes, and most of these have a steep retouch (Fig. 3).

The two visited quarries for this material were essentially alike in that the hillsides nearby or around a central spring were littered with the flake and core debitage of tool making. The Tensleep cobbles were simply broken on the spot and

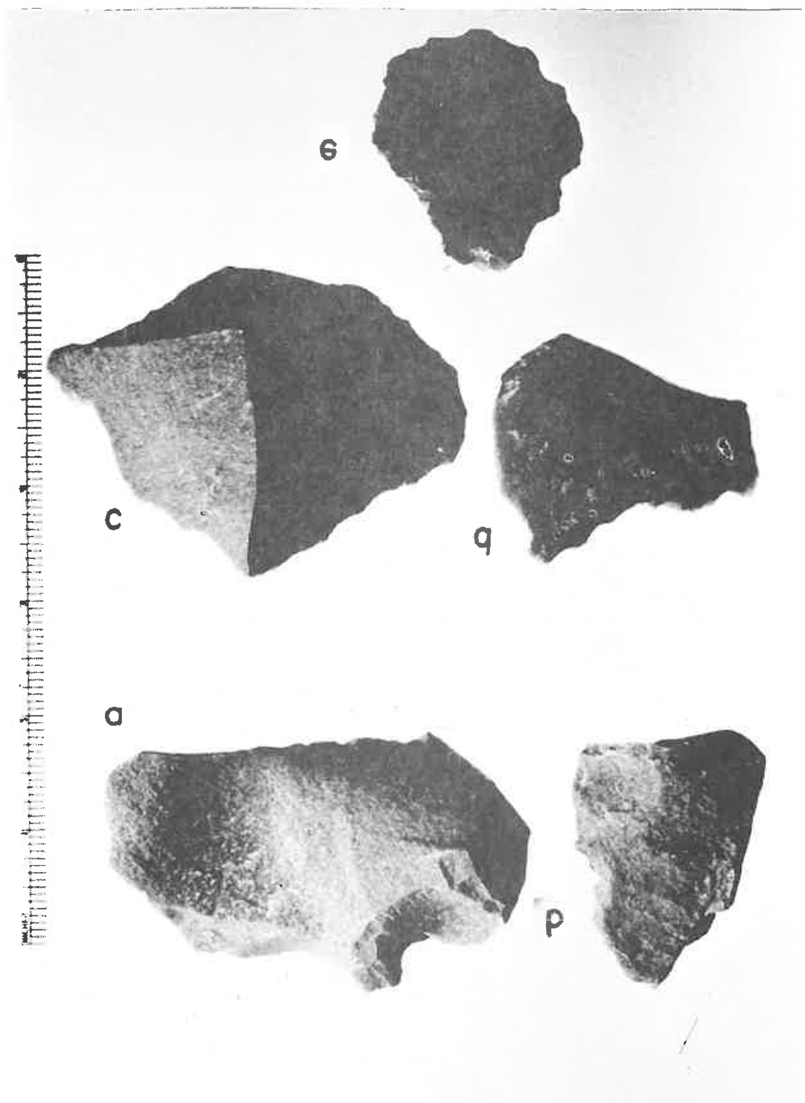


Figure 3. Steep pressure retouch on Tensleep quartzite flakes from the test pit in the Goetz site, National Elk Refuge.

flakes hammered off them to the satisfaction of the individual. Occasionally a thick pyriform bifacial core was left behind, though the normal core remnant was more almond or ovoid shaped. These are difficult to distinguish from chopper implements found in other sites. Some 41 of these expressing a continuum in form were collected and removed from the Blacktail Butte quarry. Perhaps two or three times as many were collected by Wesley Goetz from several quarry sites within the National Elk Refuge. The more important of the two visited quarry sites, however, may be the Blacktail Butte site. It has a central location on the valley floor east of the Snake River with views over much of southern Jackson Hole. Not only is there much evidence to suggest that the site was camped on many times, but the nearby slopes are virtually littered with Tensleep quartzite flakes and frequent bifacial cores (Fig. 4). Several diagnostic artifacts were found in both the visited quarry sites, which will be discussed later.

The spread of the Tensleep quartzite throughout Jackson Hole appears to be very minor considering the tremendous number of worked materials observed in the quarry areas. While huge quantities of flakes existed in these sites, obsidian flakes and tools were always present in the debitage.

Obsidian and Other Volcanic Glasses

The Yellowstone region has long been known as the "only" source of obsidian for sites east of the Rockies. In recent years a number of other prehistoric obsidian and volcanic glass quarries have been discovered in the Jackson Hole area (Love, personal communication). Prehistoric populations utilized at least five separate obsidian or ignimbrite sources south of Yellowstone Park, and all were visited. During the survey it became evident there were probably several more.

In the southern Tetons, a cluster of four of these obsidian sources occurs in a series of what appear to be obsidian vents, associated with small amounts of andesite and rhyolite. These pipes have been planed off and reduced by erosion. The largest exposure of obsidian occurs at low elevation west of the Snake River, and possibly erosional debris from this makes up the cobbles available in Mosquito Creek (Fig. 1). The vent and the Mosquito Creek gravels represent the two most accessible sources in southern Jackson Hole. A problem here is that in all the poundage samples from the large vent itself, no piece could be found as large as the average size obsidian cobble collected from the nearby glacial debris on Mosquito Creek. The vent produced banded smoky obsidian in pieces up to about 10 cm. in length, while the largest cobble from the glacial debris was about 25 cm. No actual source for the more rounded glacial cobbles could be determined, and no obsidian could be found in the glacial debris upstream from the main vent. Several artifact fragments were found on top of portions of the vent, but nothing diagnostic. At best there are suggestions of prehistoric pits, but certainly nothing suggesting major quarrying on either the

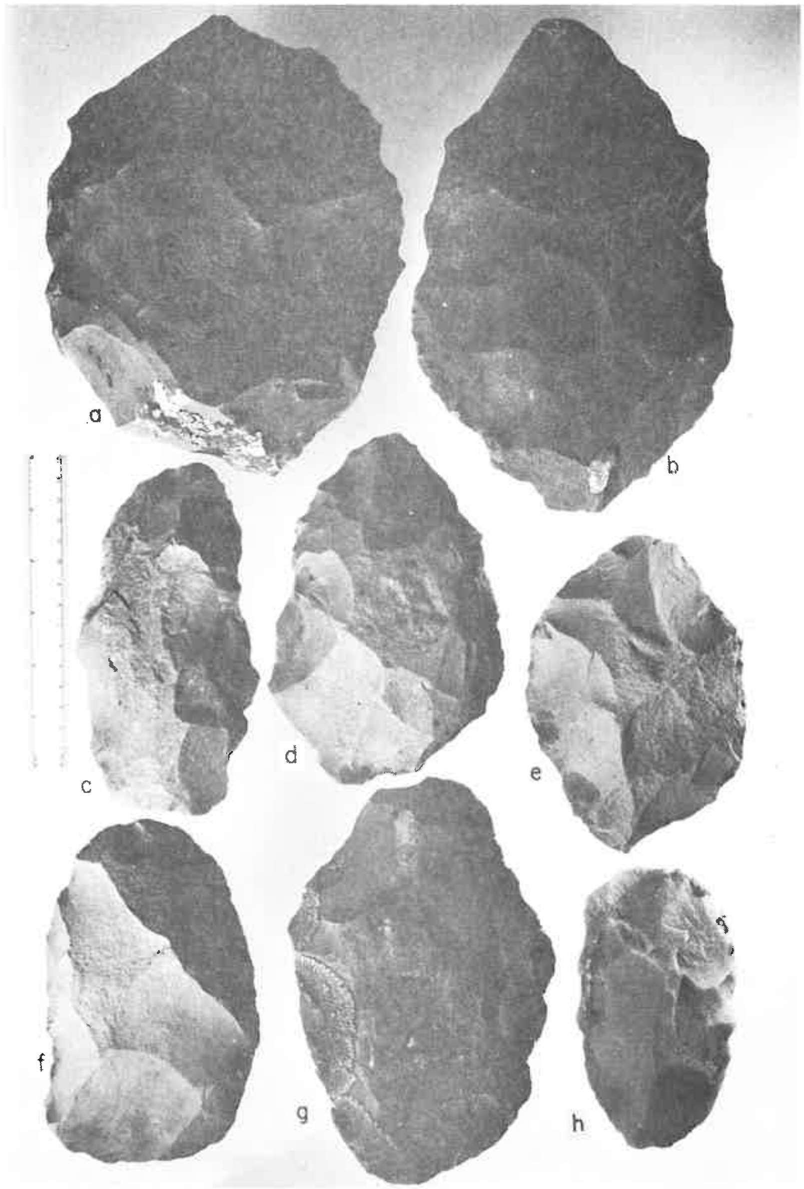


Figure 4. A variety of cores from the Tensleep quartzite quarry on Blacktail Butte. Core h is Precambrian quartzite.

vent or the glacial gravels. It simply may not have been necessary on the vent and not possible in the gravels. Much flake debitage litters the ground on the vent.

The dimensions of the vent are difficult to determine due to the glacial debris and vegetative cover. It may be up to a half mile across, but presently only small portions are suitable for easy extraction of obsidian. None of the surface material displays bedrock or surface contact features.

Discussion with local residents who had lived there some time revealed that only two known artifacts had ever been discovered in the area, yet because of the obsidian they had looked extensively. Both of the artifacts are believed to be large bifaces.

