THE WYOMING ARCHAEOLOGIST

VOLUME 39(3-4)

FALL 1995

THE WYOMING ARCHAEOLOGIST

VOLUME 39(3-4), FALL 1995

Table of Contents

ANNOUNCEMENT

ANNUAL MEETING

WYOMING ARCHAEOLOGICAL SOCIETY

27-28 APRIL 1996

WESTERN WYOMING COLLEGE CAMPUS

ROCK SPRINGS, WYOMING

The 1996 Annual meeting of the Wyoming Archaeological Society will be held on the campus of Western Wyoming College on April 27-28, 1996. Now is the time to start planning to attend this meeting. The Wyoming Association of Professional Archaeologists (WAPA) and the Wyoming Association of Professional Historians (WAPH) will also be holding their annual meetings in conjunction with the WAS meeting.

WAPA will hold their business meeting on Friday, April 26. WAPH will have their meeting on April 26 and 27 (Friday and Saturday) with a two hour moderated panel discussion on linear historic features between 2-4 pm on Saturday afternoon.

The WAS business meeting, scholarship committee meeting and presentation of student papers will be on Saturday April 27. The Banquet Saturday evening will be at the Outlaw Inn, with the speaker being Dr. Tom Dillehay. There also will be a silent auction at the banquet.

Sunday, the Wyoming Archaeological Foundation will beet. Tours to local rock art sites will be scheduled on Sunday, weather permitting.

SEE YOU IN ROCK SPRINGS!!

1995 WAS SUMMER MEETING

submitted by
Marcel Kornfeld

The WAS summer meeting was held from July 7 to 9 at the University of Wyoming field camp alongside Black Mountain Road, outside of Shell Wyoming. The meeting was hosted by George C. Frison and Marcel Kornfeld.

The meeting included a visit to the Black Mountain Archaeological District, attendance of the "Digging up the Past" 5th Annual Paleontology Symposium at the Washakie County Museum, a visit to the South Beaver Creek petroglyphs and to the Hanson Folsom site.

The WAS summer meeting was attended by the following society members: C.K. Adams (Casper), Lucille Adams (Fremont), John and Evelyn Albanese (Casper), Carolyn and Jim Buff (Casper), Cher Burgess (Sundance), Milford and Imogene Hanson (Absaroka), Bud and Cleo Kinchelow (Absaroka), Mary Lou Larson (associate), Mark Miller (State Archeologist), Marilyn Mills (Rawlins), Jim Platt (Absaroka), Glen Sweem (Sheridan), and Danny Walker (Assistant State Archeologist).

Non-members attending included: John Anderson (Laramie), Beth Ann Camp (UW student), Lisa Danke, Toddy Darlington (Rawlins), Ann, Allyn and L. Shea Dimock, Judson Finley (recipient of the 1995 Mulloy/Frison scholarship), Sherie and Chuck Glade, Pam (Washakie Museum director) and Scott Gaulke, Jerry Hansen, Rhoda O. Lewis (Denver), Carol McCanless (South Carolina Archeological Society), Row and Cliff Manuel, Virginia and Jim Patric (Cody), Russell "Chuckles" Richard (Mariah Associates), Fran Scranton, Elizabeth Shaw, Ken Stalls, and Patrice White (recipient of the 1995 Mulloy/Frison scholarship).

The meeting started with Carolyn Buff arriving early (Thursday) and helping the Black

Black Mountain Archaeological District Field Camp outside of Shell, during the Saturday night George Frison retirement bash. Left to right: Rhoda O. Lewis, Carolyn Buff, and Toddy Darlington.

Black Mountain Archaeological District Field Camp outside of Shell, during the Saturday night George Frison retirement bash. From left to right: Judson Finley, Carolyn Buff, Jim Buff, and Mark Miller.

Mountain crew. Several others arrived Friday evening or joined us at camp Saturday morning. Because of last minute rescheduling, Saturday was spent on field trips to the South Beaver Creek Petroglyphs, the Hanson site, and ultimately ending up in Worland for the symposium at the Washakie Museum.

The South Beaver Creek Petroglyphs are an unusual set of rock art panels which include human, elk, bison, bear, deer, and spider motifs. The figures are southeast facing, along a prominent sandstone outcrop that separates South

Sunday morning field trip to Black Mountain Archaeological District. George Frison, in the center of the photo, explaining the Phosphoria procurement at the district.

George Frison pointing to the canyon where several shelters, including 48BH1065, are located, and explaining the significance of these shelters for Bighorn Basin prehistory.

from North Beaver Creek. The sheer cliffs of the sandstone outcrop are perhaps 12 to 15 meters high at the tallest point. The rock art is along the bottom 2-3 meters of the base of the cliffs and some figures may be buried in the sand at the bottom of the outcrop. All of the figures are pecked, but in a few cases only the outline of the figure is pecked. The figures range is size from approximately 10 cm to probably over 1.5 meters.

The visit to the Hanson site involved a search for the right road to reach the site and

Visitors heading to 48BH1065, down a treacherous and slick path along the side of the canyon.

Russell Richard photographing the rockshelter (48BH1065). The shelter is under the cliff, approximately in the center of the photograph.

after a few tries we were at the right place. However, the view of the site was even better from the two track road on the ridge to the north of the site. From this point the entire site, Areas 1 and 2 are clearly visible, emphasizing the environmental context of the Bighorn Mountains in the background, the surrounding drainages, terraces, and so on.

Because of a few wrong turns on the way to the sites in the morning, we arrived a little late to the symposium in Worland, nevertheless, we still heard most of the presentations. Although

Judson Finley and Patrice White taking elevation measurements at site 48BH1827.

Examples of South Beaver Creek petroglyphs. Top: bugling elk and modern vandalism; Bottom: ungulate on right and a spider or crab on the left.

the symposium was devoted to Paleontology, all but one of the talks were by archaeologists, geoarchaeologists, or zooarchaeologists. The papers included: Vincent Morgan (Durham, New Hampshire) "The Granger's Paper Project (about Stewart Granger's paleontological expeditions to the Gobi Desert and Wyoming), George Frison (University of Wyoming) "Taphonomy of Mammal Bones in High Plains-Foothill Mountain Paleoindian Sites" (as an introduction to Dr. Frison's presentation and as a part of his retirement from the University of Wyoming, he was awarded-although only verbally-a certificate of appreciation by the Wyoming Archaeological Society and the Washakie County Museum, for his work with the society and especially for his

Another example of South Beaver Creek petroglyphs. Anthropomorphic figure.

investigations in the Bighorn Basin), John Albanese (Casper) "Past climatic changes in Wyoming as reflected in the geologic and topographic record," and Danny N. Walker (Office of the Wyoming Archeologist) "Excavations at Wolf Den Cave, a natural trap in the Bighorn Mountains, Wyoming." After the symposium the Washakie County Museum held a picnic, which included live music, in the park across the street from the museum. Most participants attended the picnic.

In the evening WAS members and friends returned to the Black Mountain archeology project field camp outside of Shell, for a George Frison retirement bash. Although the wind didn't cooperate, it slowed down enough to allow for a campfire and all present enjoyed a pleasant evening.

Sunday morning was the field trip to Black Mountain Archaeological District. The district is comprised of three open air sites and over half a dozen rockshelters. The open air sites are chipped stone raw material procurement locations for Phosphoria chert. Although designated as three separate sites, the Phosphoria chert procurement in the Black Mountain Archaeological District is essentially a small part of the Bighorn Mountains Phosphoria procurement area which stretches around the foothills of the entire mountain range. Because of the Phosphoria procurement activities, these sites are truly impressive in terms of spatial size and quantity of material present. The WAS members and other participants of the field trip were shown the area by George Frison and Marcel Kornfeld. The participants were able to see tremendous sago lily *(Calochortus* sp.) fields along the foothill slopes of the Bighorn Mountains. Prehistoric inhabitants could have subsisted for weeks on the fresh lilies and perhaps for months if they stored them. Other potential aboriginal resources were also viewed by the trip participants.

A great deal of time was spent in the two rockshelters currently under investigation by the University of Wyoming field crews. Although both rockshelters are small, one definitely has deposits dating to as early as the Late Paleoindian period, while the age of the deposits in the other shelter are not yet known. The visitors first went to 48BH1065. A large pit was dug by looters in this shelter, and although the pit has been backfilled, the visitors were told about looting. A burned wood sample from the wall of this pit yielded a date of nearly 3000 years before present, however, the current testing is in a layer considerably above this that contains Late Prehistoric and Avonlea period artifacts. After lunch most of the visitors went to 48BH-1827, the other small rockshelter under excava-

tion.

Acknowledgements: We (Marcel Kornfeld and George C. Frison) wish to thank the Washakie County Museum for allowing the crew to attend the symposium and for the picnic. We also wish to thank Mr. and Mrs. Carroll Miller for allowing us access to the South Beaver Creek petroglyphs. Additionally, we wish to thank Carolyn and Jim Buff (and their metal detector) for helping us locate our old subdata scattered over the Black Mountain Archaeological District and Jim for playing Paul Bunyan, Cleo Kinchelow for finding an Early Archaic projectile point on the surface of 48BH902, and the Bureau of Land Management, Worland Resource Area, especially Mike Bies for supporting our Black Mountain Archaeological District investigations.

ARPA UPDATE

Although more than a year old, the news of the U. S. Supreme Court's denial of Arthur Gerber's petition for *writ of certiorari* on January 18, 1994 might not be known to all. The decision is important because it makes those taking artifacts from sites on private property liable for prosecution under ARPA in certain instances.

Gerber had illegally obtained artifacts from one of the five largest Hopewell burial mounds in eastern North America. The site is located on private land near Mt. Vernon, Indiana. Gerber's theft violated Indiana's trespass and conversion laws. The artifacts were transported across the state line to Kentucky for subsequent sale which invoked section 6(c) of the Archeological Resources Protection Act (ARPA). Gerber plead guilty in 1992 and received a sentence of one year in prison on five ARPA counts, a $5,000 fine and an assessment of $4,750 in lieu of forfeiture of motor vehicles used in committing the offenses. He reserved his right to appeal on the grounds that ARPA did not apply in his case.

The Seventh Circuit Court of Appeals had affirmed Gerber's conviction on July 22, 1993. This court rejected his claims that ARPA's criminal provisions never extend to private property, that the prohibition against interstate trafficking required proof of violation of a specific archaeological protection statute, and that ARPA section 6(c) was unconstitutionally vague (United States v. Gerber, 999 F.2d 1112 [7th Cir. 1993].

Federal Archeology Report 7(1) Spring 1994

In December 1994, Richard P. Maniscaico, 49, of Virginia, pled guilty to violating both NAGPRA (1B U.S.C. 1170 (a)) and ARPA (16 U.S.C. 470ee). He had sold the leg bone of a Cheyenne Indian and assorted artifacts to a Bureau of Land Management (BLM) undercover agent. The bone and artifacts were from Indian and federal lands in Montana including Little Bighorn Battlefield National Monument (LBBNM). In a plea bargain agreement, Maniscalco agreed to forfeit the illegally obtained items. He was sentenced to a $500 fine and one year probation for selling artifacts and a $1,500 fine and one year probation for trafficking in Native American remains. Maniscalco must also reimburse the U. S. probation office about $2,100 for administering his case and pay the National Park Service (NPS) $1,500 for repatriation of the human remains to the Cheyenne nation.

Federal Archaeology Report 7(3) Fall/Winter 1995, 8(1) Spring 1995

Charles Snyder of Bowie, Maryland has been indicted on three counts of attempting to sell artifacts from LBBNM and possession of government property. Snyder had purchased about 50 artifacts from Maniscalco. Both were arrested in a BLM sting operation that also snared George Scott, a former seasonal ranger at LBBNM. Scott had taken many of the artifacts and sold them to Maniscalco. Snyder and Maniscalco were arrested by NPS special agents.

Federal Archaeology Report 8(1) Spring 1995

Last March, Rodney Adam Coronado, 28, of Tucson, Arizona, pled guilty to the charge of theft of government property having been arrested the previous November. Coronado took a black leather notebook from a display case at LBBNM. The notebook had belonged to Lt. Donald McIntosh of Gen. George A. Custer's command and was obtained from a Sioux wom-

an. A hole in the notebook is believed to have been made by the bullet that killed Lt. McIntosh. Coronado testified that he burned the notebook in a stove. Coronado, an Indian, had written an electronic message to supporters over the Internet in March saying that he had stolen the notebook to protest government treatment of Indians. Doug McChristian, chief historian at LBBNM, testified on August 10 concerning the historical value, rarity and worth of Lt. McIntosh's notebook. Coronado was sentenced to concurrent 57-month prison terms for the notebook theft and aiding and abetting an arson. Coronado is an animal-rights activist and had been charged in the 1992 firebombing of a Michigan State University laboratory.

