Rock art and settlement in the Owyhee uplands of southeastern Oregon.

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I. Abstract

Petroglyph sites in the Owyhee uplands of Malheur County, Oregon were documented. Dimensions of the petroglyph panels and individual designs were measured. Associated archaeological features and landscape were noted. All known archaeological sites in the Owyhee uplands were cataloged. Petroglyph sites were analyzed in relation to their location in the landscape and to their associated archaeological features. The distribution of all archaeological sites was compared to the distribution of petroglyph sites and other factors such as vegetation, elevation, and distance to perennial water. Eighty-four percent of petroglyph sites were located within 1500 meters of a perennial water source. Petroglyph sites were associated with archeological features and analyzed based upon their role in the regional settlement system. Three distinct types of sites were identified: mesa top, riverine, and water tub. Petroglyph sites were associated with resource procurement activities. The nine petroglyph sites that shared the traits of being on the mesa, associated with rock features and near perennial water sources were sites for hunting and plant gathering. The petroglyphs at one site were dated to over 4000 years based on analysis of features similar to those at the other nine sites and a recent lava flow.

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II. Introduction

Rock art located in Malheur County, Oregon is the focus of this study. The Owyhee uplands in the southeastern corner of Oregon are culturally affiliated with the Great Basin. The Owyhee uplands are located in a semiarid desert where sagebrush and perennial grasses are common vegetation. People have been living in the Owyhee uplands since the end of the last ice age. These people traveled around the region. The remains of their campsites, garbage and settlements make up archaeological sites. These sites can be examined to determine the settlement system of people who lived in the area. This study of rock art deals with petroglyph sites as archaeological sites, where all artifacts are important and petroglyphs are just one of the features.

The Owyhee uplands are a region maintained primarily by the Bureau of Land Management (BLM). Records from the BLM archaeologist with information on reported petroglyphs served as the primary method of locating these sites, few of which had been systematically documented. Not only were the petroglyphs recorded, but the associated archaeological features, like lithic scatters and rock walls, were recorded. Petroglyphs have often been examined based on their styles. This research takes a different approach, where the features associated with the petroglyphs are important. These enabled the researcher to categorize petroglyph sites, place petroglyph sites in the context of the settlement system, and determine some of the activities of people at sites where they made petroglyphs.

This study addresses multiple questions about the petroglyphs of the Owyhee uplands. What activities were associated with making petroglyphs? What was the duration of residence and size of population for use of petroglyph sites? In what approximate time period were petroglyphs made? Is the spatial distribution of petroglyph sites markedly different from camp and hunting sites in the settlement system, suggesting that petroglyph sites were special purpose sites? Do any of the interpretations proposed for understanding rock art apply to petroglyph sites in the Owyhee uplands?

III. Background

Rock art is found in locations across the globe. The most widely known are the French cave paintings. Paintings are the primary component of one rock art category, pictographs, which are distinguished by the use of pigment on rock. The other category of rock art is petroglyphs. These are created by removing a portion of the rock surface. The most common abrasive methods are engraving, pitting, pecking and scratching. Both pictographs and petroglyphs occur in varied context within the archaeological record worldwide.

Interpretations of Rock Art

Since rock art occurs in prehistoric contexts throughout the world, numerous researchers work in this field. From the contexts in which rock art occurs, various proposals have been made concerning its meaning and function. None of the interpretations can universally explain rock art. Each interpretation is based upon research in specific areas. The following interpretations of the meaning and function of rock art are all based upon a generic definition of rock art as 'designs' which have particular meaning for particular people. Since the rock art of any given area may reflect more than one theme or cultural affiliation, two or more interpretations may apply. The well documented uses of rock art include shamanistic and totemistic rituals, hunting magic, documentation of important events and recording of astronomical events.