A loess drift, cut in the process of excavation for a house site, disclosed obsidian chunks and flakes to be concentrated near the top, though obsidian did occur sporadically at depth. If obsidian dating could be refined for this area, both successive dating of loess deposition and prehistoric occupancy might be determined. Test excavations should be conducted in several areas, not only in an attempt to discover time-depth of quarrying in the area, but for samples of the "bedrock" obsidian if possible.

At higher elevations, three small vents outcrop, two of which still exhibit shallow pits on the surface. The third vent is so small that only small pebbles of unworked float could be discovered. The surface of the largest vent, perhaps 50 yards across, shows some 8 or 10 separate pits, the average being about 8 to 12 feet across and up to a foot deep. The largest pit, in a nearby stand of timber, was about 4 feet deep and 12 feet across. While obsidian fragments, "pebbles", and flake debitage composed the ground cover, several fragments of small thin triangular preforms were discovered. No piece of unworked obsidian discovered was longer than three inches, in spite of two test holes, one in the wall of the largest pit. The second test hole near a shallow pit disclosed both flakes and unworked obsidian chunks to a depth of 32 inches. An adequate test pit is obviously needed.

The dimensions of the second vent were hard to determine due to extensive slope wash, but it appears to be perhaps 30 yards across. Two shallow pits were in evidence with possibly some quarrying taking place where the slope begins to drop off to the north. Small amounts of debitage appear on the surface.

The obsidian from these two vents is essentially similar. It is high quality translucent to transparent thin banded material, with the groundmass ranging from nearly clear to smoky. Nowhere are there any phenocrysts, ash impurities, or lava fragments, within the matrix. Nowhere is it completely opaque or jet. Many pieces with and without thin black bands exhibit the semi-transparent, "apache tear" quality.

Some however, is grey banded and translucent only on an edge. Other pieces have black cloudy zones. The weathered surfaces are angular to globular with differential weathering emphasizing the unequal physical properties of the bands and matrix. Its working qualities are like typical obsidian, with keen sharp, and rather brittle edges being the rule. The more opaque and grey banded varieties seem to be less brittle however, and in general are better for heavier use.

Nearby these two quarried vents are numerous places where much flake debitage can be found not in association with chunk obsidian. It appears that these places might either be workshops or temporary camps. One such area in the lee of a cluster of trees had an annual snowdrift which when melted added successive thin layers of snow-accumulated dirt to the soil. A later 18 inch deep test hole showed obsidian flakes throughout. Soil turnover in this region is high, however, due to rodents and frost action. A test pit would certainly be recommended.

Just how far these obsidians were spread throughout Jackson Hole remains to be discovered by neutron activation analysis. Some seem to have reached the Green River near Big Piney (Frison, personal communication). A great deal of obsidian which has these visual qualities is found throughout the region, but since similar material has been found in the Yellowstone quarries and others in Jackson Hole, distinctions between them and the resulting ramifications for travel-trade relations will have to await further analysis. When a survey of the region west and south of the Tetons is completed, neutron activation analyses of the southern Teton obsidian may show how effective a barrier the Snake River was for its diffusion.

The fifth quarry visited is in the north end of the Tetons near Conant Pass. In this case, one of the extensive lava flows from Yellowstone Park has been dissected by glaciated canyons. The base of the flow in this area is a thick layer of welded tuff or ignimbrite. This material looks very much like a poor quality obsidian at first, but a closer examination shows it to consist of melted, wavy, lens-shaped particles of obsidian and ash. Unmelted crystals and ash particles are common enough to give the ignimbrite a broadly speckled appearance. It is not translucent on a thin edge. The quarry area itself is spectacular in that the amount of material broken up extends over several hundred yards of talus slope. The talus is composed entirely of weathered blocks of crude columns from the base of the flow. These have migrated down a steep slope for some distance. There appears to be no natural cause for the number, distribution, and pattern of fresh breaks on the blocks of the slope. Large biface cores and chopper-like implements are common on the slopes and on the flat-topped hill above. Many of the worked pieces on top of the hill are buried deep in the loess soil and must have been carried up from below. Several representative samples were collected (Fig. 5). A quartzite hammerstone was also located. No test holes were dug, but the implication is that this would be a major area to test for reasons discussed in a later section.

Figure 5. A variety of ignimbrite cores and flakes from the quarry near Conant Pass. All but b have edge retouch to some extent; g, h, i are tools showing both deliberate and use retouch.

Ignimbrite somewhat like this can be found in a similar geologic situation at the Grassy Lake Reservoir. Excavations for the dam materials reveal a thick flow of ignimbrite with some of the same visual characteristics. The Grassy Lake ignimbrite by contrast is not really workable. The ash shards and crystals are much more numerous than the Conant Pass variety and these prevent true flaking. Also, the quality of the matrix is so poor that it tends to exfoliate or break in thin brittle sheets when struck. This may be due to the depth or level within the flow and be a function of the cooling process. The Conant Pass ignimbrite is also somewhat difficult to work into refined artifacts however. Most of the pieces distributed throughout the area are flake types. The ash and crystals undoubtedly interfere with the fine flake work necessary for more exacting tools. Interestingly, the Conant Pass ignimbrite is far tougher than the Grassy Lake equivalent, and makes excellent long knife-like flakes. The two ignimbrites do not belong to the same flow and hardly overlap in their working qualities.

Nearby the Conant quarry area, another outcrop occurs from the same rhyolitic flow. In this area almost no debitage can be found and unbroken blocks lie on the surface. This seems a bit unusual since a constant water supply and shelter is close by, while the quarry area is quite some distance away and more exposed.

Quantities of ignimbrite with a distinctive visual similarity to the Conant Pass material is found throughout Jackson Hole and parts of the Teton Range. Some of these are refined artifacts. Neutron activation analysis of these has not been made. If any correlations should exist, populations moving over Conant Pass made their way through much of the area to the east. Flakes of this type of material have been found east of the town of Jackson, indicating at least 60 miles of foot travel from the nearest possible source.

Obsidian Quarries Not Visited

Two unrelated reports have led to the conclusion that a source for obsidian lies north of Teton Pass. A one day excursion into a geologically advantageous area yielded only a tiny flake of obsidian, in spite of searching the streambeds. Occasional pieces of obsidian found in Phillips Pass to the north indicate either a nearby source or a travel route involving the transport of good quality obsidian from elsewhere. Andesitic and rhyolitic volcanics in the potential area are similar to those found at the base of the range several miles to the south, and it appears geologically that the extrusions may be related.

In southern Yellowstone Park, an ignimbrite quarry was located on Mount Hancock (Love, personal communication). The quarry appears to consist of several shallow pits. The samples are full of phenocrysts and ash impurities, and both red and black varieties occur. This is unlike the entirely black Conant Pass ignimbrite.

The flaking quality is greatly disrupted by the impurities, although the ground mass is more glassy and better welded than the Conant Pass samples.

A low group of whitish hills south of the Gros Ventre River in Jackson Hole contain several water-laid ash beds of pliocene age. Small obsidian pebbles are available from several outcrops, and while they are a potential source for obsidian, most of the pebbles obtained for study are too small to be worked well. A pebble most likely from this source has been found in a test excavation several miles southeast of these outcrops. There is tremendous variety in visual characteristics exhibited by the obsidian in these pebbles. A complete range in variation is seen in quality of translucency, dark grey to black coloration, banding, cloudiness, and even in the flake surface produced. A distinctive coarse grained and even sandy appearance is common in flakes. All the pebbles are stream worn and show no near-vent characteristics. Close examination of the obsidian in the Jackson Hole Region's sites suggests this source may be far more important for distribution than any other in the survey area. Neutron activation analyses and adequate sampling of the obsidian pebbles needs to be done.

Several other quarry probabilities appear from the volcanic glasses found in the sites of Jackson Hole. From several areas has come a high quality pure jet, non-translucent, unbanded obsidian. It is in small proportion to the other obsidians and visually is not at all like anything in the Jackson Hole quarries. Another obsidian, equally sporadic on occurrence but in slightly larger proportions is a lightly banded, slightly translucent, high quality variety with a distinct nut brown tint on a thin edge. Again it approaches none of the variation found in the Jackson Hole quarries.

A third variant was seen in the scattered collection of a high quality light grey ignimbrite. The few small flakes have no interferring impurities and appear to behave entirely like obsidian in their flaking qualities. Nothing remotely similar has been found in any quarry area.

Fourthly, occasional pieces of black ignimbrite, in flakes or refined artifacts, have been found which do not quite fall within the range of the Conant Pass ignimbrites. These have smaller, more widely spaced crystals and may be a sample from either a different flow or a different phase of the Conant Pass flow.

The above four variants hint that obsidian and ignimbrite were being brought into Jackson Hole from either outside or undiscovered sources. Certainly there is much Yellowstone obsidian in the area, but how much is local and how much is Yellowstone obsidian needs to be determined. The possibility should not be ruled out that some of these obsidians and ignimbrites may come from sources in eastern Idaho.

Steatite

Three steatite quarries were visited and several more are indicated. All the steatite localities are within the Precambrian metamorphic complexes of the Teton, Gros Ventre, or Wind River Ranges. The deposits in the Tetons take the shape of large pods or augen which pinch out at both ends of the long dimension. Those in the Gros Ventre Range are covered, but blocks are available in the talus or glacial debris.