Billings Gazette, August 8 and 13, 1995

The theft and sale of petroglyphs from Kaibab National Forest, Arizona resulted in ARPA convictions for three Arizonans. Adam Bruce sold four pieces of rock art to federal undercover agents in January 1994. Adam implicated his father, John Bruce, as the "mastermind" of their "business" which also included elk poaching and the removal of moss rock on Forest Service lands, both natural resources violations.

In February 1994 Adam stole five more petroglyphs with the aid of a backhoe provided by Becky Whitted. She helped load the petroglyphs and transport them to Phoenix. There, Ms. Whitted and the Bruces sold them to undercover agents for $1,500. For the crimes, Adam received seven months in prison and 36 months supervised release. His father received 36 months probation, and Becky Whitted was given 24 months probation. All three were ordered to pay more than $7,600 to the national forest in restitution. Three pickup trucks used in committing the violations were forfeited to the government. Forest Service (USFS), BLM and Arizona Game and Fish Department law enforcement personnel investigated the case.

Federal Archeology Report 8(1) Spring 1995

In the first prosecution under the Native American Graves Protection and Repatriation Act (NAGPRA) (18 USC 1170(b)), Brian and Gerald Garcia of New Mexico were found guilty of removing kachina dolls from the Pueblo of Acoma and then attempting to sell them to a BLM undercover agent. Brian was fined $300 and given 18 months probation. Gerald was also fined $300 and ordered to spend three months in a halfway house.

Federal Archeology Report 7(3) Fall/Winter 1995

In addition to the preceding convictions, Operation Heritage, a combined federal law enforcement effort to stem the theft and destruction of Arizona's archaeological heritage, led to the indictment of five other persons. Investigation by the BLM and the USFS assisted by the U.S. Customs Service, the San Carlos Apache Tribe, the U. S. Marine Fisheries Service and the Rocky Mountain Information Network resulted in the indictment of Larry R. Hedrick, 55, Apache Junction; Rick L. Shaw, 44, Cave Creek; and Jerald S. Sullivan, 34, of Gilbert with conspiracy (18 USC 371) and trafficking in unlawfully removed archaeological resources (16 USC 470ee[b]). Sullivan is also charged with the interstate transportation of stolen property (18 USC 2314), and Shaw is also charged with being an accessory after the fact (18 USC 3).

Allegedly, Shaw and Sullivan, both city of Mesa firemen, enlisted Hedrick, then Director of the Superstition Mountain Museum, to sell several bows stolen from the San Carlos Apache Reservation. Shaw was alleged to have been one of a group who removed a ceramic pot,

staffs and bows from a cave on the reservation once used as a shrine. The bows date from 900 to 1200 A.D. and are believed to be Mogollon. The indictment states that Hedrick arranged a meeting between a federal undercover agent and Sullivan who sold about 40 of the bows for approximately $50,000.

Sullivan is alleged to have taken ten of the bows from Arizona to Nevada resulting in the transportation of stolen property charge. The indictment further alleges that, in an attempt to shield Sullivan, Shaw deliberately led federal agents to a place from which he knew the bows had not been taken, thus making him an accessory after the fact.

A BLM investigation led to the indictment of Michael Lee Collins, 38, of Phoenix and Bobby Gene Shipley, 36, of Glendale with conspiracy (18 USC 371), unlawful removal of archaeological resources (16 USC 470ee[al) and trafficking in unlawfully removed archaeological resources (16 USC 470ee[b]). The pair is alleged to have dug at Pueblo Pato on June 22, 1994. The site is managed by BLM on Ferry Mesa north of Phoenix. A ground stone tool and a number of beads were removed from the site.

Federal Archeology Report 7(4) Winter/Spring 1995

Brian R. and Christine A. Bader, a husband and wife looting team from Banco, Virginia, were convicted on March 17, 1995 of removing artifacts from the C & 0 National Historical Park in Maryland. In November 1993 park ranger Michael Sabatini discovered the Baders with two metal detectors, two shovels, and numerous Minie balls, canister shot and buttons. Later, more than 24 freshly dug holes were discovered in former Union fortifications on park property. The Baders plea-bargained and were fined $200, ordered to pay $1,400 in restitution to the National Park Service and placed on unsupervised probation.

Federal Archeology Report 8(1) Spring 1995

Jack Lee Harrelson, 54, of Grants Pass, Oregon was arrested in Grants Pass and charged with abuse of a corpse, theft, unlawful possession of an illegal gambling device and tampering with evidence. Harrelson was held in lieu of $150,000 bail. Artifacts and bones looted from prehistoric Indian graves on a dry lake bed near Winnemucca, Nevada were found in Harrelson's home. The looting occurred in the 1980s, and the statute of limitations on federal laws protecting cultural resources had run out.

Artifacts 11(1), July 1995, Idaho Archaeological Society, Inc.

OVERVIEW OF WIND RIVER BASIN ROCK ART

by
James J. Stewart

In the Wind River and southern portion of the Big Horn Basins there are ancient Native American drawings of super-humanoids, animals, and geometric figures. Exactitude in understanding or deciphering these ancient religious/artistic endeavors is not available, however, a general understanding and expanded appreciation can be obtained. And, hopefully with that understanding, a desire to see they are protected from both intentional and unintentional vandalism.

The religious/artistic rock drawings in Wyoming are called petroglyphs if they have been carved into the rock face, and pictographs if they have been painted. Ancient rock art in general, whether it is in the Wind River Basin of Wyoming, the plains of Africa, the caves of France, or the deserts of Australia, can be classified first, by whether it is carved or painted; second, by its subject matter -- animals, people, abstract patterns, etc.; third, by whether its intent appears to be ceremonial, biographic, utilitarian, numerical, or artistic; and fourth, by estimates of its general age. In Wyoming, these general ages can be divided as follows: Paleoindian (12000-6000 B.C.) Early Archaic (6000-3000 B.C.), Late Archaic (3000-0 B.C.), Prehistoric (A.D. 0-1800), Protohistoric (A.D. 1540-1805), and Historic (A.D. 1805-1900).

The two basic techniques for creating petroglyphs in Wyoming are pecking and incising. Pecked petroglyphs generally are associated with the Great Basin cultures, such as those found in the desert lands from Utah to California, at Dinwoody (48FR109) in the west end of the Wind River Basin, and with most of the sites in the Wind River Basin in general. Incised petroglyphs are generally associated with the Plains Indian cultures, and are noted at Castle Gardens (48FR108) in the east end of the Wind River Basin, and at a number of select sites along drainages leading to South Pass (48FR2506-48FR2510). Besides these two basic petroglyph techniques in the Wind River and Bighorn Basins, there are also examples of abraded (burnished) petroglyphs, and rare examples of mixing of all or several of the techniques -- which is further compounded by "paint" being applied to some of the petroglyph techniques.

PECKED PETROGLYPHS

Most petroglyphs in the Wind River and Bighorn Basins, including those at Dinwoody Lakes, Whiskey Basin, Sinks Canyon, and Legend Rock, are pecked. The technique is thought to have been created by pounding or tapping a sandstone rock face with a hand-held tool creating an effect and look much like what one gets when tapping a ball-peen hammer repeatedly in a small area. This speckled "pecked" effect, in past studies, had been associated only with the Shoshonean speaking peoples of the Great Basin area. However, recent archaeological studies are finding examples of these smaller-older pecked petroglyphs from the Black Hills of South Dakota, to Southern Alberta, Canada, with some of those areas, according to archaeologists, not having been frequented by Shoshonean speaking peoples.

Evidence indicates the pecked glyphs represent the oldest petroglyphs in the Wind River and Bighorn Basins, with the most ancient being small in size (smaller than eight inches in width or height), solid pecked, and usually depicting profile (side view) mountain sheep, elk, and deer, and frontal simple or stick figure humanoids. The humanoid figures typically do not have facial features, fingers, toes, or detail in general. The sex gender of these small figures is rarely discernable. After studying the Dinwoody sites, and several other Wind River sites from 1949-1969, archaeologist David Gebhard

(1951, 1969) noted the small solid pecked glyphs were the most ancient general style found in the area, and tagged them as the Old Hunting Style I. In recent studies, archaeologist James Keyser (1975, 1984) speculated these smaller pecked petroglyphs most likely date within the general range of 3000 B.C. to A.D. 1000. The Old Hunting Style I petroglyphs have generally been associated with prehistoric hunting magic, or more specifically with the hunter communicating with an animal spirit to assure a good hunt, or to give justification to the animal spirit for its death. A rare example of a small solid pecked stick figure, with little repatination (re-oxidizing or rusting of the rock face), exists in Sinks Canyon along the Popo Agie River (48FR2498) where deer or elk antlers have been drawn in charcoal extending from the humanoid figure's head. The dating of this glyph proves very difficult because it might be an Old Hunting Style glyph that is so well protected by the rock overhang that its has weathered and repatinated very little. The glyph though, gives insight into the idea that many of the smaller solid pecked glyphs might have had some sort of paint associated with them. In addition, this human/animal glyph might indicate a number of pecked humanoid figures at one time had animal traits "superficially" painted on, deliberately avoiding any permanent attachment attributed to a pecked technique, creating a temporary joining of two differing natures, and the retaining of the permanent one by the human. This temporary sort of composite of the hunter and the hunted, or the humanoid and the animal, could be to create a super-being, super-hunter, or to indicate the transmigration of the human's soul to the animal on a limited basis. All of which, could support the concept of the hunter needing to communicate with the hunted animal to justify his survival in a harsh environment.

Superimposition, or the overlapping of one style over another style is the most reliable relative dating technique available. Other methods have proved less reliable usually due to differing amounts of oxides; rock face hardness; and exposures to erosion. These problems all possibly make an older petroglyph appear newer, or a newer one appear older depending on the variants. The general trend is for the smaller/older pecked mountain sheep and elk petroglyphs, of the Old Hunting Style to be fine pecked on harder rock surfaces like those found in Sinks Canyon (48FR2498), where the glyphs are very clear while some are totally repatinated (turned brown again), somewhat wind eroded, and partially refilled in with a fine black lichen coating.

The second major category of pecked petroglyphs are more recent, but still ancient, larger, and more ceremonial than the older small hunt related ones. This category forms the largest amount, and the fanciest pecked glyphs, in the Wind River Basin area with examples found throughout the basin and internationally known examples found at Dinwoody (48FR109). This style was tagged by Gebhard (1969) as the Interior Line Style, and has been since referred to by other archaeologists as either the Dinwoody Style, or Wind River Basin Style. These large grandiose petroglyphs (Figure 1), are most often outlined rather than solid pecked; often have interior dots, lines, or geometric patterns; at times are burnished or have speckled pecking; and can range up to six feet tall. The larger more recent pecked mountain sheep glyphs in this style can measure up to several feet, while examples of elk and deer measure up to four feet. This style generally is very stylized and ceremonial in nature, with most humanoid like figures being frontal and very symmetrical. Many of these larger Interior Line Style petroglyphs though, appear to be associated with natural or supernatural zoomorphs in one form or another, with some of the horned or winged figures measuring up to six feet high. There is a tendency for some of the pecked horned humanoid figures to be accompanied by a canid (dog), often on a leash, wiggly lines, dots, and dangling lines. The dog motif is found especial-

Figure 1: Pecked Interior Line Style petroglyph from Legend Rock (48HO4).

ly in the eastern end of the Wind River Basin, and the southern end of the Bighorn Basin. In the opposite direction, toward Dubois, there is a tendency for fewer canid glyphs, but a larger portion of the petroglyphs are winged or bird related. To the south, toward South Pass, there is a tendency for more of the petroglyphs to be accompanied by bear, mountain sheep, deer, and elk figures.

There is a tendency for the larger Interior Line Style figures to have facial features, fingers, hands, toes, and other humanoid details. Some, but not most, have some sort of indicator as to the sex gender of the figure. The attention to facial detail, and the ceremonial nature with some of these glyphs, creates the sense that the figures are staring out from the rock face. This ceremonial style often has a mixing of humanoid and animal elements to create supernatural beings, such as horned humanoids, like those found at Legend Rock (48HO4); humanoids with wings, like those found at Dinwoody (48FR109); or humanoids with tails, like those found at Whiskey Basin (48FR311). These larger petroglyphs are most likely around at least 2,000 years old according to the recent studies done at Legend Rock by Francis (1989) (see also Francis 1991; Francis et al. 1993).

Until the studies by Francis, the age dating of pecked petroglyphs in Wyoming was limited to noting the amount of repatination (recoloring of the red/brown rust color of the rock surface); the amount of erosion; the over growth of lichens; and noting that newer petroglyph styles overlapped (superimpose) older ones. Walker and Francis (1989) researched a partially buried large pecked petroglyph at the Legend Rock site (48HO4) in the Bighorn Basin near Thermopolis, and found the base of the petroglyph was level with an old fire hearth, from which the charcoal carbon date tested approximately 2,000 years ago. This research was the first realistic date reference ever associated with any of the prehistoric petroglyphs found in Wyoming.