The most extensive quarry, located in the north end of the Teton Range, was visited and sampled. The steatite is grey-blue in color, of good quality, and is amenable to easy scraping and minor chopping. Prior to vandalism two broken pedestals and several vacant scraped depressions were evident on a narrow ridge of steatite bordering a steep slope. Vandals have since dynamited the main outcrop containing the best pedestal. One part of a pedestal is all that remains of the original prehistoric workings on the outcrop. Search of the talus disclosed a few other worked pieces, several of which might ultimately have become platters. A few have been partially shaped into what might be bowl prefoms. A puzzling factor of this site is that no materials were discovered indicating a nearby campsite, although a few obsidian flakes were discovered on the access canyon rim. A spring some distance away may provide the answer.

Of interest are the tool marks on the partially shaped pieces and around the pedestals. Lichen has grown over parts of them hinting they are not of immediate origin. Chop marks appear around the pedestals made with what must have been a hard, sharp, chisel-like blade. Whether this was used as an axe or chisel is not known. The blade width varies from 1/2 inch to about 1 inch, and their pattern is vertical and symmetrical. The suggestion is that a chisel tool was used by pounding on the back of it, creating clean straight slices up to 3/4 inch long. If these marks are prehistoric, quartzite tools would have been the only material durable enough to have made the apparent marks. The marks could be historic, of course, and be produced by pounding an actual metal chisel or metal fragment. The semi-shaped talus blocks have incised grooves in addition to chop marks. One hearsay report contends that Rose Leigh, half-Indian daughter of Beaver Dick Leigh, camped at this particular steatite quarry on a regular basis, using the bowls on pedestals for mixing and pounding pigments. These she apparently traded to the men for use in their ceremonies. If this is the correct quarry, there is evidence for no more than four or five possible bedrock workings.

Two other "quarries" have been visited where the extent of the steatite workings amount to little more than a pounding or rough shaping of talus blocks. The start of a pecked metate-like platter was found near the Granite-Flat Creek divide (10,000 feet) along with obsidian flakes. Though no bedrock steatite could be discovered in the area, the few large blocks are angular, hinting they have been transported only a short distance by ice. Several other pecked pieces were discovered nearby. In the Swift Creek cirque (10,000 feet) several small steatite bowl preforms were found, none with any indication of a finishing process. The largest preform is seven inches in the longest dimension. On the outside, small chop marks can be seen, some slightly over 1/2 inch square. The steatite source is in blocks from a protalus rempart, created most likely during the Temple Lake glaciation. If so, this would fix a maximum date limit of about 3,000 years since the formation of the talus. No bedrock source was found.

Another glacial source of steatite in the upper Bunker Creek drainage (10,400 feet) was found, though no evidence of prehistoric use could be determined.

Steatite from these sources in the Gros Ventre Range is of low quality, steel blue, coarse grained, and full of impurities. None of the sources appear to have been used extensively. That there may be additional sources is indicated by at least one soapstone bowl found by local residents in the Bondurant area. Other bowls have been discovered and reported. The steatite material is of much higher quality, though surface weathering prevented a close inspection of it. A Precambrian outcrop at the head of Shoal Creek and Dell Creek might contain the nearest sources.

That steatite locales may exist near Union Pass (Fig. 1) is suggested by the discovery of a soapstone atlatl weight or ground pipe preform by a local mountain guide. This is of high quality, light grey-blue material, and does not suggest the Gros Ventre Range sources. Reports of soapstone bowl discoveries both at Union Pass and on the Gros Ventre River drainage also hint at a source in that region. It should be remembered that Union Pass was also a main travel route and the occurrence of soapstone artifacts may be reflective of a "funnel effect" of prehistoric populations, and not an indigenous source.

Basalt

Basalt flows outcrop in a number of places in Jackson Hole, and cobbles of that composition are common in the older preserved glacial debris. As a source for materials it does not appear to have enjoyed much priority. It was found only in occasional flakes in a few sites, though the W. C. Lawrence collection from the north end of Jackson Lake contains a number of basaltic projectile points and large haftable knife-like bifaces. A mid-section of a basalt Scottsbluff-like point was found on the Jenny Lake moraine. In the high Gros Ventre Range far from any basalt flows, a number of flakes were discovered. Whatever their source, they represent a significant and tortuous travel route. No quarry areas for basalt were reported, discovered, or looked for.

Silicious Tuff

In a few sites, scant flakes or implements of a hard silicious tuff were discovered. These are grey-white, weather to a tarnished cream-buff, and appear to be clearly a second-rate tool material. While no quarries were reported or looked for, outcrops of a sedimentary Cretaceous formation bearing a possible source for this material occur in the Mount Leidy Highlands area. The discovered flakes and implements were few and distributed in sites near the Gros Ventre River and high in the Gros Ventre Range.

Cherts

Cherts represent the third most common material found in sites after quartzite and obsidian. Not one good chert source was discovered in Jackson Hole, though there are a number of Paleozoic formations which contain chert nodules. The most frequent chert fragments which are not flakes or used material, come from the Madison Limestone. Unfortunately every place these have been discovered and sampled by the writer, the chert is badly fractured and unworkable. Potential red chert sources might be found in the overlying Amsden Formation but it appears not to have been used and like the Madison chert it is brittle and breaks into angular blocks. With one or two exceptions, none of the chert flakes or artifacts discovered bear much resemblance to either the Madison or Amsden potential chert sources. The major exception is one site near the head of the Gros Ventre River where apparently one good Madison chert nodule was completely worked into flakes and possibly left as a cache.

It seems that most of the chert flakes found in Jackson Hole represent transportation from areas outside the survey region. Only one area was discovered to have utilized indigenous chert cobbles. This was from a conglomerate outcrop along the Conant Pass travel route. Several kinds of chert types may be found in this area, most notable is a smooth-flaking jet variety. Other less used types vary from mottled and banded dark greys and whites, to banded translucent white agate. Opaque tan, green, and yellowish varieties also are available, though not in any quantity.

The northwestern end of the Wind River Basin has long been known as a source for silicified or agatized wood. Some of this type of material was found in Jackson Hole, though flakes and pieces are rare. A few similar flakes were discovered in sites above 9,000 feet in the Gros Ventre Range, and their occurrence there indicates potential sources in the Green River basin. A whole avenue of research could possibly be conducted on the spread of these agatized wood specimens.

The writer feels that most of the chert varieties found in the survey region have their ultimate source in the Wind River or Green River basins. This view includes the possibility that diffusion of chert from Idaho was slight, due to the easy quarrying of obsidian along the travel routes from that direction, and the difficulty in crossing the Snake River. It would seem more reasonable to assume chert was carried when traveling from the east, since no obsidian outcrops present competition along these routes. Only Precambrian quartzite was the alternative. Once the more easily worked obsidian was obtained in Jackson Hole, the cherts may have been discarded. When traveling out of Jackson Hole, only obsidian and quartzite may have accompanied the populations. Four of the five sites discovered in the high Gros Ventre Range on Crystal Creek contain only obsidian or hard quartzite. Sites on the lower Gros Ventre River travel route or close to it all have obsidian as a scant minority compared to chert and hard quartzites.

CHAPTER IV

LOW ELEVATION SITE LOCATIONS

For logistical reasons the survey necessiatated reconnaissance over semi-specific areas. This resulted in a patchwork pattern of site locations. The divisions for discussion of site locations and analysis are therefore arbitrary.

Jackson Lake Area

Two excursions into parts of this area were made, both along the shores in the northern parts of the lake. On the advice of W. C. Lawrence, whose large collection from this area is housed in the Jackson Hole Museum, a search of a selected shore line strip was conducted. Wave action from repeated raising and lowering of lake level has destroyed and carried out up to 4 feet and more of the topsoil in specific areas, leaving tree roots supporting stumps over 4 feet off the beach level. A number of obsidian flakes of various sizes were found as wave-washed remanants of long destroyed sites. An occasional isolated rib fragment was found, but none could be positively attributed to a butchered animal. Only one specific site feature was found on the eastern shore. An uneroded mud flat disclosed a circular layer of fire-cracked rocks, 40 inches in diameter, very closely packed, and one rock thick. The rocks ranged from 2 to 9 inches in long dimension, and were various broken cobbles of morainal origin. A small wedge was carefully removed to detemine the depth and thickness of the rock layer, and no charcoal or deeper layers were exposed. This pancake-like feature was sunk into the mud several inches. It is possible this may have been a fire hearth, but the perfectly circular fom, closely packed arrangement, and the lack of charcoal or charcoal-stained sand underneath gives the impression of a secondary placement. No nearby debitage could be found, though a mano was discovered some 30 feet to the southeast.

Later in the summer the second excursion was accomplished along a section of the western shore of Jackson Lake. Four sites were discovered, though no diagnostic artifacts were uncovered. Here too, wave action has proceeded far enough to erode as much as 20 feet or more into the slope. While three of the sites were discovered by obsidian flakes remaining at the high-water line, diligent search of the slopes above failed to indicate site perimeters. Continued search of the slopes revealed only one other site in a three mile stretch. One of the shore line sites had been discovered by a boating tourist, who had found a diagnostic, triangular, corner notched projectile point of yellow chert. It was not made available for more than a cursory examination. See Figure 24h for an identical category.

Three problems arise on the west shore line of the lake. The first is that deep soil turn-over occurs here at a rapid rate due to rodents. Secondly, the shore line has eroded away extensively in several areas. Thirdly boating tourists have by evidence camped and picnicked along the shore in such great numbers that the present chances of discovering a site of any depth or extent seem discouragingly small.