Recent pecked petroglyphs, newer than the Interior Line Style, tend to be the hardest to "age date" and categorize into another general style. For instance, there are pecked examples, though somewhat rare, of profile humanoids (side view), warriors with bow and arrow, frontal animals, and side view birds. All of these motifs "should" be newer than the 2,000 B.P. (before present) date associated with the Interior Line Style, with the real question being "how much newer?" (Figures 3 and 4).

Figure 2: Pecked humanoid figures from Wind River Basin area rock art sites. Note "leashed" canids" in first, second, and bottom rows.

An example of the bow and arrow motif associated with an Interior Line Style figure is found along a South Pass area drainage (48FR-2502). In general, archaeologists postulate the bow and arrow was introduced into this area about A.D. 300-700, which would suggest that the Interior Line Style at least spanned from 1300-2000 BP. A second example of the bow and arrow motif is found with a smaller solid pecked profile warrior at Whiskey Basin (48FR-311) which leads one archaeologist to claim the Old Hunting Style is not as old as 3,000 B.P. Or, more logically, it suggests that after the Interior Line Style, a newer style followed that was again smaller and solid pecked, but also included profile humanoids associated with more recent motifs like the bow and arrow.

A second newer pecked style, and again a rarer style in the Wind River area, is of warriors with round "shields." This Shield Bearing Warrior Motif in the Wind River Basin is most often associated with incised petroglyphs attributed to the Plains Indian culture, such as at Castle Gardens (48FR108), rather than the pecked petroglyphs generally attributed to the Great Basin. However, archaeologists Heizer and Baumhauf (1958), in studying Utah petroglyphs, speculate the motif originated in the Great Basin before A.D. 1300 and was transported to the Plains Indian cultures by Shoshonean peoples, most likely passing through the South Pass/Wind River area, to become an Incised Plains Design used from about A.D. 1300 through 1890. Pecked examples of the Shield Bearing Warrior Motif are found at Legend Rock (48HO4) in the south end of the Bighorn Basin, and in southern Montana, near the north end of the Bighorn Basin. Montana archaeologist Larry Loendorf (1988) carbon dated materials directly associated with a large Interior Line Style pecked petroglyph of a Shield Bearing Warrior that still bore traces of paint. This pecked petroglyph proved to have been created some time between A.D. 1150-1300 which coincides with the approximate dates speculated by Heizer and Baumhauf the motif was transported out of the Great Basin. These dates generate speculation as to when the oldest examples of incised petroglyphs were created at Castle Gardens (48FR108), and in general, when the Shield Bearing Warrior Motif moved into the northern plains. Noticeable throughout the Wind River Basin is the absence of any pecked horse motifs. Even though a current book on Wyoming petroglyphs depicts pecked horses as existing (Hendry 1983), close examination of the actual examples show they are canid (dog) motifs, as does a closer look at the photos in the book. The horse was intro-

Figure 3: Examples of more recent pecked petroglyphs from the Wind River Basin area.

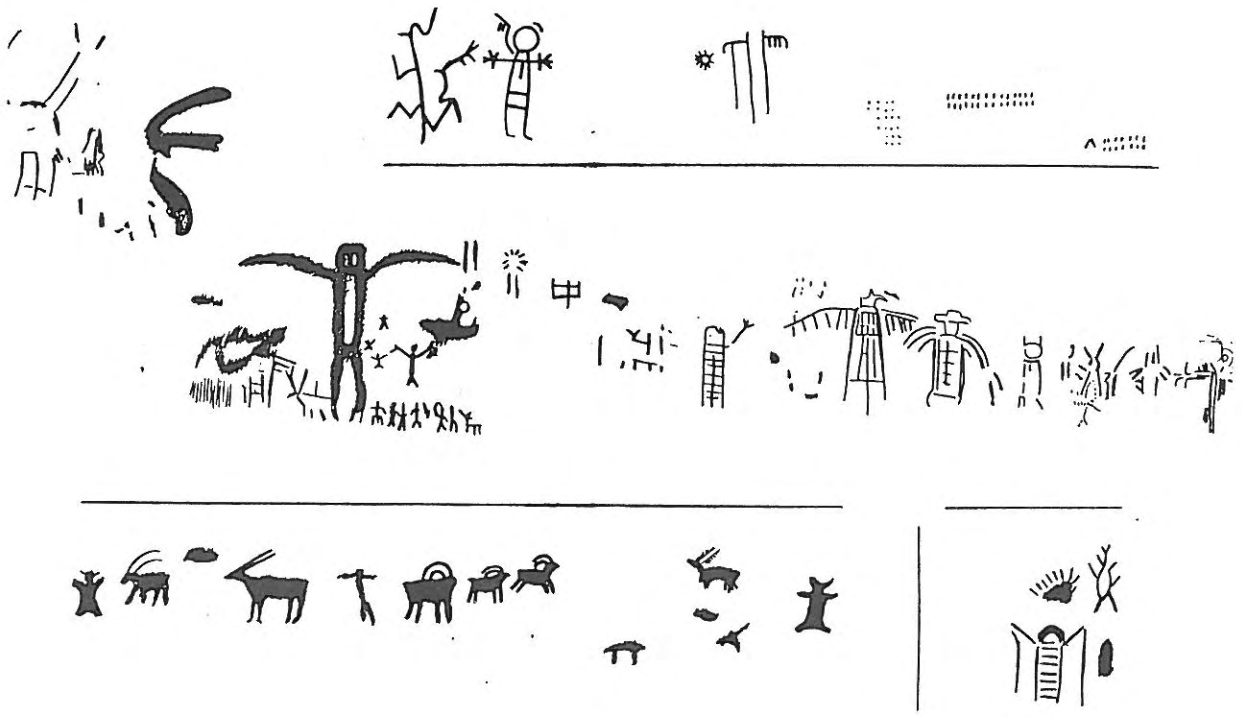

Figure 4: Examples of more recent pecked petroglyphs from the Wind River Basin area.

duced into the Wind River area, according to historians, about A.D. 1720. This leads one to conclude the pecked technique, for the most part, had vanished from the area by the time of the horse and was replaced by the incised, abraded, and painted techniques.

INCISED PETROGLYPHS

The second major technique used in creating petroglyphs is incising, or scraping into and on the rock surface. The tools generally thought to be used were sharp edged rocks, animal antlers, or in later periods metal knives. This category also includes the related classifications of tool grooves, and slash/tally marks, and directional indicators. This technique generally tends to indicate a Plains Indian culture, which overall follows the Missouri River and its tributaries including the high plains as far north and west as Montana, Idaho, and Southern Alberta, Canada. However, it can also be found as far south as the Texas-Mexico border, and eastward to Kansas.

Incised rock art ranges from deep to shallow, and from wide to fine line. Incised humanoid and animal figures in the Wind River Basin range from very large to very small, with examples in the South Pass area varying from several inches up to eight feet across. The multitude of subject matter and motifs created by incising is noticeable, with the range being from ceremonial to historic and autobiographic. Incised motifs commonly found in the Wind River Basin include: the Shield Bearing Warriors, Rectilinear V-Necked Warriors, frontal and side view humanoids, warriors with feathers, warriors with war bonnets, horses, mounted horsemen, battle scenes, hunting scenes, love scenes, tepees, the bow and arrow, spears, guns, buffalo, elk, deer, antelope, mountain sheep, large birds, and geometric designs.

The Older Incised Petroglyphs of humanoid motifs tend to be frontal and ceremonial with much of the symmetrical stiffness found with most Interior Line Style pecked petroglyphs. The newer Incised Petroglyphs, however, especially after the introduction of the horse, tend to be more free flowing artistically, less ceremonial, and depict more communal events that are historic or autobiographic, such as battles, hunting scenes, and life style activities. Deep incised petroglyphs tend to be older, lack the horse as a motif, and appear ceremonial in style. These are especially notable at Castle Gardens (48FR108) and along some South Pass area drainages (48FR2506-48FR2508, 48FR2458, 48FR2495). Some of these older incised petroglyph styles currently are considered to date back to A.D. 1150. A number of these sites do not depict horse or Euroamerican related motifs such as the gun, indicating their probable origination dates as before A.D. 1720.

Historic/Autobiographic Petroglyphs in the Wind River Basin are scarce. In the South Pass area (48FR2506-48FR2508) are some medium incised petroglyphs sites with stiffly created horses without well defined legs and sans hoofs, and medium incised glyphs appearing to be somewhat ceremonial and somewhat historical/biographic. The stiffly executed combat motifs in these areas most likely indicate origins no later than the early 1800s, when incised petroglyph styles tend to became quite realistic, and less deeply incised.

The "Missionary Panel" at Castle Gardens (48FR108), (Figure 5) is a medium-deep incised panel in an older style, which has striking similarities a panel attributed to Lipan Apaches (an Athapaskan speaking peoples) at Meyers Springs, Texas, which depicts Spanish priests "saving" a group of Apaches. This artistic commonality could indicate the medium-deep "Missionary Panel" reflects Spanish expeditions, and as early as the 1540s. Though a later example, the concept of Spanish priests or representatives traveling this far north is not unreasonable. Lewis and Clark found the Brule-Yankton Sioux had two Spanish flags when visiting them on the Missouri River near what is now the South Dakota-Nebraska border

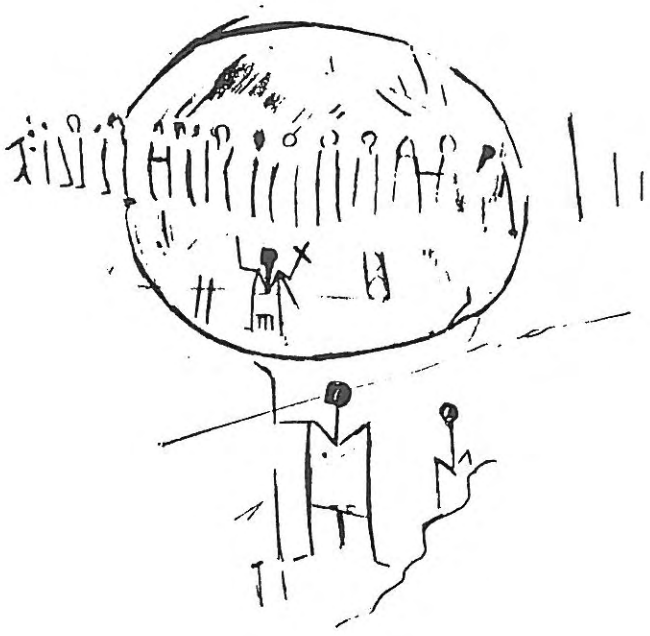

Figure 5: "Missionary" panel from Castle Gardens site (48FR108).

on September 26, 1804. The Texas comparative example is not noted to prove Apache origination of the Castle Gardens panel, however, it is possibly an "indicator link" to some sort of Athapaskan, especially Apache, influence with incised petroglyphs in the Wind River area. The Athapaskans are reported to have migrated south from Northern Canada through the South Pass area to the Southwest beginning about A.D. 700-1000, with those migrating to the southern Great Basin becoming Navahos, and those down the eastern side of the Rockies becoming Apaches. Keyser, on the other hand, states the resemblance of the figure to depictions of a Christian priest holding a cross is purely coincidental (James Keyser, personal communication, 1994).

Deep and medium incising appears to have been replaced sometime by the early to mid-Nineteenth Century by lighter incising or scratching, which might reflect less leisure time for the artist due to being further from a tribal home base, and pressured by a more mobile horse bound society into being "in a hurry." In addition, some of these Native American artistic changes tend to parallel the fur trader and Oregon Trail periods of 1830-50, and some of the changes probably reflect the influx of trade items like cloth goods that had printed designs. But, more importantly the changes are probably attributable to Native Americans watching frontier artists like Karl Bodmer and George Catlin at work. Both artists visited numerous Plains and painted portraits of their leaders and life styles, with Catlin visiting Sioux, Arapaho, Cheyenne, Assiniboine, Blackfeet, and Crow villages.

A rare late historic/autobiographic petroglyph example, but fine line and lightly incised, is of a battle scene (Figure 6) with horse mounted long haired Shield Bearing Warriors attacking a standing figure holding a stripped flag next to two stacks of guns (48FR2509). This lightly incised battle scene clearly indicates the period between A.D. 1805-1882. However, it probably can be logically narrowed to the years between A.D. 1840-1876 when Native American tribes were being forced westward and increased Euroamerican intrusions drastically increased with the Oregon Trail immigrations of the 1840s, and the boomers and miners of the South Pass "gold rush" of 1868. Considering the rifles depicted in the scene do not appear to be flintlocks, and one is possibly a lever action, further narrowing of the time span to 1860-1876 can be made. A review of known historic Indian raids in the immediate area leads to the speculation this rare historic petroglyph might possibly have been created in 1851 by Cheyenne or Shoshone Indians, in 1869 by Sioux Indians, or in 1870 by Arapahos Indians.

ABRADED/BURNISHED ROCK ART AND TOOL GROOVES

There are some, though relatively scarce, lightly abraded or burnished Shield Bearing Warrior figures at Legend Rock (48HO4), and

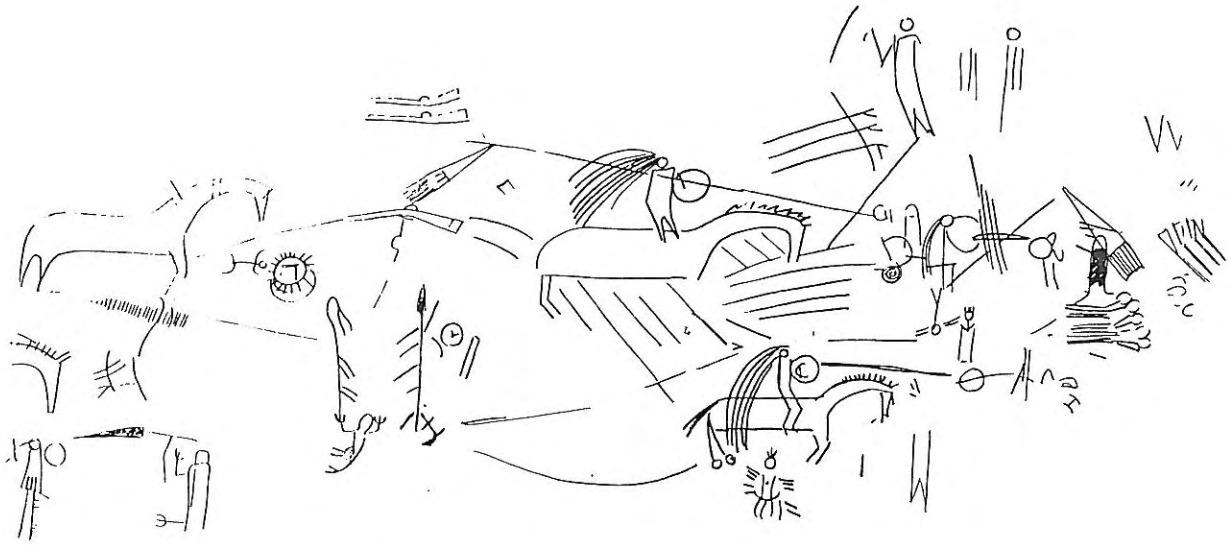

Figure 6: Rock art depicting a battle scene with Shield Bearing Warriors, from site 48FR2509.

pecked petroglyphs, especially of large elk, in the South Pass area (48FR2494) with the interior area of the large animal figure burnished and speckled with sparse pecking. Burnishing, I believe, represents the artist's preparation of the rock surface to hold paint.

Tool grooves generally are associated with incised petroglyphs in the Wind River Basin, and are not considered by some rock art researchers as petroglyphs. Most grooves and slash marks in the Wind River Basin are located next to incised petroglyphs, and some have been formed into deliberate artistic configurations. In the South Pass area, there exists a fan shaped set of otherwise utilitarian tool grooves making a hand design, with the thumb groove re-embellished into a lizard figure. The tool groves in a fan shape are not uncommon, nor are they considered to represent an artistic move. Instead the fan represents the craftsman sitting in the same seat and creating a new groove down the wall as the previous one proved unusable in sharpening or shaping what ever tool was being worked on. The artistic move here was the making of the fan shaped utilitarian set of grooves into a hand, and then making the "thumb" groove into a lizard. At least one other such "fan set" of tool grooves in the Lander area has been reworked into rising or setting sun motif.

PAINTED ROCK ART

Painted rock art is called pictographs or pictograms. E. B. Renaud (1936) referred to some multi-colored painted incised petroglyphs at Castle Gardens (48FR108) as Chromopetroglyphs. In general, painted rock art is less common in the two basins than petroglyphs, and it is most often found included among petroglyphs. Though there are rare humanoid and horse figures in the basin, most often the pictograms are red dots, slashes, grids, or short lines. Pictograph examples exist at Castle Gardens (48FR108), in Sinks Canyon (48FR2498), in the South Pass area (48FR2494), at Whiskey Basin (48FR311), and at Legend Rock (48HO4). There are also examples along the Oregon Trail east of South Pass. Most of the pictographs are red, with some blacks, and in rare cases, such as at Castle Gardens blues and yellows are also

found. The red paint most often is hematite (iron ore), referred to as red ocher, mixed with a binder. The binder differs with various tribes, and possibly with different ceremonies, and includes water, blood, milk, and animal fat. The brighter colors were most likely vegetable dyes.

This research was supported in part by the United States Bureau of Land Management, Lander Resource Area. Their support is gratefully acknowledged and appreciated.

REFERENCES CITED

Francis, Julie E.
1989 *Rock Art at Legend Rock. In Legend Rock Petroglyph Site (48HO4), Wyoming: 1988 Archaeological Investigations*, edited by Danny N. Walker and Julie E. Francis, pp. 151-208. Unpublished Cultural Resource Management Report. On file, Office of the Wyoming State Archaeologist, University of Wyoming, Laramie.
1991 An Overview of Wyoming Rock Art. In *Prehistoric Hunters of the High Plains*, 2nd ed., by George C. Frison, pp. 397-430. Academic Press, New York.

Francis, Julie E., Lawrence L. Loendorf, and Ronald I. Dorn
1993 AMS Radiocarbon and Cation-Ratio Dating of Rock Art in the Bighorn Basin of Wyoming and Montana. *American Antiquity* 58(4):711-737.

Gebhard, David S.
1951 Petroglyphs of Wyoming: A Preliminary Paper. *El Palacio* 58(3):67-81.
1969 *The Rock Art of Dinwoody, Wyoming*. The Art Galleries, University of California, Santa Barbara.

Heizer, Robert F., and M. A. Baumhoff
1958 Great Basin Petroglyphs and Prehistoric Game Trails. *Science* 129:904-905.

Hendry, Mary Helen
1983 *Indian Rock Art in Wyoming*. Augstums Printing Service, Lincoln, Nebraska.

Keyser, James D.
1975 A Shoshonean Origin for the Plains Shield Bearing Warrior Motif. *Plains Anthropologist* 20(69):207-216.
1984 Rock Art of Western South Dakota: The North Cave Hills. *South Dakota Archaeological Society, Special Publication* 9.

Loendorf, Lawrence L.
1988 Rock Art Chronology in Carbon County, Montana and the Valley of the Shields Site, 24CB1094. Paper Presented at the 1988 Montana Archaeological Society Annual Meeting, Missoula, Montana.

Renaud, E. B.
1936 Pictographs and Petroglyphs of the High Western Plains. *Archaeological Survey of the High Western Plains, Eighth Report*. Department of Anthropology, University of Denver, Denver, Colorado.

Walker, Danny N., and Julie E. (editors)
1989 *Legend Rock Petroglyph Site (48HO-4), Wyoming: 1988 Archaeological Investigations*. Unpublished Cultural Resource Management Report. On file, Office of the Wyoming State Archaeologist, University of Wyoming, Laramie.

James J. Stewart
Primitive Art Research
780 Scott Drive
Lander, WY 82520

PRELIMINARY ANNOUNCEMENT

THIRD BIENNIAL ROCKY MOUNTAIN ANTHROPOLOGICAL CONFERENCE

18-20 SEPTEMBER, 1997

HOLIDAY INN, BOZEMAN, MONTANA

The Third Annual Rocky Mountain Anthropological Conference will be held in Bozeman, Montana on September 18-20 of 1997. Now is the time to start planning to attend this important regional conference. Interested individuals are encouraged to organize forums as a possible alternative to symposia, to enable thoughtful, focused, and more open discussion of carefully delineated themes/topics. Please contact the conference organizers for information about organizing a forum. The organizers of the conference encourage the participation of individual researchers from all areas of anthropological study pertaining to the Rocky Mountains. Researchers in related fields addressing issues of past environmental conditions are also welcome.

Deadline for symposium or forum proposals is 15 March 1997. Other deadlines and information will be announced in future communications.

Organizers are:

Ken Cannon
National Park Service
Midwest Archeological Center
Federal Building, Room 474
100 Centennial Mall North
Lincoln, NE 68508-3873
Phone: 402/437-5392 x139
Fax: 402/437-5098
EMail: Ken_Cannon@nps.gov

Jack Fisher
Department of Sociology
Montana State University
Bozeman, MT 59717
Phone: 406/994-5250
Fax: 406/994-6879
Email: isijf@msu.oscs.montana.edu

OBSIDIAN UTILIZATION IN PREHISTORIC JACKSON HOLE

by
Melissa Connor and Raymond Kunselman

ABSTRACT

We used X-Ray fluorescence (XRF) spectroscopy to identify nine obsidian sources used by the prehistoric inhabitants of Jackson Hole, Wyoming. This paper examines this prehistoric use of obsidian and obsidian sources. Variation in utilization patterns is suggested through study of temporally diagnostic obsidian artifacts. The diachronic pattern of sources used allows consideration of the influences in acquisition, distribution, and use of obsidian.

INTRODUCTION

The obsidian lithic assemblage from Jackson Hole in nortwestern Wyoming (Figure 1) examined here is mostly from surface sites from which it is difficult to glean more than minimal information about human behavior. This paper examines variability within the assemblage, examining the cultural affiliation of the projectile points and the source variability from chemical sourcing. These techniques allow examination of aspects of human behavior related to mobility and diachronic variations in settlement patterns.

Considerable archeological research in Jackson Hole has resulted in the recording of over 450 prehistoric sites in the valley. Most of the early archeological work in Jackson Hole was completed by amateur archeologists, most notably W.C.'Slim' Lawrence. Private collections from Jackson Hole include steatite pots, ceramics, and hundreds, if not thousands, of projectile points. Professional research began with Paul Beaubien (1956) who completed an inventory of part of the north shore of Jackson Lake. In 1971, Charles Love inventoried portions of Jackson Hole and documented most of the well-known sites in the valley, local raw material sources, and probable migration routes in and out of the valley (Love 1972, 1975). In 1972, the State University of New York-Albany began a series of contracts with the National Park Service's (NPS) Midwest Archeological Center, which continued over a period of about eight years (Wright 1975, 1984). In 1983, the Midwest Archeological Center began the inventory, testing, and mitigation of sites around Jackson Lake in conjunction with the building of a new dam at the mouth of the lake (Connor 1985, 1986, 1987, n.d.; Connor et al. 1991). Besides these major efforts, several small archeological projects have been conducted in the valley by the National Park Service, and others, throughout the years.

PREHISTORIC OBSIDIAN UTILIZATION IN JACKSON HOLE

Obsidian dominates the prehistoric assemblages throughout Jackson Hole. We examined the aggregate data from the Jackson Lake Archeological Project, which recorded 109 sites around the shore of Jackson Lake (Connor 1986, 1987, n.d.; Connor et al. 1991).