The best evidence and conclusions for site materials for the northern Jackson Lake area are found in the collection of W. G. Lawrence, to be discussed later. Reported sites from other areas along the lake shore have been plotted, but no materials from them have been observed or analyzed.

Terrace Sites

The Snake River terraces present ideal places for views of the Snake River bottom lands. Only one area was adequately checked for sites. The highest terrace in central Jackson Hole has a 2 to 20 foot thick loess capping, and overlooks what would have been the Snake River flood plain at the time the Jackson Lake Moraine was forming. The writer felt that search of this 60 foot terrace might reveal sites older than 7,000 B.B. since the flood plain below was formed at that time. It was assumed prehistoric populations would not have camped on the gravelly flood plain itself. The three miles of this terrace revealed some 10 separate sites. They were discovered because any stone materials on top of the loess would have had to have been placed there. Quartzite cobbles had been dragged up from the gravel underlying the loess. Most of the sites consisted of a handful or two of flake debitage, mostly quartzite and obsidian. One tiny area yielded a well-made red chert haftable end scraper (Fig. 6a), and the broken fragments of a ground red sandstone plate. The milling or grinding stone is only partially reconstructable, and it shows directional grooves of the grinding surface. The thickness varies up to 1/2 inch thick.

Another site contained two 35 lb. metates, sunk into the loess but associated with fire-cracked rock. Another area yielded quartzite and obsidian flakes, a complete white chalcedony tanged biface, and a broken silicious claystone biface (Fig. 6b, c). The silicious claystone seems to be a type common in the Green River Basin. A fourth site consisted of a biface of soft quartzite from the south end of Blacktail Butte. With it were two peculiarly flakes disc-shaped cobbles (Fig. 7a,b). Both of these had a flake or two taken out of exactly opposite sides of the disc, but driven from the same side. These were noticeable primarily because Mr. Goetz of the National Elk Refuge had collected similarly flaked cobbles from other sites. No conclusions about them can presently be made.

The largest and perhaps the oldest site was divided into quadrants for sampling. This multicomponent site appears to have two levels, and more than one area of occupation. The lowest level appears to be emerging from the loess in the southwest sector near the terrace edge. Not only are fire-cracked rocks in abundance,

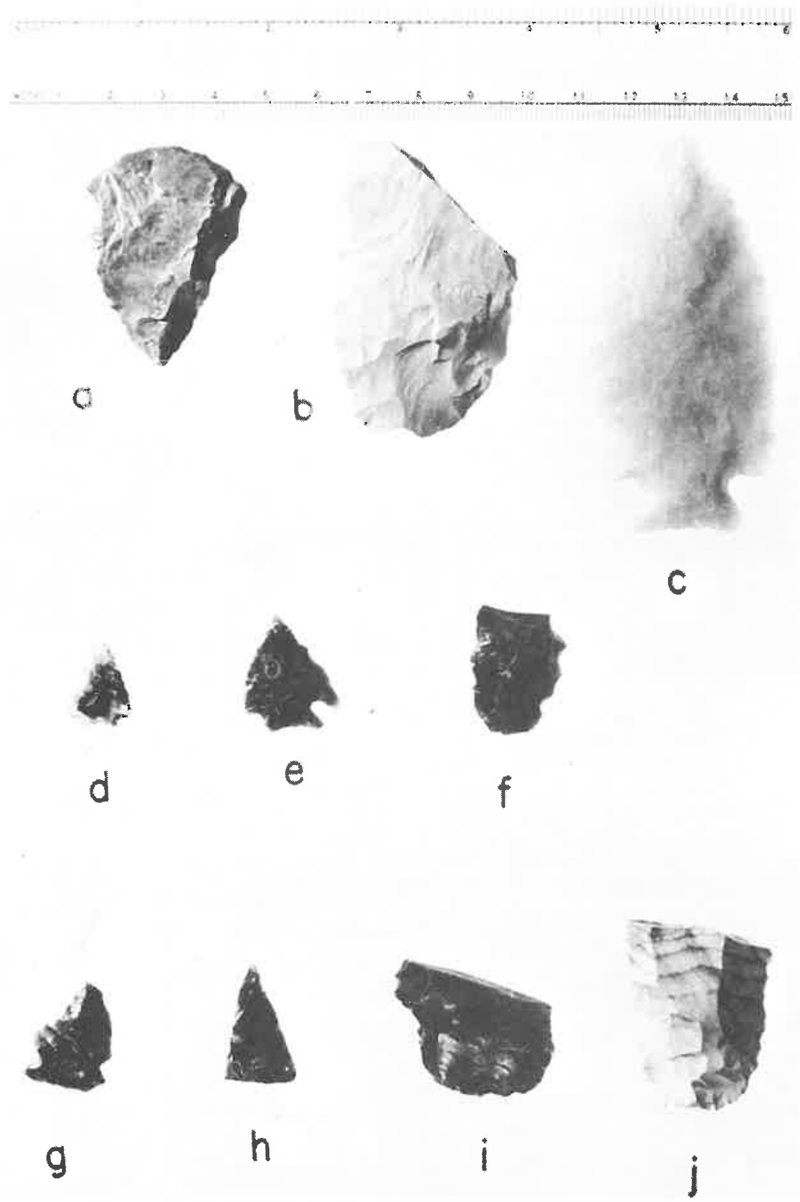


Figure 6. Artifacts from three terrace sites south of Blacktail Butte: a, b–c, d–j.

but flakes and tool fragments of obsidian and quartzite were found. A fragment of an obsidian cornernotched point and a small, thick, wornout base of an obsidian biface were both discovered in this sector. These, along with fire-cracked rock appear to be coming out at a lower level. A small obsidian sidenotched point was found in the central sector along with much fire-cracked rock and one stone circle 12 to 14 feet across. A tiny stemmed obsidian point was all that was diagnostic for the eastern sector (Fig. 6, d-j). While very little scattered charcoal seems to have survived, at least 15 fire hearths may be estimated for the whole site by the localized patterns of fire-cracked rock. Quartzite cobbles were hauled up from the gravel below the loess to form the stone circle and fire hearths, as well as for apparent tool making. Some cobbles show signs of having been made into chopper-like instruments, but most seem spalled for flake materials. Below the loess on the hillside, many cobbles are spalled and beaten, as though the inhabitants tested the material before selecting those to bring to the top of the terrace. Outside of the site area, the cobbles below the loess are not spalled, cracked, or broken up. On the north edge of the north sector, two areas of charcoal-stained, fire-cracked rocks appear to be weathering out of the loess, down several feet from the present flat surface. While these may be migrating down the slope somewhat, they represent the most deeply buried material along the entire terrace edge. Nothing was found in association with them.

The entire wedge-shaped terrace south of Blacktail Butte appears in aerial photographs to have developed a curious shallow gully pattern across it, parallel to the Gros Ventre River. A smooth landscape is evident closer to Blacktail Butte, while to the south an unevenly furrowed, pimply surface can be seen. To the east of the terrace, one can see radiating fingers of apparent flood debris from the mouth of the Gros Ventre canyon. These subdued debris trains are on the present terrace above the river and outside the obvious and fresh remains of the 1927 flood. The Ditch Creek alluvial fan seems to be slowly encroaching upon the subdued pattern from the north. Perhaps this situation is indicating what happened when the aforementioned 5,000 year old landslide in the Gros Ventre canyon finally eroded through. Since the lake behind it was at least 100 feet deeper than the present Lower Slide Lake, it seems that such a huge flood could have deposited this old debris pattern, and quite possibly it overran the wedge shaped upper terrace south of Blacktail Butte. The shallow southwestward drainage pattern cut into the loess on the terrace might have its origin in such a cataclismic flood. There seems to be no other cause for formation of this pattern, especially since the loess cover thins to the south. Archaeologically, a flood would have destroyed any surface sites on the terrace edges older than the catastrophe. The smoother and thicker loess surface at the south edge of Blacktail Butte is not only higher in elevation but in spite of the springs seems untouched by any drainage pattern. If there was a flood of the proportions described, this area was preserved. It may not be coincidence that fragments of ground-edged points were found here, and the potentially oldest point obtained