The Jackson Lake assemblages show strong correlations between function and raw material. These appear related to the availability of the material and the raw material characteristics. The project recovered 36,836 pieces of flaked and ground lithic material. Of this, 1,507 pieces were classified as cores. Almost 80% of these were quartzite cores (n = 1195). This reflects the ubiquitous presence of the Precambrian quartzite on the sites, as much of the glacial till in this part of the valley is composed of this quartzite. Quartzite was used for expedient tools

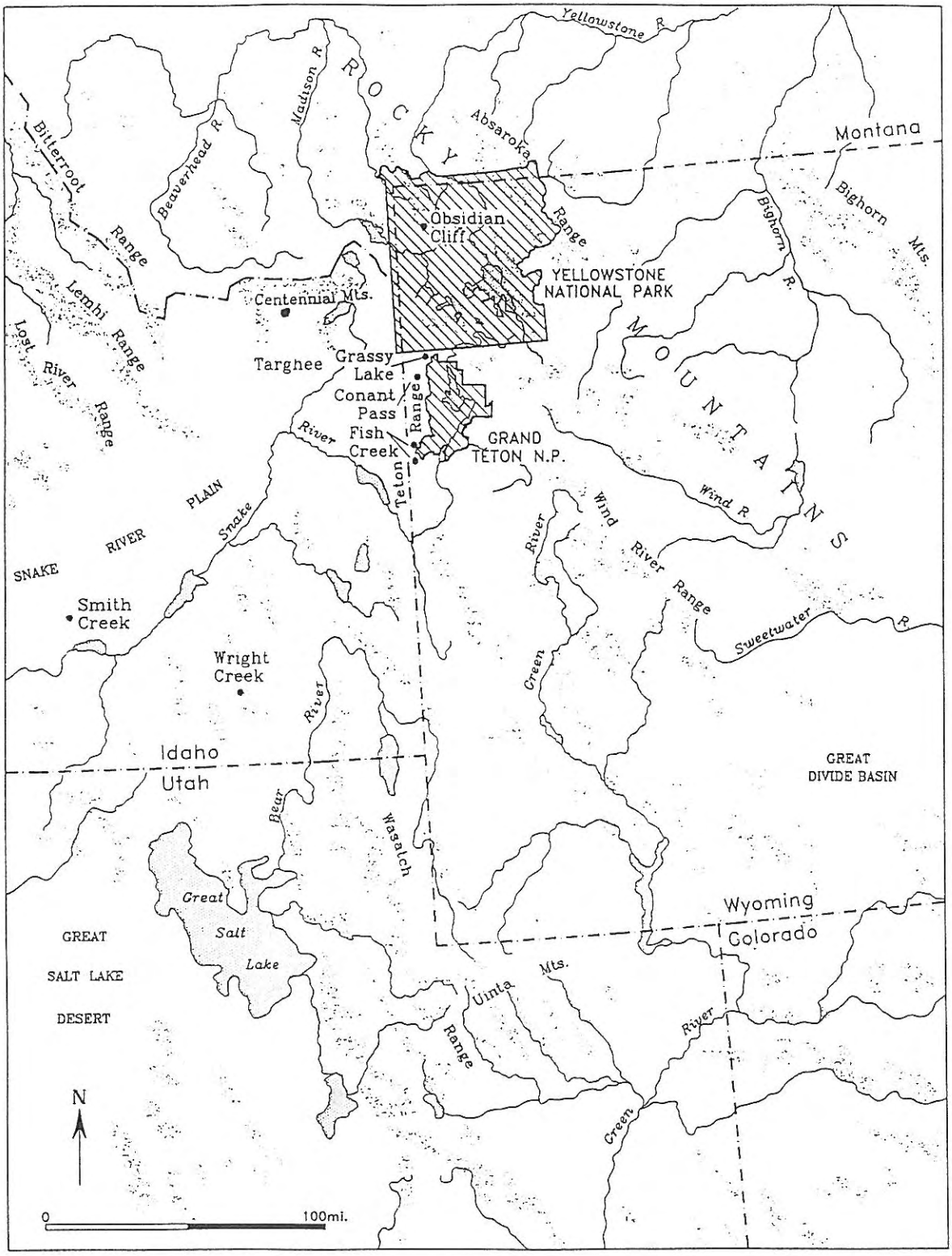

Figure 1: Map of Jackson Hole, showing region and obsidian sources mentioned in text.

throughout the valley, as reflected in a low number of quartzite unifaces and bifaces, compared with the total assemblage.

Only 44 obsidian cores were found. Most obsidian cores in the collection are nearing exhaustion, as suggested by the small number (less than 30% of the obsidian cores) with more than 20% of the original cortex remaining. This suggests obsidian cores were curated materials.

Obsidian was the material of choice for projectile points (Table 1). Sixty-three percent of the projectile points found were obsidian. The second-most common raw material for projectiles was cryptocrystalline silicate, forming only 19.8% of the projectile assemblage. While the flaking characteristics of obsidian and the sharp cutting edge may be two reasons for its use in this tool category, there may be aesthetic considerations as well.

	Bifaces	Total forms
Obsidian	722	10,489
Vitrophyre	195	4,026
Quartzite	271	15,038
Basalt	12	239
CCS[1]	315	6,579
Sandstone	1	190
Other[2]	25	275

[1] Crypto-crystalline silicates
[2] Includes petrified wood, quartz, and porcellanite

Table 1: Biface component of lithic assemblage from Jackson Lake Archeological Project. Omitted, non-biface, raw material include shatter, flakes, cores, unifaces, ground and pecked stone, and nodules.

The heavy reliance on quartzite and cryptocrystalline silicate as raw material for scrapers (together forming 61.8% of the scraper assemblage from the Jackson Lake Archeological Project) undoubtedly reflects the durability of the cutting edge of these materials. The volcanic glasses produce an extremely sharp edge when flaked, but also loose the edge quickly during use.

Sandstone was, not surprisingly, almost solely used for ground, pecked, or ground and pecked stone, i.e., manos and net weights. In three of the five tool classes in which sandstone is used, it is over 50% of the artifacts in that tool class. Quartzite is the second largest raw material category in these tool classes, suggesting quartzite is the most acceptable substitute for sandstone. The availability of the Precambrian quartzite means it can be used expediently when sandstone is not readily available. It appears much of the variability in the raw material assemblage in Jackson Hole reflects a combination of access to the raw materials and the raw material characteristics. It does appear different raw materials were preferred for different functions.

The relative rarity of obsidian cores in the Jackson Lake assemblage, while the material dominates the flake and tool assemblages, emphasizes the curation this material received. Because of this, it is possible there is also re-use of obsidian found by prehistoric peoples. Single component sites are rare. There is no reason to suppose prehistoric people, when finding an obsidian piece from an earlier temporal period, did not reuse it, adding noise to our analysis.

In general, the intensity of maintenance and recycling of lithic raw material is reflective of the quantity of the raw material availability (Bamforth 1986). At Paleoindian sites on the Llano Estacado, Bamforth (1985) also found a tool kit consisting of curated tools of non-local material and expedient tools of local materials. Bamforth postulated this resulted from the uncertainty inherent in non-communal hunting and the need to simplify mobility. The hunters could carry the tools they knew would be needed

and might be difficult to make from poor quality material, and supplement the tool kit as needed with poorer quality local material. The general use of raw materials seen in the total assemblage suggests the use results from the combined needs to be mobile, versatile, and yet well-prepared.

RAW MATERIAL VARIATION IN PROJECTILE POINTS

Obsidian is the most frequently used material in making projectile points (Table 1). However, it is not the only material used for the 413 temporally diagnostic projectile points documented in the NPS collections throughout Grand Teton National Park. Although obsidian is the raw material for over 50% of the projectile points in all periods, there is a great deal of variation in the raw materials.

The use of obsidian for projectile points increases dramatically between the Early Plains Archaic (where it is the raw material for 50% of the projectile points) and the Middle Plains Archaic (where it is the raw material for 85% of the projectile points) (Table 1). While use of obsidian drops slightly in the Late Plains Archaic (to 73%), the later periods show a significantly increased use of obsidian than during the Paleoindian and the Early Plains Archaic Periods.

For the Late Paleoindian projectile points, quartzite is the raw material for over a quarter (27%) of the points. The Paleoindian material shows greater use of quartzite for projectile points than during any other time period. The Early Plains Archaic material shows the greatest use of cryptocrystalline silicates (CCS) of any time period (42%). In fact, reliance is so heavy on the CCS sources there is no clear preference for obsidian here. This changes dramatically with the Middle Plains Archaic, predominately McKean-style projectile points. With these points, the preference is clearly for use of obsidian as a raw material. This continues throughout the remainder of the prehistoric continuum. In the Late Plains Archaic, however, a slight shift toward a greater use of CCS materials is again seen, although not as strongly as during the Early Plains Archaic.

The changes in raw material use in projectile points through time may result from cultural preference. However, all other things being roughly equal, it is likely the change results in difference in land use between cultural groups, changes which result in bringing the people closer to some sources of material than others. The difficulty in interpreting this data is associating the raw material with the source.

The obsidian source data produced here allows a connection from the artifact provenience to the primary source. Unlike cherts and other lithic raw materials used by prehistoric peoples, obsidian is too brittle to move far through glacial or water action. Obsidian may be distributed in talus in the area near the source, but large quantities of the material are unlikely to travel tens of miles. Many problems in the archeological interpretation of trade and settlement patterns were caused by visual examination of cherts and the assumption the material came from the primary source (Boldurian 1990; Gregg 1987). The chemical sourcing of obsidian, while carrying its own problems (Hughes 1992; Wright and Chaya 1985), does avoid many other pitfalls.

CHEMICAL SOURCING OF OBSIDIAN PROJECTILE POINTS

The study presented here was confined to obsidian projectile points from the Jackson Lake Archeological Project and the Lawrence Collection. The material from the Lawrence Collection was loaned to the Department of Anthropology, University of Wyoming for study. W. C. "Slim" Lawrence collected antiquities and projectile points throughout the region. While, most of his "hunting" appears to have centered on the Jackson Lake delta, he certainly was familiar with sites throughout the valley, and probably the entire region. Peterson (1991) published a brief description of the points using

Kunselman's obsidian source data. As the actual points were not available for classification into the same system as the remainder of the points used, Peterson's (1991) classifications are used. There are no notes describing the find sites of the material. The uncertainty of provenance of the projectile points from the Lawrence Collection limits the interpretation of our results. Thus, the data are presented with this uncertainty (Appendix 1) and a column includes an "NPS" label for the NPS artifacts, and "LS" or "TL" for the material from the Lawrence Collection. We assume that "LS" stands for Lawrence Site and "TL" for Teton Lakes, but there is no support to back the assumption. This resulted in a combined sample of 81 projectile points from the late Paleoindian to the Late Prehistoric periods for the analysis.

METHODOLOGY

When using diagnostic artifacts in a study, it is important non-destructive procedures are used. Flexibility in both the apparatus and the procedure is also necessary to be able to analyze both large and small artifacts, as they all contain source information. The method must also be reliable, accurate, simple, and inexpensive. These criteria led to the selection of X-Ray fluorescence (XRF) spectroscopy to produce trace element data in parts per million (ppm).

An atom fluoresces when an incident X-Ray non-elastically removes an inner shell electron that is then refilled by an electron to produce the final X-Ray, which is detected by the machine. From the point of view of the archeologists, these changes to the internal, sub-microscopic physics of the artifact, are not noticeable and this technique is non-destructive. Two distinct methods of collecting the X-Rays were used in this study. One method is called energy dispersion and collects the total range of the energy spectrum at once. The second method is called wave-length dispersion and collects the counting rate of X-Rays at one angle for each element separately. An element produces fluorescence X-Rays at one distinct, calculable energy or wavelength. Hence, the excess of the X-Ray count rate above any background rate at the single energy or wavelength represents and is proportional to the amount of the element present.

With a thin artifact, some incident X-Rays will go through the artifact and produce no fluorescent X-Rays that go back to the detector. Thus, the ideal artifact for this analysis is at least several millimeters thick and produces as many X-Rays that reflect back to the machine as an infinitely thick artifact (Giaque et al. 1993). For this study, all artifacts were considered infinitely thick.

Five main elements are used in this study to distinguish sources: rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), and niobium (Nb). Several other elements were also measured, but these five were available with all three apparatuses, and these five are usually the most diagnostic. Fluorescent peaks produced by these diagnostic elements are small compared to other elements in obsidian, such as iron (Fe). By using calibrated rock samples, one converts the measured data counting raters of the artifacts to parts per million (ppm). The details of the energy dispersive XRF procedure used at the University of Wyoming have been previously described (Kunselman 1991, 1994) and are similar to the wave-length dispersive procedures.

Given the variation between sources and using several diagnostic elements to produce a signature, different sources can be distinguished. To match the source to the artifact, the concentrations of all the elements for artifacts and sources must match.

RESULTS

Results of the analysis (Appendix 1) shows the artifacts are from five large well-known sources (Figure 1): Obsidian Cliff (YC) in Yellowstone National Park, Targhee National Forest (TA) (the same source is also known as Bear Gulch, Centennial Mountains, and

Camas/Dry Creek), Fish Creek (FC) near Wilson, Wyoming, in southern Jackson Hole (aka Teton Pass, Teton Pass Variety 1), Fish Creek, Second Variety (FS) (aka Teton Pass Variety 2), and Wright Creek (ID) near Malad, Idaho. Smaller samples are from the Smith Creek (SC), Chesterfield, Idaho, the Grassy Lake (GL), Wyoming, Conant Pass (CP), Wyoming, and the Reas Pass (RP), Idaho sources. A bivariate plot of the Rb ppm versus the Zr ppm for all the projectile points is also presented (Figure 2). A second bivariate plot (Figure 3) reveals that by examining the Sr ppm versus the Zr ppm, a separation into distinct groups between the Wright Creek, and the two variations from the Fish Creek area sources can be seen. The obsidian from the two Fish Creek sources occurs both separately and together in southern Jackson Hole. It occurs as primary pipe deposits, and as cobbles moved by water and glaciers.

The five sources, Obsidian Cliff, Targhee National Forest, Fish Creek, Fish Creek Variety 2, and Wright Creek represent the source of raw material for 94% (76 of 81) of the projectile points. The Fish Creek sources in southern Jackson Hole represent the source of raw material for 56% (45 of 81) of the sample.