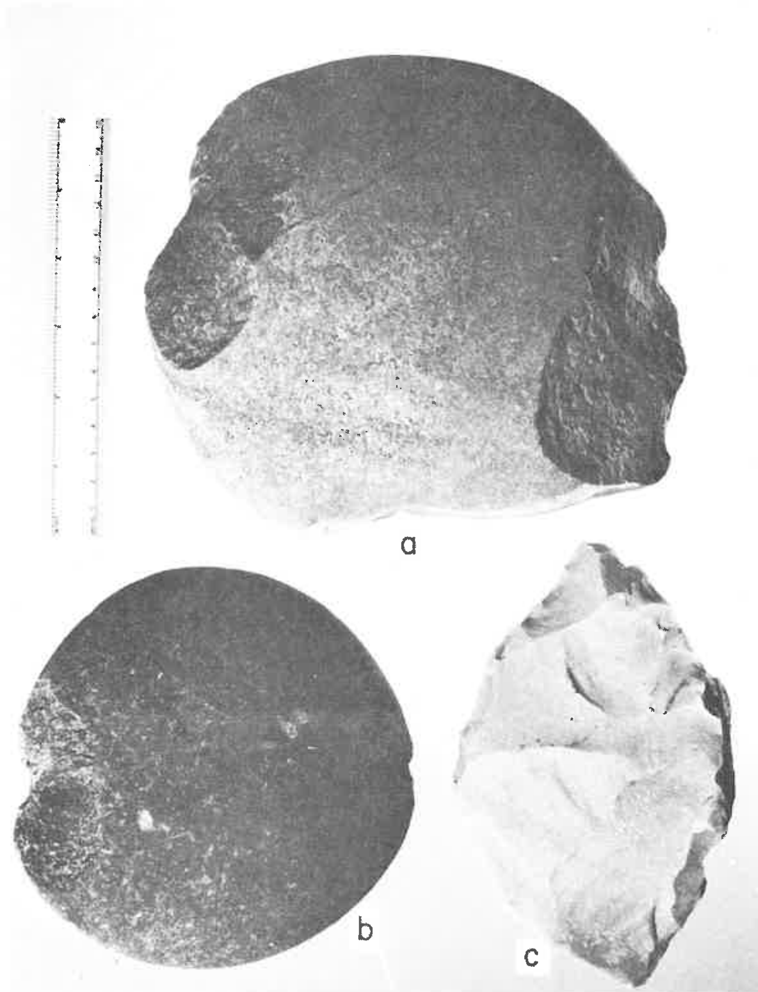


Figure 7. Artifacts from a terrace site south of Blacktail Butte. The disc-shaped cobbles are flaked only on the visible side. The biface is probably from the Tensleep quartzite quarry on Blacktail Butte.

from the 10 terrace sites was a fragment of a corner-notched specimen.

By contrast, the other terraces along the Snake and lower Gros Ventre Rivers have no loess capping and the pavement of sunken cobbles presents difficulties for site location. Since no sites had been reported for any portion of the Snake River Terraces, a brief and selective survey of a small portion of the higher western terrace (80 feet) was accomplished. No indications of any sites were found. A check of the only privately owned dude ranch in the vicinity revealed that no artifacts had ever been discovered by any of the dudes or local residents in the owner's memory. The impression was given that had there been artifacts discovered, they would have been sumptuously displayed.

All the sets of terraces along the Snake, Gros Ventre, and Buffalo Fork Rivers need to be walked out. In every case they represent the areas of best bottom land view coupled with a valley view and a breeze to keep down the incessant mosquitoes.

Reports on other terraces and benches have been encouraging. The previously mentioned 200 foot faulted bench diverting the flow of Flat Creek apparently contains a number of reported stone circles. The few materials observed from this bench included a middle section of an Eden point variety, and a small unground lanceolate, round base, "notched" type (Fig. 25c). The materials were grey and white chert and suggestive of a Green River Basin origin. Two or three areas along similar terraces west of Fish Creek in southern Jackson Hole contain a great many obsidian flakes and debitage. One of these areas was sampled, and in a slightly exposed space of 100 feet diameter, 183 obsidian flakes were obtained, including two point fragments and 15 retouched flakes. No chert and little quartzite was apparently discarded. This area lies west of the Snake River.

In checking with all the dude ranches on Cottonwood Creek near Timbered Island, only one artifact, of obsidian, had ever been discovered. A huge and probably unhaftable "hammerstone", suggesting a differentially weathered quartzite cobble, was the only other artifact found from the entire area.

Blacktail Butte

At the south end of Blacktail Butte is an unusual quarry site previously discussed. However the area has several site locations which have disclosed a variety of materials and artifacts. Several sampling trips were taken to these localities and in all the most common cultural material was the locally obtained brown Tensleep quartzite. Some 41 large quartzite cores or preforms were collected. The majority of them are almond-shaped and display varying degrees of thickness. Others were worked into handy bifacial pieces which might have been used except for their location on steep slopes (Fig. 4). Several of the pieces are "high ended", giving a

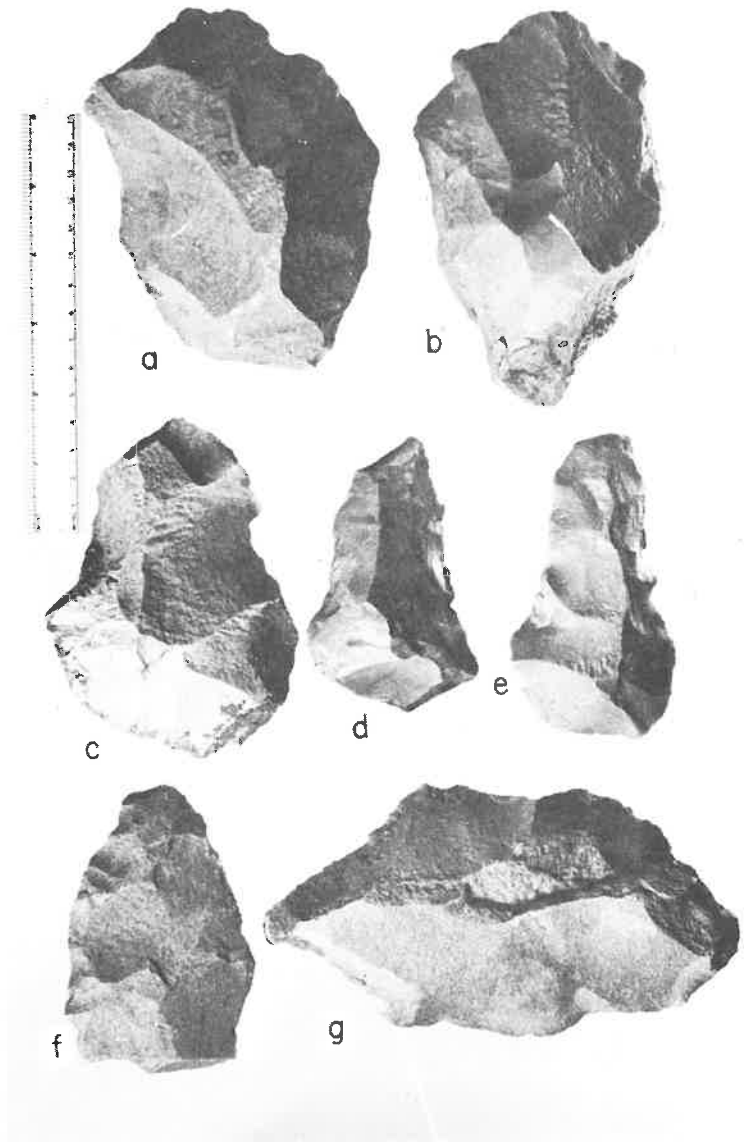


Figure 8. "Duckbilled" cores and retouched tools from the Tensleep quartzite quarry on Blacktail Butte.

duckbilled appearance (Fig. 8a, b). In one area, two reworked spatulate pieces were found along with a thin broken biface (Fig. 8d, e, f). Other spatulates and retouched flakes were present (Fig. 8c, g). The area appears to have been only a local quarry since little of the Tensleep quartzite seems to have been transported elsewhere. One complete biface 7 inches in length with pointed ends from this quarry was discovered over a mile away on a terrace edge (Fig. 7c), but few flakes seem to have been carried farther than this. In fact, most of the re-occurrence of the Tensleep quartzite from Blacktail Butte was never farther than about 3 miles south.

Of the 21 pieces of obsidian found, two are of importance. One is a slightly edge-ground concave base of a lanceolate point (Fig. 9a). The other is a second very similar concave base with one heavily ground edge and a reflaked broken edge. The longitudinal end flakes cut across the older edge flakes at right angles (Fig. 9b). No older age indicative materials were found.

Of the few variegated chert flakes discovered, one was of a black variety similar to that found near Conant Pass. One broken end scraper of agatized wood was picked up (Fig. 9c). In addition, a local resident collected a few portions of a steatite bowl from this site many years ago. It is definitely not Gros Ventre steatite, and one might surmise that it probably came from the Tetons. On top of a small knoll in this vicinity is a partly destroyed stone circle about 12 feet in diameter. Nearby are several heavily spalled boulders.

How much of this entire area remains undisturbed needs to be determined, for several early homesteads and the old town of Grovont were nearby. Their structures have been removed and tall sage presently grows over most of the remains. The springs in the area were cleaned and diverted through irrigation ditches by the early homesteaders. This disrupted the established sedimentation pattern and may have brought buried materials closer to the surface.

East Side of Jackson Hole and the National Elk Refuge

Four sites have been reported for the east side of the valley north of the Gros Ventre River. No materials were collected by the writer, but a few pieces from two of them were submitted for study. The northernmost site is apparently a stone circle on a knoll not far from a ranch on the Burned Ridge Moraine. A red quartzite core was associated with it. A second site is on a ridge in the vicinity of the mouth of Ditch Creek canyon. A split hard quartzite cobble chopper and a broken Tensleep quartzite, slightly stemmed biface are the materials from this area. The extent of these two sites are not known. The third site exists in the Kelly warm springs area, but much of this has been altered by road, ditch, and fence construction. It does represent, however, an important area for close scrutiny since many local collectors have obtained artifacts from it and it lies on the main travel route along the Gros Ventre River. It is an ideal place for game, at the lower break in slope of the eastern mountains. The fourth reported site area is on the low northern hills composing the mouth of the Gros Ventre canyon. Stone circles and artifacts have been noticed and collected here by local residents since historic occupation of that area.

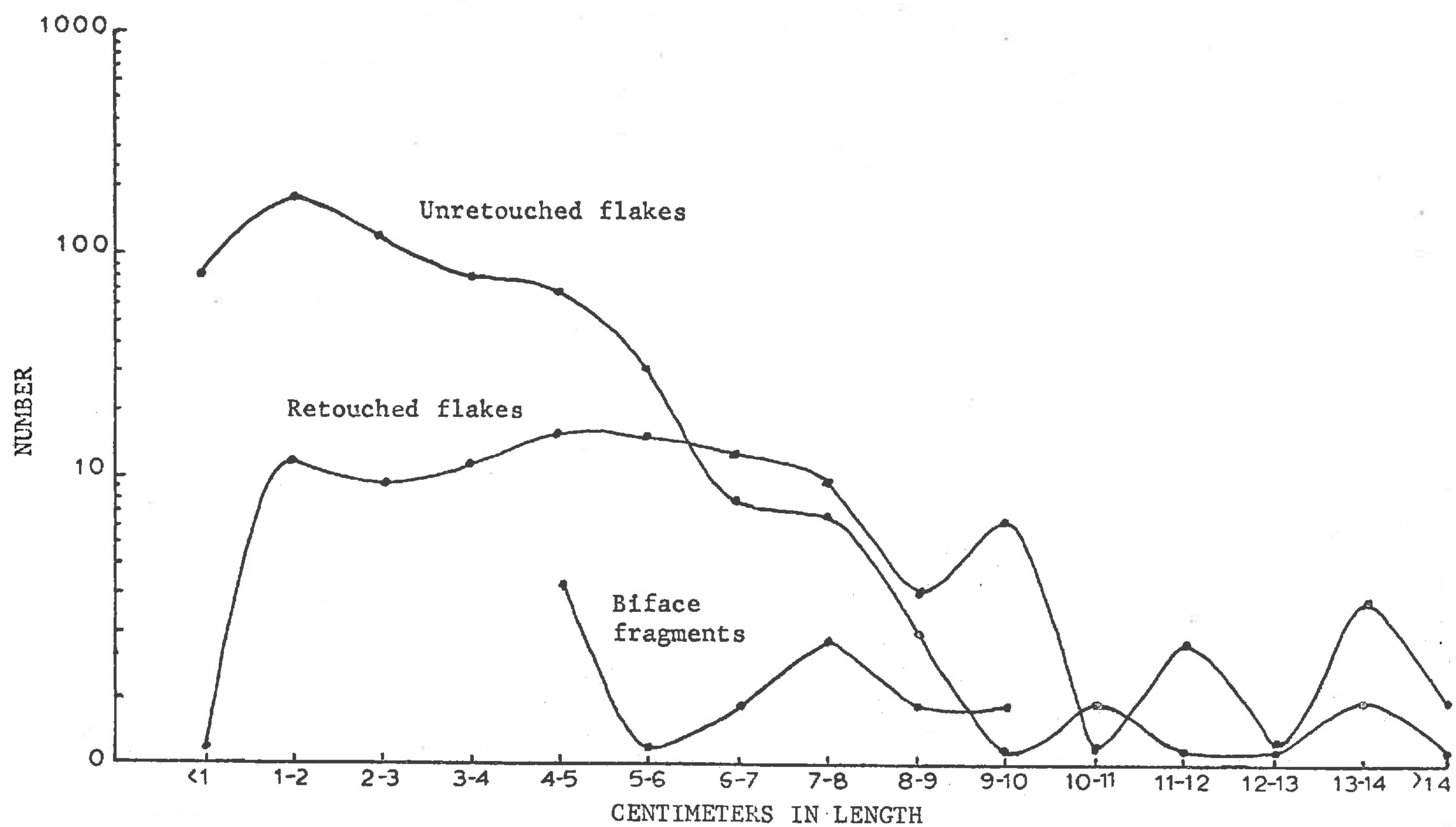
Most of the east side of Jackson Hole proper south of the Gros Ventre River lies within the National Elk Refuge. The low group of white hills has been mentioned before in connection with two locations of obsidian pebbles. There are several sites in these hills and in one a test pit was excavated during the summer of field research. This site was made known by Wesley Goetz of the National Elk Refuge, and will hereafter be referred to as the Goetz site. This is one of several sites where Tensleep quartzite boulders and cobbles were spalled and quarried. Several dozen cores and bifacial preforms were collected from nearby slopes by Mr. Goetz and these were available for study. The site surrounds a spring in a small valley whose walls contain lag glacial boulders, some of which are Tensleep quartzite. A dragline operation to open up the spring brought up quantities of butchered bison bone and flake materials. An incomplete bear mandible was recovered from this site in an earlier test hole. A 5 by 10 foot test pit into an undisturbed portion revealed the scattered remains of three separate butchered bison as well as numerous flakes, choppers, bifacial fragments, and projectile point pieces.

Over twenty pounds of flakes, core pieces, scrapers, and chopper or knife-like bifaces were obtained from the single test pit, and the vast majority of this material is the Tensleep quartzite. Less than 5% of the flakes found were obsidian, all of which fall within the visual characteristics of the white hills quarries nearby. A broken pebble with the same surface characteristics as pebbles from these quarries was also uncovered. No ignimbrites were found. Curiously, two flakes, one of them partially worked into a flake tool, were found of the silicious tuff. Of the few pieces of chert excavated, one is a deliberately retouched black opaque flake similar to that utilized at Conant Pass. A flake of agatized wood and a Precambrian quartzite hammerstone were included. The total number of chert flakes is very small, less than 2% of the total.

The flakes with deliberate retouch tend to be slightly larger than the average non-retouched flake (Table 1). Obsidian flakes are apparently from soft hammer or pressure flaking of larger utilized pieces. Only three of the latter were discovered. Seven fragments of biface were uncovered.

A thin layer of carbon at a depth of approximately 9 inches was collected and subsequently dated at A.D. 1560 ± 115. The corrected date is A.D. 1480 ± 115. At this level and below were found a reworked obsidian edge-ground lanceolate point, a thin straight edged, square-based, unnotched brown chert point, a piece of

Table I - Unretouched flakes, retouched flakes, and biface fragments from the Goetz site test pit, National Elk Refuge.



obsidian corner notched point, and what appears to be a McKean-like stem base of an obsidian point (Fig. 9d-g). A great deal of fire-cracked rock was distributed throughout the test pit as well as other undiagnostic tools (Fig. 9h-l). Possibly two layers of bone and materials are present, though a specific dividing line between them could not be drawn.

The significance of the Goetz site is that it represents the one bit of solid evidence as to the economy of the prehistoric populations frequenting Jackson Hole. If the non-indigenous cherts come from different areas, as suggested, it may mean the site was used more than once, probably by different groups. There are questions which this site raises that might be looked into in the future. First, the extent of the living areas has yet to be determined, and secondly there are ramifications inherent in the fact that this locale was not subjected to the meltwater effect of the last major glaciation. This spring setting, as well as several others similar to it nearby, might have been prime living sites since prehistoric peoples first arrived in the region. This is one of the few portions of Jackson Hole that has escaped flood plain washes, landslides, stream-diverting fault scarps, and active alluvial fan construction. In most other areas some geological event has disrupted any developing archaeologic continua. The same might be said for an area on the south end of Blacktail Butte.

Three or four other sites were pointed out that are similar in setting to the Goetz site. One of them was visited, and found to be similar in potential, though few bone fragments were apparent. This spring too had been partly trenched and piped to provide water for elk, and in the back dirt, flakes of obsidian and quartzite were collected along with a haftable and complete, partly grooved bifacial ax head. One fragment of a probable corner-notched point of obsidian was found. Mr. Goetz also submitted a small concave-based, triangular obsidian point, found at the time of the trenching (Fig. 10 a,b,c). About 150 feet away and overlooking the spring and adjacent small valley is a low knoll. On it is a stone circle and minor debitage. Three other similar sites were recorded but not visited.

An apparent burial site has also been located in the white hills. It consists of an elongate pile of cobbles with a large maroon quartzite boulder at what is probably the head. This may or may not be prehistoric. It was left undisturbed.

At the head of the Flat Creek alluvial fan is a high bench on the north side of the stream. On it are three areas of one, three, and six partially destroyed stone circles which have long been exploited by local collectors. This site is recognizable because like certain other terraces, quartzite cobbles and materials have been brought up on top of the loess capping from below. Nothing diagnostic was discovered although some curiously flaked and spalled cobble "tools" were retrieved. These might have gone unnoticed except that Mr. Goetz had collected numbers of the same