Nine obsidian sources were identified as sources of the raw material for tools found in

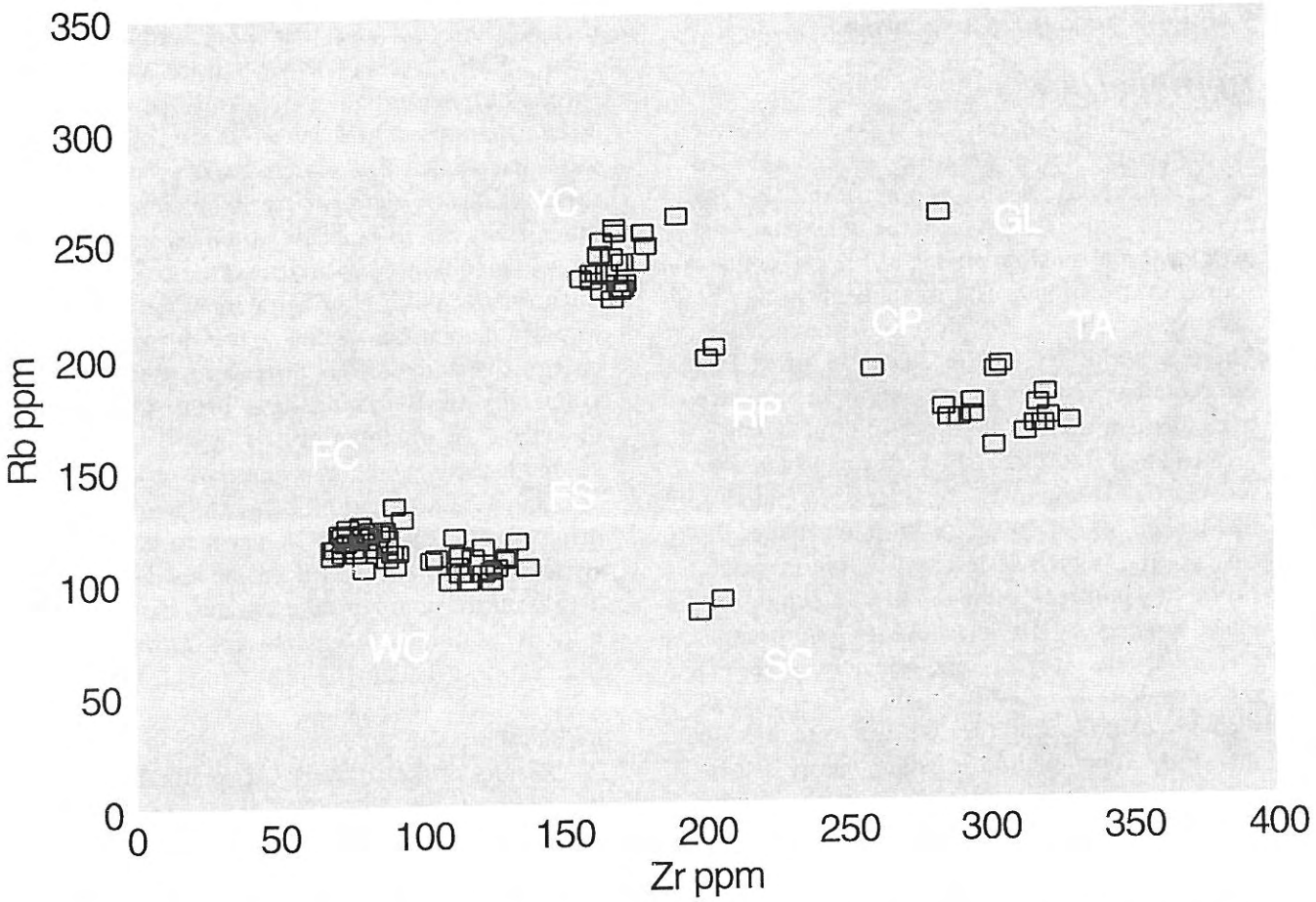

Figure 2: Concentrations of RB and ZR for analyzed artifacts. Note all sources are separated except Fish Creek and Wright Creek sources. Key to source areas in text.

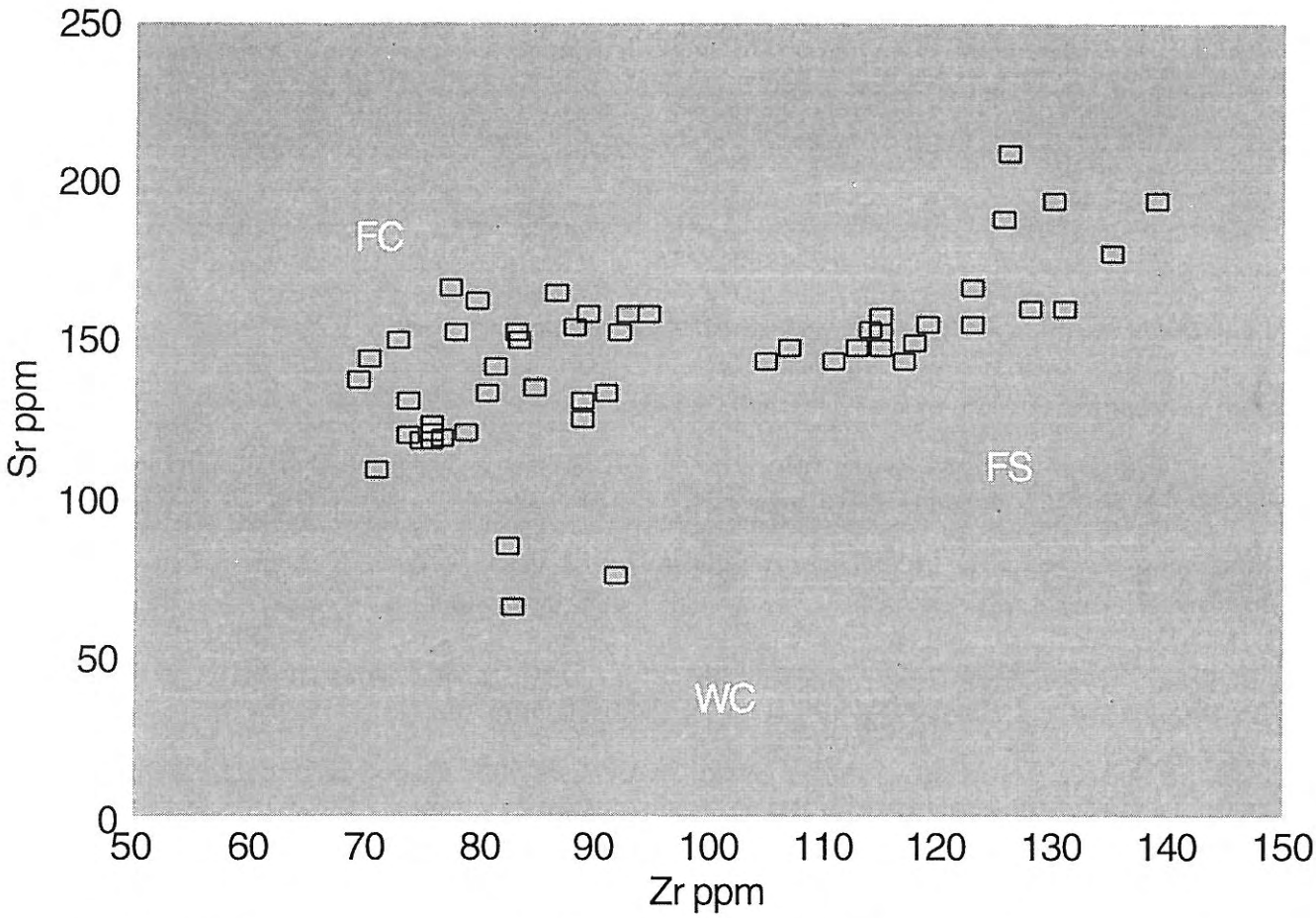

Figure 3: Concentrations of SR and ZR for artifacts between 50 and 250 ppm SR, and 50 and 150 ppm ZR. This separates Wright Creek and the two Fish Creek sources, but eliminates all others.

Jackson Hole (Appendix 1), with four tentative sources and five well-known sources. The two Fish Creek sources are near Wilson, Wyoming about 80 km from Jackson Lake; Obsidian Cliff is about 75 km north; and Targhee National Forest is about 95 km away. The remaining sources vary in distance from ten km for Grassy Lake and Conant Pass to 215 km for Wright Creek near Malad, Idaho, and 250 km for Smith Creek near Chesterfield, Idaho. The low number of projectiles points where the raw material sourced to Grassy Lake and Conant Pass may be a result of poor quality material, as these are ignimbrite, rather than true obsidian sources. These two points were from the Lawrence Collection.

SETTLEMENT PATTERNS

In relating the obsidian sources to the prehistoric use of the landscape, we assume the obsidian was obtained through visits to the source. Obsidian may also have been transported to the area indirectly, through trade, rather than directly by the group in Jackson Hole as part of specific collecting trips, or embedded in other activities during the seasonal round (Renfrew 1977; Torrence 1986; Vehik 1993). Indeed, no one would suggest the obsidian found in Hopewellian sites was carried there directly by site inhabitants (Griffin et al. 1969; Hatch et al. 1990). In the Southern Plains, obsidian is used

as an indicator of Pueblo-Plains interaction (Baugh and Terrell 1982).

However, obsidian in Jackson Hole was mainly obtained through visits to the source, rather than through trade. The sources are well within the range of known hunter-gatherer seasonal rounds (Kelly 1995; Lee 1968). A relatively low population density and an abundant resource suggests access to the obsidian was unlimited. Finally, it is difficult for any seasonally mobile group, as were all prehistoric inhabitants of the Central Rocky Mountains, to restrict access to a non-seasonal resource. In other words, there is no reason to assume the populations in Jackson Hole would not have had access to obsidian from Fish Creek, Obsidian Cliff, and Targhee National Forest, as well as the more distant obsidian sources.

In using the distribution of obsidian sources to examine the settlement pattern of prehistoric peoples, the non-uniform distribution of obsidian sources on the landscape is also important. For instance, there are no obsidian sources east of Jackson Hole and thus movement in that direction is a blank. This non-uniformity biases our interpretation of home ranges and movement toward the areas where the obsidian sources occur.

In this paper, we have also assumed the sources of obsidian are functionally similar. For the true obsidian sources, this is probably not far from the truth. Some areas of each flow have better quality obsidian than other areas, but within each flow are areas of good quality obsidian. Some sources, such as Grassy Lake or Conant Pass are actually sources of ignimbrite, a basal vitrophyre, produced at the base of a flow. This material frequently has inclusions making it much more difficult to flake than obsidian. However, in small pieces, it can be difficult to distinguish macroscopically from obsidian.

The Late Paleoindian projectile point styles show a wide range of point styles and further differentiation among sources will undoubtedly be useful. The late Paleoindian points source to both Fish Creek sources, Obsidian Cliff, and Targhee National Forest, as well as Wright Creek, Chesterfield and Reas Pass in Idaho (Table 2).

That there are seven obsidian sources for 19 samples (Table 2) suggest reliance on a variety of sources. This becomes more pronounced considering the discussion of the raw materials of projectile points above, where Paleoindian style projectile points show a much greater use of non-obsidian material types than other periods. This probably reflects a high degree of mobility that allowed them access to a variety of sources.

Thirteen of the 19 Early Plains Archaic samples came from the Fish Creek sources, four from Obsidian Cliff, one from the Targhee National Forest and one from Grassy Lake (Table 2). The large percentage (68%, 13 of 19) from the Fish Creek sources suggests many Early Plains Archaic peoples may have retooled there while entering Jackson Hole through Teton Pass.

Of the projectile point styles cross-dated to the Middle Plains Archaic Period, eight of the sample of 12 came from Obsidian Cliff (Table 2). The percentage from Obsidian Cliff is larger if one separates the McKean-style projectile points from the Oxbow. Then, eight of a sample of ten comes from Obsidian Cliff. Between the Duncan, Hanna, and McKean lanceolate style points there are no clear patterns of source differentiation. The Oxbow style projectile points were sourced to the Fish Creek sources.

For all periods except the Middle Plains Archaic, the dominant sources of obsidian are the two Fish Creek sources (Table 2). Only for the Middle Plains Archaic McKean style projectile points does the dominant source shift to Obsidian Cliff in Yellowstone National Park. As discussed earlier, the Middle Plains Archaic is also when obsidian first becomes the dominant raw material for projectile points. The combined changes suggest either a change in settle-

	FC	FS	YC	TA	WC	SC	OT	Total
Late Paleoindian	8	3	1	4	1	1	1	19
Early Plains Archaic	10	3	4	1	0	0	1	19
Middle Plains Archaic	1	3	8	1	0	0	0	13
Late Plains Archaic	4	4	2	0	1	0	2	13
Late Prehistoric	5	4	4	4	0	0	0	17
Total	28	17	19	10	2	1	4	81

Key to source labels: YC = Obsidian Cliff, Yellowstone National Park; TA = Targhee National Forest, ID; WC = Wright Creek, Malad, ID; FC = Fish Creek var.1/Teton Pass Wilson WY; FS = Fish Creek var.2; SC = Smith Creek, Chesterfield, ID; OT = Other sources, including Grassy Lake, WY, Conant Pass, WY, and Reas Pass, ID

Key to Cultural Affiliation labels: PI = Late Paleoindian, EA = Early Plains Archaic, MA = Middle Plains Archaic, LA = Late Plains Archaic, LP = Late Prehistoric

Table 2: Sources for Jackson Hole obsidian artifacts as a function of cultural affiliation.

ment patterns from previous groups or a change in the lithic procurement pattern.

The Late Plains Archaic style projectile points were predominately (72.5%) obsidian. The large corner-notched points with concave or straight bases, similar to Pelican Lake projectile points, source to Obsidian Cliff, the Fish Creek sources, as well as Reas Pass, Wright Creek, and Conant Pass (Table 2). Again the wide variety of sources may reflect an increase in mobility.

Only one Late Prehistoric projectile point was analyzed from the Lawrence Collection. Within the National Park Service collections, there are a variety of projectile point styles from the Late Prehistoric Period. The diversity of sources was low, with 13 of the 16 samples coming from the Fish Creek sources and Targhee National Forest (Table 2). This may suggest a more circumscribed territory than used by previous groups.

The acquisition of obsidian could fit into the settlement pattern in different ways - collection as part of specific collection trips, or foraging behavior of collection during seasonal migrations. Addressing this question requires analyzing the settlement data for the entire area and is beyond the scope of this paper. For here, it is sufficient to propose how obsidian collection fits into the settlement system undoubtedly changes over time, with the accessibility of a source to a travel route and other resources, as well as with accessibility of other lithic raw material sources.

DISCUSSION

Examining the sources of obsidian has to be done within the context of the remainder of the lithic assemblage. The differential use of obsidian for specific tool types does suggest a prehistoric bias in the use of obsidian toward specific tool types. The aggregate assemblage from the Jackson Lake Archeological Project suggests the use of on-site raw materials, or materials available from within a kilometer or two, as used for expedient tools and the use of obsidian for formal tools. This paper suggests a general

emphasis on mobility.

It is important to note the Jackson Hole sources were used at the sites of this study, compared to the Jackson Hole sources not being used at two other sites on the region. The amount of Jackson Hole sources present was less than from a smooth falloff with distance at Lookingbill (Kunselman 1994) and in the Beartooth Mountains (Kunselman and Husted 1995). Presently, we do not want to do more than point out the contrasting utilization of good quality obsidian material. The poorer quality material is not being considered. We can offer no explanation about mobility and territoriality at the present as why some sites in the region would not include much southern Jackson Hole material, while other sites would include the material.

Even within the projectile point assemblage, as opposed to the complete assemblage, examining the use of obsidian has to be done within the context of the entire projectile point assemblage. In Jackson Hole, the importance of obsidian varies at different time periods with it apparently being least important during the Early Plains Archaic. During the Early Plains Archaic then, the location of the obsidian sources may be less indicative of the actual settlement pattern than during other periods.

The XRF of obsidian sources can be used to examine mobility between groups. In the assemblages discussed here, there were seven different sources for the 19 Late Paleoindian samples (Table 2). In contrast, in the Late Prehistoric material there were only four sources for 17 samples. Combined with the knowledge that obsidian was used for a lower percentage of points in the Late Paleoindian than in the Late Prehistoric and there is the sense a wider range of lithic sources was used during the Late Paleoindian, probably resulting from overall greater mobility.

CONCLUSIONS

Looking at the variation in both the raw material used and the sources of obsidian can also help locate periods of cultural change. The variation in both raw material types seen in the projectile points and in sources of obsidian is greatest between the Early Plains Archaic and the Middle Plains Archaic materials. This could be used to strengthen the arguments of those who suggest the McKean cultural complex is the result of an influx of a new population into the region, bringing with them changes in settlement patterns and raw material use.

The use of XRF technology to determine the source of prehistoric material is a powerful tool. It can take information from surfical sites and palimpsets, and use it to generate a series of hypotheses that can be tested at single component, or stratified sites. Few of the projectile points used in this study have an associated assemblage. However, the use of X-Ray fluorescence allowed us to propose contrasts between the settlement patterns and mobility of cultural groups using the raw material variability and differences in obsidian sources. These can be used as hypotheses to be tested when single component or stratified, sites are located.

ACKNOWLEDGEMENTS

The Jackson Lake Archeological Project was funded by the Bureau of Reclamation and assisted by Grand Teton National Park. X-Ray fluorescence on 25 projectile points was completed by Chris McKee. Access to the Lawrence Site points was provided by the Jackson Hole Museum and George Frison.

REFERENCES CITED

Bamforth, Douglas B.
1985 The Technological Organization of Paleoindian Small Group Hunting on the Llano Estacado. *Plains Anthropologist* 30(109):243-258.
1986 Technological Efficiency and Tool Curation. *American Antiquity* 51(l): 38-50.

Baugh, Timothy G., and Charles W. Terrell
1982 An Analysis of Obsidian Debitage

and Protohistoric Exchange Systems in the Southern Plains as Viewed from the Edwards I Site (34BK2). *Plains Anthropologist* 27(95):1-19.

Boldurian, Anthony T.
1990 Lithic Technology at the Mitchell Locality of Blackwater Draw: A Stratified Folsom Site in Eastern New Mexico. *Plains Anthropologist Memoir* 24:1-115.

Beaubien, Paul
1956 Trip Report, Grand Teton National Park, September 11-12. On file, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

Connor, Melissa A.
1985 An Archeological Reconnaissance of Jackson Lake: A Preliminary Report. Unpublished Cultural Resource Management Report. On file, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.
1986 Jackson Lake Archeological Project, 1985: An Interim Report. Unpublished Cultural Resource Management Report. On file, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.
1987 Site Testing at Jackson Lake: A Jackson Lake Archeological Project Interim Report. Unpublished Cultural Resource Management Report. On file, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.
1995 Archeological Investigations at the Jenny Lake Developed Area, Grand Teton National Park, Wyoming. *National Park Service, Midwest Archeological Center, Technical Report* 33. Lincoln, Nebraska.
n.d. Final Report of the Jackson Lake Archeological Project, Grand Teton National Park, Wyoming. Unpublished Cultural Resource Management Report. On file, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

Connor, Mellisa A., Ken P. Cannon, Steven E. Matz, Denise C. Carlevato, and Colleen A. Winchell
1991 Jackson Lake Archeological Project. The 1987 and 1988 Field Work. *National Park Service, Midwest Archeological Center, Archaeological Report* 7. Lincoln, Nebraska.

Giaque, R. D., F. Asaro, F. H. Stross, and T. R. Hester
1993 High-Precision Non-destructive X-ray Fluorescence Method Applicable to Establishing the Provenance of Obsidian Artifacts. *X-ray Spectrometry* 22:44-53.

Gregg, Michael L.
1987 Knife River Flint in the Northwestern Plains. *Plains Anthropologist* 32(118):367-389.

Griffin, James B., A. A. Gordus, and Gary A. Wright
1969 Identification of the Sources of Hopewellian Obsidian in the Middle West. *American Antiquity* 34:1-14.

Hatch, James W., Joseph W. Michaels, Christopher M. Stevenson, Barry E. Scheetz, and Richard A. Geidel
1990 Hopewell Obsidian Studies: Behavioral Implications of Recent Sourcing and Dating Research. *American Antiquity* 55(3):461-479.

Hughes, Richard E.
1992 Another Look at Hopewell Obsidian. *American Antiquity* 57(3):515-523.

Kelly, Robert L.
1995 *The Foraging Spectrum*. Smithsonian Institution Press, Washington, D.C.

Kunselman, Raymond
1991 Durable Paleoindian Artifacts: XRF Variability of Selected Wyoming Source Materials. *The Wyoming*

Archaeologist 34(1-2):15-25.

1994 Prehistoric Obsidian Utilization in the Central Rocky Mountains: The Lookingbill Site, 48FR308. *The Wyoming Archeologist* 38(1-2):11-18.

Kunselman, Ray, and Wil Husted

1995 Prehistoric Obsidian Source Utilization in the Beartooth Mountains. Paper presented at the 2nd Biennial rocky Mountain Anthropological Conference, Steamboat Springs, Colorado. September 27-30, 1995.

Lee, R. B.

1968 What Hunters do for a Living, or How to Make out on Scarce Resources. In *Man the Hunter*, (R. B. Lee and I. DeVore, eds.), pp. 30-48. Aldine Publishing Company, Chicago.

Love, Charles

1972 An Archaeological Survey of the Jackson Hole Region, Wyoming. Unpublished Master's Thesis, Department of Anthropology, University of Wyoming, Laramie.

1975 An Archaeological Survey of the Jackson Hole Region, Wyoming. *The Wyoming Archaeologist* 18(1-2).

Peterson, Michael R.

1991 Obsidian Projectile Points from the Lawrence Site (48TE509) near Jackson Lake in Northwestern Wyoming. *The Wyoming Archaeologist* 34(1-2): 51-66.

Renfrew, Colin

1977 Alterative Models for Exchange and Spatial Distribution. In *Exchange Systems in Prehistory*, (T. K. Earle and J. E. Ericson, eds.), pp. 71-90. Academic Press, New York.

Torrence, Robin

1986 *Production and Exchange of Stone Tools*. Cambridge University Press, Cambridge, England.

Vehik, Susan C.

1990 Late Prehistoric Plains Trade and Economic Specialization. *Plains Anthropologist* 35(128):125-145.

Wright, Gary A.

1975 A Preliminary Report on the Archaeology of the Jackson Hole Country. Unpublished manuscript on file, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

1984 *People of the High Country: Jackson Hole Before the Settlers*. Peter Lang Publishing, Berne, Switzerland.

Wright, Gary A., and Henry J. Chaya

1985 Obsidian Source Analysis in Northwestern Wyoming: Problems and Prospects. *Plains Anthropologist* 30(109):237-242.

Melissa Connor
Midwest Archeological Center
National Park Service
Lincoln, Nebraska 68508

Raymond Kunselman
Department of Physics
University of Wyoming
Laramie, Wyoming 82071

APPENDIX ONE

Data produced from the XRF analyses: chemical source; cultural affiliation (PI = Late Paleoindian, EA = Early Plains Archaic, MA = Middle Plains Archaic, LA = Late Plains Archaic, LP = Late Prehistoric); chemical element composition; artifact identification by catalog number and collection (NPS = National Park Service; LS, TL = labels on the Lawrence Collection). Measurement uncertainties are 4 to 7 ppm for Rb, 3 to 7 for Sr, 2 to 8 for Y, 5 to 7 for Zr, 3 to 9 for Nb, and 400 to 500 for Fe. Selected artifacts were analyzed a second time and both values are listed on separate lines for comparison. Peterson (1991) used Cascade-like and Haskett designations we include as late Mountain Paleoindian.