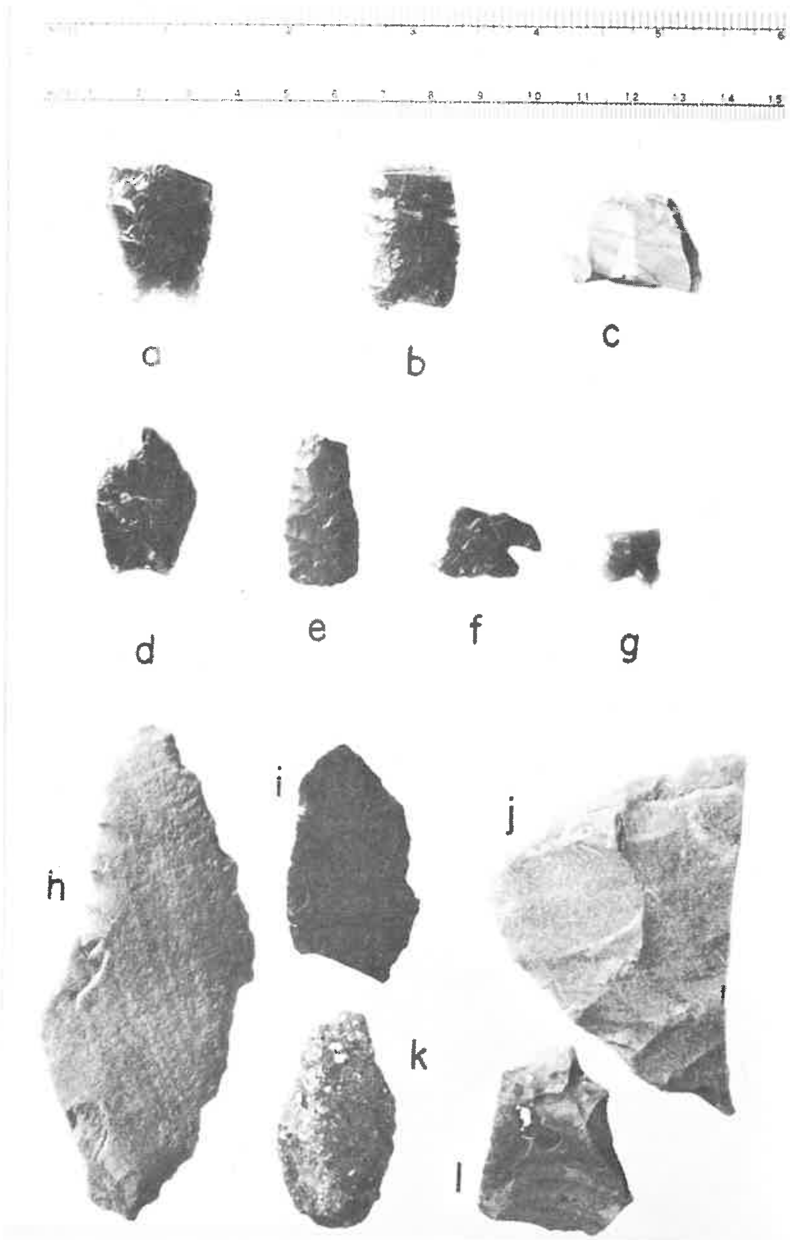


Figure 9. Artifacts from the Tensleep quartzite quarry on Blacktail Butte: a-c. Artifacts from the Goetz site test pit, National Elk Refuge: d-g; representative tools from the same test pit: h-l.

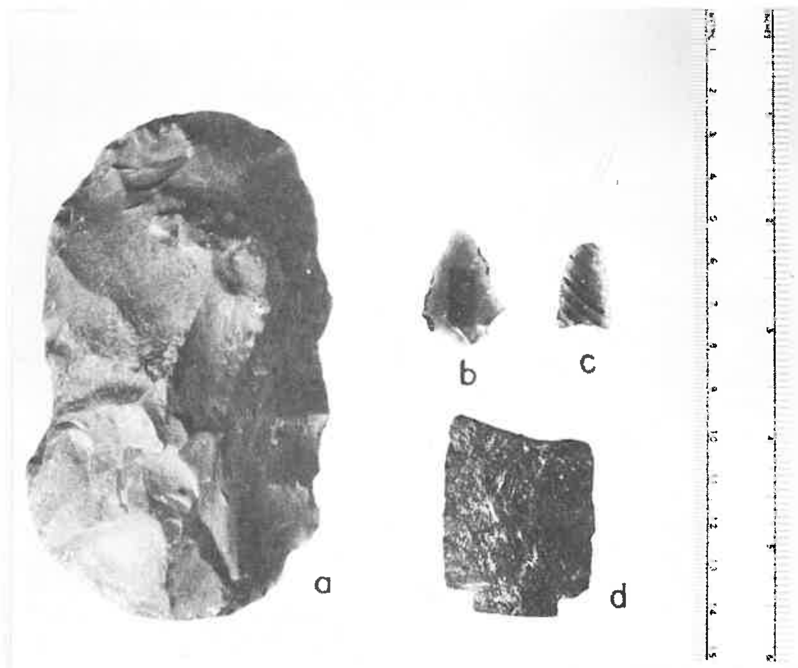


Figure 10. Artifacts from backdirt of a trenching operation on a spring in the National Elk Refuge: a,b,c. Basaltic Scottsbluff-like point from the Jenny Lake moraine.

"tools" from the other sites just previously discussed. The writer is convinced that these have some significance, but their use remains unknown. One flake of an unusual grey obsidian was found.

Farther south, near the mouth of Curtis Canyon, several isolated stone circles have been reported from several sources, and each particular site is apparently in a different spot. This area, as well as a stone circle reportedly on the Flat Creek alluvial fan, was not visited.

A site from which a large, unusual, and polished obsidian cobble was obtained is located on the Nowlin Creek alluvial fan near a large seep. While this area has been plowed and has since heavily grown over, it was reportedly a large and extensive site on the former banks of Nowlin Creek. No cultural material was found on a visit to the site.

Miller Butte northeast of Jackson has been a favorite local collecting area for the town residents. Several warm and cold springs emanate from the base of the butte on the south and southwest sides. Around them prodigious quantities of artifacts have been found by the public. Most of the materials are obsidian and Precambrian quartzite. A few tiny caves on the southeast edge of the butte were cleaned out many years ago. In the central part of the butte are several groups of partly buried stone circles. The largest group has 13 in good condition but 3 or 4 more may have existed at one time. Fire-cracked rock is both inside and outside of the rings, and is generally spread over much of the area. Some six separate sites were distinguishable in this central portion of the butte, and a few flake materials were collected from five. A total of 25 stone circles were counted, and all range within 12 to 18 feet in diameter. The flaked materials are predominantly obsidian and Precambrian quartzite. The obsidian visually appears to have sources in the white hills and the Mosquito Creek area due to characteristics of the pieces exhibiting pebble surfaces. One flake of grey obsidian was found. Cherts, where they scantly occurred, were partly from Madison modules obtainable on the butte. Only a few chert flakes were found which were not indigenous. Most of them have extensive use retouch or deliberate reworking.

It would seem from the flake evidence that the majority of the prehistoric populations camping here had already been to one or more of the obsidian quarries and hence may have discarded most of any cherts they brought with them. It might be possible these sites represent mid to late summer encampments since the proportion of chert is very low and that of obsidian is very high. If the populations originally came from the east and utilized any other obsidian source than the white hills, they would have to cross the Snake River twice before camping on Miller Butte. If the populations came from the west, they would have to cross the Snake once, a feat least possible in June. It should be noted that Miller Butte is in one of the driest areas of Jackson Hole on both isohyetal maps of Carter & Green (1913) and Mundorff, et al, (1964).

Near the town of Jackson, many artifacts and materials have been recovered. The National Park Service collection contains a classic long stemmed McKean point found on the top of the south end of East Gros Ventre Butte. Local collections show similar points and younger varieties from the south edge of town near Flat Creek. Other materials have been gathered from the east side of town and upstream on Cache Creek. Most of the materials have been of obsidian, and many of the collection areas have been altered or destroyed by construction. No systematic check of the remains of these areas was made, although a few sporadic collections are available.

West Side of Jackson Hole

While a few extensive sites exist west of the Snake River in southern Jackson Hole, surprisingly few sites were reported for any of the distance between Jackson Lake and about three miles north of the town of Wilson, At best, only a few scattered artifacts and fragments have been found in this region, and no quarries, trails, encampments, or structures have been reported. The high Teton divide seems to have far more evidence of prehistoric activity than the flats below to the east. Reasons for this might be found in the extensive willow swamps which occupied much of the southern part of this stretch. The heavy timber on and off the glacial debris in parts of this strip might have posed difficult travel problems. Lastly, much of this area was settled late and the residents may not have been aware of artifacts. Mentioned previously were the three ranches in the vicinity of Timbered Island whose owners and caretakers were virtually unaware of any artifact finds in their area. Another ranch to the southeast also had nothing to offer. Five miles north of the town of Wilson a rancher established on the pre-dike flood plain of the Snake had never known of any artifacts from that area in spite of extensive work clearing willows. One especially observant long time resident of Moose had discovered only a few undiagnostic pieces and had heard of only a few more west of the Snake.

None of the collections observed during the field season had any artifacts from this region, and these include the W. C. Lawrence and the National Park Service collections. A single artifact was obtained however, that was luckily turned in by a tourist. This is the mid-section of a basalt Scottsbluff-like point found on the Jenny Lake moraine (Fig. 10d). Immediate observation of the site disclosed nothing more.

In the writer's opinion, lack of reported sites for this particular strip of flatland may reflect a lack of observation north of Moose, while topographic and vegetational patterns may be the cause of the paucity of sites farther south. Undoubtedly sites will turn up in these areas with more concentrated search.

From the Wilson area south the story is much different. Many isolated finds of artifacts occur and several extensive sites are present. While the most important of these have been mentioned previously under quarry and terrace sites, several others might be reported. One of the ranches at the mouth of Trail Creek has seen much local collection for obsidian artifacts. This area is along the Teton Pass travel route and the obsidian may come from any of the sources in that region. It appears that the obsidian spread both north and south along the terraces and west banks of Fish Creek, and the material is so densely distributed in several localities that it is difficult to place site perimeters. This sporadic condition discontinues several miles north and south of the town of Wilson. One site was indicated by a fortuitous fresh scraper cut during widening of the road south of Wilson. The obsidian from the loess all appears to be of the local variety, and consists of a broken pebble and flakes. None appears to have use retouch. In some of the agricultural land south of Wilson, a number of fire hearths were unearthed several years ago during leveling of the land by a soil conservation project. These hearths had been buried approximately one foot, and collections were not made at the time. This area was not visited by the writer. Another obsidian flake site occurs near the mouth of Mosquito Creek, but the obsidian is local and no diagnostic pieces were collected.