Obsidian Cliff, Yellowstone National Park

		Rb	Sr	Y	Zr	Nb	Fe	Cat.#	Coll.
1	MA	252	0	78	180	250	9527	45	TL
2	MA	223	0	75	170	59	8507	112	LS
3	PI	260	0	84	193	56	10028	18	TL
4	EA	240	0	77	179	52	9354	233	LS
5	EA	231	0	74	171	48	8818	223	LS
6	EA	242	0	80	170	50	9475	229	LS
7	MA	227	0	78	166	53	8852	43	TL
8	LP	255	2	84	170	43	---	21195	NPS
9	LA	243	2	80	165	42	---	21022	NPS
10	MA	235	3	76	162	40	---	21014	NPS
11	LP	253	3	83	170	43	---	21137	NPS
12	LP	233	3	79	159	47	---	40247	NPS
13	LP	235	3	76	164	41	---	41769	NPS
14	MA	249	3	80	166	44	---	3203	NPS
15	LA	235	3	81	168	42	---	3040	NPS
16	MA	231	4	78	162	41	---	21035	NPS
17	EA	247	4	78	181	52	9337	208	LS
18	MA	240	5	81	173	40	---	7016	NPS
19	MA	231	8	83	174	55	8801	44	TL

Bear Gulch, Targhee National Forest, Idaho

		Rb	Sr	Y	Zr	Nb	Fe	Cat.#	Coll.
20	MA	170	40	45	296	55	---	195	NPS
21	LP	169	41	45	291	55	---	277	NPS
22	PI	167	42	39	330	63	12570	106	LS
23	PI	162	42	42	314	61	12725	80	LS
24	LP	169	42	45	287	52	---	43516	NPS
24	PI	190	45	45	304	58	---	43516	NPS
25	LP	176	43	47	296	54	---	3936	NPS
26	?	165	44	43	321	66	12483	72	LS
27	PI	174	46	39	318	57	12570	103	LS
28	LP	192	46	50	306	61	---	1842	NPS
29	EA	180	54	38	321	62	12587	226	LS
30	PI		42	53	303	27	---	362	NPS

Fish Creek var.1, Teton Pass/ Wilson, Wyoming

		Rb	Sr	Y	Zr	Nb	Fe	Cat.#	Coll.
31	LA	115	109	27	71	10	---	486	NPS
32	PI	118	118	25	76	10	---	1896	NPS
33	MA	117	118	27	75	14	---	21143	NPS
34	LP	115	119	28	77	14	---	21188	NPS
35	LP	120	120	29	74	13	---	21142	NPS
36	PI	124	121	28	76	13	---	21032	NPS
37	PI	118	121	25	79	12	---	2287	NPS
38	LP	121	123	29	76	15	---	41484	NPS
39	PI	110	125	27	89	12	---	266	NPS
39	PI	113	133	24	91	15	---	266	NPS
40	LP	119	131	28	89	13	---	2692	NPS
41	PI	113	131	23	74	34	8403	105	LS

42	EA	105	133	26	81	30	8507	227	LS
43	LA	115	135	26	85	11	---	21046	NPS
44	PI	114	137	32	70	28	8645	195	LS
45	EA	122	142	26	81	34	8559	207	LS
46	EA	111	144	21	70	32	8023	214	LS
47	EA	123	150	26	84	31	8852	205	LS
48	LA	122	150	30	73	21	8731	42	TL
49	EA	120	152	29	83	36	8576	230	LS
50	LP	107	152	22	92	32	9354	612	LS
51	EA	113	152	23	78	33	8507	231	LS
52	LA	123	154	28	88	30	9008	46	TL
53	EA	116	158	28	89	34	9233	213	LS
54	PI	113	158	30	93	36	9458	87	LS
55	EA	127	158	33	95	37	9440	210	LS
56	PI	125	162	31	80	34	8628	221	LS
57	PI	122	165	26	87	32	9095	16	TL
58	EA	118	167	18	78	32	8714	232	LS

Fish Creek var.2, Jackson Hole, Wyoming

		Rb	Sr	Y	Zr	Nb	Fe	Cat.#	Coll.
59	LA	99	143	20	117	13	---	301	NPS
60	LP	100	143	20	111	8	---	21219	NPS
61	MA	108	143	24	105	12	---	4909	NPS
62	LA	103	147	24	115	10	---	6856	NPS
63	LP	110	147	24	107	12	---	21094	NPS
63	PI	119	147	23	113	13	---	3942	NPS
64	MA	103	149	25	118	12	---	2693	NPS
65	LA	111	152	21	115	11	---	21153	NPS
66	LP	106	153	23	114	11	---	43522	NPS
66	LP	111	157	21	115	10	---	43522	NPS
67	MA	110	155	21	119	10	---	32666	NPS
68	EA	103	155	20	123	12	---	2985	NPS
68	EA	105	160	21	128	14	---	2985	NPS
69	LP	110	160	24	131	12	---	2381	NPS
70	EA	115	166	24	123	10	---	21203	NPS
71	LA	117	177	24	135	12	---	21644	NPS
72	PI	100	187	20	126	28	11844	68	LS
73	EA	105	194	21	139	31	11826	203	LS
74	PI	104	208	26	126	27	11550	102	LS

Wright Creek, Malad, Idaho

		Rb	Sr	Y	Zr	Nb	Fe	Cat.#	Coll.
75	LA	118	66	30	83	12	---	21160	NPS
75	LA	133	76	37	92	14	---	21160	NPS
76	PI	118	85	42	83	32	7002	6	TL

Grassy Lake, Wyoming

		Rb	Sr	Y	Zr	Nb	Fe	Cat.#	Coll.
77	EA	260	0	208	285	223	11740	238	LS

Conant Pass, Wyoming

		Rb	Sr	Y	Zr	Nb	Fe	Cat.#	Coll.
78	LA	191	29	65	261	54	9492	AJ1	LS

Smith Creek, Chesterfield, Idaho

		Rb	Sr	Y	Zr	Nb	Fe	Cat.#	Coll.
79	PI	90	185	30	207	12	---	3950	NPS
79	PI	84	177	26	199	10	---	3950	NPS

Reas Pass, Idaho

		Rb	Sr	Y	Zr	Nb	Fe	Cat.#	Coll.
80	PI	197	19	64	202	30	---	2298	NPS
81	LA	201	24	87	205	58	---	21025	NPS

BOOK REVIEWS

Vertebrate Taphonomy. by R. LEE LYMAN. Cambridge University Press, Cambridge. 1994. xxvi + 524 pp., figures, illustrations, bibliography, glossary, index. $79.95 (cloth), $34.95 (paper).

Taphonomy, defined as the science of the laws of embedding or burial, is a composite term originated by Russian paleontologist I. A. Efremov (1940), derived from the Greek words ***taphos*** (burial), and ***nomos*** (laws). Taphonomic research is of importance not only to paleontologists, but to archaeologists concerned with how to interpret the faunal remains (and other organic materials) they recover from archaeological deposits. In this important, although at times pedantic new book, R. Lee Lyman provides a comprehensive overview of this exciting new discipline, focusing on the need for researchers to *investigate*, rather than *assume*, the causal agent(s) that have created (or modified) the faunal assemblages they seek to understand. In addition to offering extensive coverage of current taphonomic research topics in archaeology, this volume also introduces the reader to many of the current methodological and theoretical implications of this diverse field of study. The central theme underlying all of the research presented here addresses how taphonomists derive reliable information about the past from faunal remains, and how these insights are related to evidence from other domains of archaeological investigation.

Chapter 1 provides a brief introduction to the subject of vertebrate taphonomy, including a discussion of basic concepts as well as an outline of the goals of taphonomically-oriented archaeological faunal analysis, or zooarchaeology. Chapters 2 and 3 offer a brief history of the field, as well as a review of theory and method in taphonomic research. Although adequate, these are not the strongest portions of the book. The sections in Chapter 3 on uniformitarianism, actualism, and analogy are particularly disappointing, since they fail to adequately synthesize these difficult, but important topics. Chapter 4 provides a discussion of the structure and quantification of vertebrate skeletons, including a clearly written introduction to the specialized terminology of skeletal biology. Chapter 5 introduces the topics of mortality, skeletalization, disarticulation, and scattering of vertebrate carcasses. Also included here is a brief discussion of the construction and interpretation of mortality profiles. Chapter 6 reviews the accumulation and dispersal of vertebrate remains. This chapter, together with Chapter 7, on the quantification and interpretation of skeletal part frequencies, represent the strongest portions of this book. Here, Lyman provides examples of how multiple lines of evidence are employed in a "state of the art" analysis of archaeological faunal assemblages. The actions of non-human agents of dispersal and accumulation are compared with data on human use and transport of carcass parts. Lyman's pioneering work on the quantification of the structural mineral density of individual bones (and bone portions), is introduced here and contrasted with other critically important techniques for investigating and analyzing the life histories of faunal assemblages. Chapter 8 provides a brief review of the extant literature on butchering, bone fracturing, and bone tool use, as well as a discussion of recent attempts by archaeologists to deal with these important sources of human behavioral evidence. Chapters 9, 10, and 11 review a variety of other, pre- and post-depositional taphonomic factors, such as bone weathering, root etching, trampling, burning, final deposition and burial, chemical alteration, etc., that can influence the location, condition, and identifiability of faunal remains. These chapters provide important reference material for exploring the rapidly expanding taphonomic literature, and the author is to be commended for his thorough review of this material. Chapter 12 briefly introduces the emerging topic of non-mammalian vertebrate taphonomy, including the scant available data on fish, birds, reptiles, and amphibi-

ans.

I enjoyed this book and recommend it to all those interested in increasing their understanding of the archaeological record. However, rather than approaching this volume as a synthetic treatment of a mature discipline, this book should be considered a useful reference guide to current trends in the theory and practice of the rapidly evolving discipline of archaeologically-oriented taphonomy.

David J. Rapson
Adjunct Assistant Professor
Department of Anthropology
University of Wyoming
Laramie, Wyoming 82071

The U. S. Army in the West, 1870-1880: Uniforms, Weapons, and Equipment. By Douglas C. McChristian with a Forward by John P. Langellier. University of Oklahoma Press, Norman and London. 1995. xix + 315 pp., illustrations, notes to pages, bibliography, and index. $34.95 (cloth).

The decade of the 1870s in the American West was one of profound, historical significance. Post-Civil War America tried coming to grips with increasing numbers of western immigrants, growing unrest among Native American populations residing beyond the Mississippi River, and soft Congressional support for a downsized Army. Repeated confrontations between the U. S. Army and Indian tribes exposed numerous deficiencies in army capability, not the least of which was the need for suitable uniforms, weapons and equipment to efficiently patrol the frontier. Specifications for this material and equipment are available in numerous, obscure government publications and other hard-to-get references. Not until McChristian's book has a comprehensive, detailed study of these military artifacts been available in a single volume to interested readers.

The U. S. Army in the West, 1870-1880 delivers what it promises. The volume traces the development of uniforms and equipage, primarily those used by the Infantry and Cavalry, during a turbulent decade. Each pattern change and technological development is clearly described and most are illustrated with high quality photographs.

This valuable book is divided into seven chapters and three appendices. Chapter I introduces a factor that actually influenced many decisions of the Quartermaster General for the entire decade, that of utilizing surplus material left over from the Civil War. Chapter II focuses on uniform changes during the period 1872-1873 and illustrates the influence that European patterns had on U. S. Army designs. Accoutrements for carrying extra clothing and campaign rations are discussed in Chapter III. Chapter IV is an excellent section on the development of small arms during the decade. Chapter V revisits the subject of clothing and the burdensome desire of Congress to have the Army exhaust available supplies before issuing new patterns. The visual result of mixed uniform assemblages containing new and outdated elements is depicted in a series of period photographs showing a very un-uniform, uniform style during the peak of the Indian Wars on the High Plains. Equipment changes adopted in 1874 are the focus of Chapter VI. Chapter VII covers the final changes at the close of the decade, many of which influenced uniform elements for decades to come. Readers wishing to pursue even more detail will find McChristian's Notes to Pages and Bibliography to be valuable sources for primary reference material.

Three appendices complete the text. Appendix I is a photographic essay of cartridge boxes by longtime collector, Dennis L. Gahagen.

Appendix II reprints the 1872 Watervliet Arsenal *Directions for Fitting Infantry Equipments, U. S. Army*. Appendix III is a transcription from the 1882 *Annual Report of the Chief of Ordnance to the Secretary of War*, entitled "Instructions for Assembling and Wearing the Infantry Equipments, Blanket Bag Pattern," by Captain A. L. Varney.

McChristian concludes in his Epilogue that the decade of the 1870s was "truly an era of experimentation and evolution" (page 248) in the development of military equipage. The author's meticulous coverage of design and detail changes clearly reflects this evolution. His writing style is very readable and he has made a magnificent effort to find appropriate illustrations to accompany the text.

Historic archaeologists interested in military sites and the period of the Indian Wars will find this volume an indispensable addition to their library. One can only marvel at the diversity of uniform and equipment elements either issued to, or used by, the typical soldier during the Indian Wars. While much of the equipage discussed in the book constitutes perishable material and is not likely to have survived 120 years in archaeological context, portions of almost every piece of equipment could still be preserved under certain conditions. Gun parts, ammunition, buttons, buckles, nails, leather, and insignia are only a few examples. The author's narrative even discusses some of the archaeological discoveries at the Battle of the Little Bighorn that shed new light on how Custer's command was equipped, and he relates this evidence back to what historical documents say about the same equipment.

McChristian has produced a very affordable reference that belongs on the shelf of every historic archaeologist on the High Plains. It is destined to become a key reference for Indian Wars scholars who concern themselves with physical evidence and the archaeological context of military sites in the trans-Mississippi West.

Mark E. Miller
Office of the Wyoming State Archaeologist
Department of Anthropology
University of Wyoming
Laramie, Wyoming 82071

IDAHO ARCHAEOLOGIST

ISSN 0893-2271

The Idaho Archaeological Society and the College of Social Sciences and Public Affiars, Boise State University invite you to subscribe to the *Idaho Archaeologist*, the biannual publication of the Idaho Archaeological Society, a non-profit association of professional and amateur archaeologists. The journal publishes peer reviewed articles and shorter contributions concerning the archaeology of Idaho and those areas of adjacent states and provinces including the Columbia drainage and the Great Basin. Recent articles have included papers on ceramics, fishing technology, and rock art. Subscriptions are $12.00 per year and may be obtained by writing the *Idaho Archaeologist*, Department of Anthropology, Boise State University, 1910 University Drive, Boise, Idah 83725. Back issues are available upon request.