Other Low Elevation Sites

Several other sites are hard to place in the previous area sections. Perhaps most indicative of these is a cache of materials turned in by J. D. Love from Boyles Hill. The site was revisited and the few remaining flakes and hammerstones were retrieved. The obsidian includes flakes, preforms, and unworked pieces. Some of those flakes had peculiar rounded and polished edges which possibly suggest having been carried in a bag. The raw obsidian pebbles look like the material from the glacial source directly across the Snake River to the west. They are certainly not like those collected from the Mosquito Creek or white hills localities. Chert flakes make up 40% of the materials, though no rough or pebble surfaces are present. Three small quartzite hammerstones are included. One artifact brightens the cache materials. This is a small concave based lanceolate point refined from a slightly curved grey-brown chert flake (Fig. 11a). No edge or basal grinding is present. It would fall within the agate basin category discussed in the section on the W. C. Lawrence collection (Fig. 23b). One large obsidian biface preform and a wide 4 inch long brown chert biface are the only worked tools besides retouched flakes (Fig. 11b,c). One of the quartzite hammerstones is a miniature of some of the inigmatic cobble tools found by Mr. Goetz (Fig. 11 d). The conclusion is that whoever made this cache came from the west or south, obtained obsidian and crossed the Snake. The cherts do not seem to be of an eastern variety.

Another site was located on Boyles Hill that yielded mostly obsidian debitage and a peculiar distinct black chert with a deep red wash. Nothing diagnostic was found.

A cave or overhang site, thoroughly screened, reportedly exists near the mouth of Porcupine Creek at the entrance to the Snake River Canyon. Only tiny, monochrome glass beads were found, no flakes or artifacts. The overhang or niche occurs in the Camp Davis Formation which outcrops along the canyon wall in castellated cliffs. Another report mentioned beads dripping off the wall onto the top of the slope below. No investigation has been made.

Farther south on the Snake River, a developed hot spring occurs on the old Johnny Counts flat. In a more recent excavation for development of this spring, not only were early historic (probably Astorian) paraphernalia found, but a layer of mixed *bison* bone and shell was exposed. The shell was carbon dated at 11,940 ± 500 years (Ives et al. 1964). Several *bison* skulls were retrived from this layer but they have not been located. Judging from description they were not of any *bison* larger than modern populations. A lanceolate obsidian point comparable to an

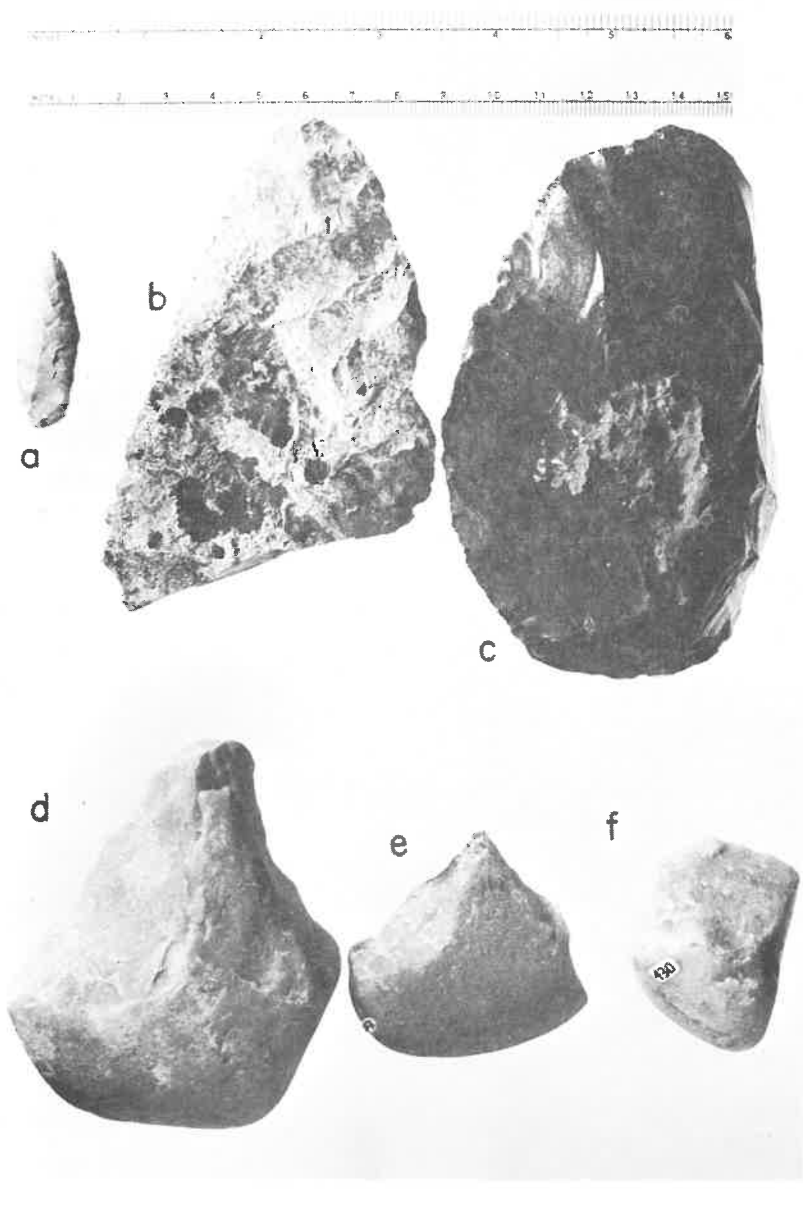


Figure 11. Artifacts and representative materials from the Boyles Hill cache.

unfluted Clovis came from this site and is in the W. C. Lawrence collection. Its context is not known. Many other artifacts have been found and disseminated from this site.

A tiny cave site was discovered several years ago by the writer high up on a cliff in the Hoback Canyon. Some seven poles protruded from a small opening in the cliff face. The entrance can be gained only by a narrow and risky ledge, and the small surface collection made was of some small bone fragments. These include marmot, pika, and the phalanges of probably bighorn sheep. The sampling was purely surficial and the cave was left undisturbed. It was not revisited during the past research season.

Farther upstream in the Hoback Canyon an unusual site was reported and visited several years ago. This consists of a talus slope in which a foot deep pathway through the talus blocks has been constructed. It is less than 125 feet long and at each end a circular depression has been excavated in the talus, the blocks unearthed used for rocking up the walls. Two large boulders form part of the rocked up walls of the western depression, and the eastern depression has incorporated some large twisted and weathered dead tree roots into its wall construction. The roots were probably gathered from avalanche debris on the talus. Both of the depressions are about 7 feet in diameter and have walls over 3 feet high. The pathway averages about 2 feet wide and the talus removed used to rock up the downhill wall. In places the wall is nearly three feet high. The pathway, though not straight, rises slightly over a mound in the talus on the east and twists down through some larger boulders to the western depression. The entire structure is completely invisible from any view on the grassy terrace directly in front of the talus. The position of this feature on the talus seems to rule out its potential functions as a living or defense structure. Although the broad terrace may have been a congregation point for migrating game, it would necessitate corral or fence lines to force them near enough to the talus edge to be within accurate bow-shot of the structure. By contrast, any game on the near half of the terrace could be easily taken by rifle from this blind. In view of the surrounding natural cover however, the amount of work put into construction of this feature does not seem to justify its existence as a hunting blind. While no cultural materials were found in the structure, two flakes of obsidian were discovered on the near part of the terrace, one a reworked blade.

In the southern part of Jackson Hole, another obsidian flake site was reported for a hillside overlooking the Snake River on the West Gros Ventre Butte. It is in a small swamp nearby, five buffalo skulls were collected by the landowners, suggesting at least that game was available in the vicinity. Three miles away at the north end of the East Gros Ventre Butte is a developed warm srping. The surrounding land has yielded numerous artifacts to local collectors. While a systematic tracking-down of these materials was not made, a three-quarter grooved polished serpentine ax head discovered there was available for observation. This is about 6 or 7 inches long by 2 or 3 inches wide and typical in all respects to those from cultures in the southwestern United States. A second similar grooved polished ax was apparently found in the Gros Ventre riverbed somewhere in the canyon, but this one was no longer in Jackson Hole. It was described as being of the same material, but much smaller, perhaps less than four inches in length.

Two rather poorly represented sites were located on Two Ocean Lake. The remains of one of these sites is near the east end of the lake where an early dam was constructed. In spite of the destruction of the site by this activity, a number of flakes and one non-diagnostic artifact were found along the dam shore (Fig. 12a). To the west a delta on the southwest shore exposed several obsidian flakes, two of which were unusual. One contains rhyolitic impurities and the other is a sandy opaque jet variety. Perhaps these come from Yellowstone or presently undiscovered local sources, for they do not fit into the range of variation for the know Jackson Hole quarries.

An area of buried fire pits was reported on a ranch near the Buffalo Fork River. Discovered many years ago in a soil conservation analysis, no detailed information was then recorded. The site was not visited during the field season.

TO BE CONTINUED IN JUNE ISSUE.....