Shamanistic and totemistic ritual

Shamanism and totemism are cross-cultural titles applied to two forms of religion. Both of these religious practices have been associated with the creation of rock art. To understand these interpretations of rock art, basic definitions are necessary. "Shamanism refers to the use of spirits as guardians and helpers of *individuals*, contacted through *trance*. ... [Totemism] is generally agreed to refer to the use of animals or plants as emblems or guardians of social *groups* celebrated in *ritual*" (Layton 2000:169). Layton (2000) suggests that following ritual experiences, individuals involved would have created rock art reflective of their experience. Layton (2000:179) explains the differential use of symbols by the two religious practices. "In totemism, each social group appropriates animal or plant images as their exclusive emblems. In shamanism, certain species may be favored vehicles for spiritual encounters for shamans, but they are generally available to anyone throughout the society."

Of the many examples of this kind of interpretation, the following illustrate this perspective. The !Kung of South Africa are well known practitioners of shamanism. There is evidence that trance experiences and curing rituals compose a major portion of the events recorded in their rock art. The interpretations are accepted because they are consistent with ethnographic information from the area (Layton 2000). Similarly, Whitley (1994) has presented a shamanistic interpretation of rock art. From work in the Coso mountain range of southern California, Whitley (1994:361) concluded that "Numic rock art was produced by shamans and shaman-initiates following the altered states of consciousness (ASC) experiences of their vision quests." This study was based upon ethnographic information from the area. Whitley (1994) provides an example to explain the multiple mountain sheep found in rock engravings of the area. Seeing a mountain sheep killed while in an ASC was a sign to the shaman that there would be rain, so the engravings recorded these occurrences. Another form of shamanic experience is the vision quest. This is documented on the Columbia plateau where individuals, through fasting and strenuous exercise, would see visions. Walker (1991) considers this the impetus for some of the rock art created at this locale.

The independent development of totemism has been documented in North America, Africa and Australia (Levi-Strauss 1962). From these regions, there are examples where totemic activities carried over to the rock art which the people created. Rock art from the Woroa and Ngarinyin in the Kimberly region of Northwest Australia is totemic in nature. The major totem of each clan, an ancestral being, or *Wandjina*, is painted on a rock shelter within their territory along with some minor totems of the clan (Layton 1992:33-47). In the North American southwest, totemism is known among the Hopi, who are organized into multiple clans. Colton's (1960:78-81) Hopi informants identified symbols within rock art of the area as being related to specific clans. These clan symbols are also found on *kiva* walls at Hopi pueblos. In studying the art of the Anasazi, Olsen (1989:429) noted that all portable objects, like pottery, contained geometric designs, while the decorations on fixed objects, like *kiva* plasters and boulders, were predominantly animal and human designs. Interestingly, thirty-eight percent of the animal motifs are modern Hopi and Zuni clan motifs.

Hunting magic

Another common interpretation of rock art is that it was created as hunting magic. Rock art of this type would have been created to insure success in a forthcoming hunt or to celebrate a

successful hunt. It is likely that this magical rock art would portray the hunter and prey. These images are often in scenes which involve the killing or entrapment of animals by hunters. Going back to the Columbia Plateau, besides rock art created during visions, there is ethnographic evidence that elaborate scenes of the hunt were a product of hunting magic (Teit 1906). Turpin (1992) has documented sites in West Texas which were used as hunting camps and have rock abrasions. These locations are not the only sites within the landscape, however their function and rock art are distinct. Turpin (1992:295) states that, "some of the motifs were created as sympathetic magic devoted to insuring or commemorating hunting success, atoning for taking life and encouraging animal fecundity."

Documenting important events

Documentary rock art would tell a story of an event in the people's history or mythology. These rock panels would narrate a story which was important to those who made and saw it. The best known example of recording events in rock art is found among the Plains Indians of North America. Their tradition, called the biographic style, resembles the realistic art found on tipis and ledger books. The biographical style and its narrative capacity is well documented ethnographically and is a widely accepted interpretation (Cole 1990, Klassen et al. 2000, Keyser 1977). In fact the biographical style continued into rock art created in the 1900's when a petroglyph was made depicting automobiles and the individual artist could be identified (Klassen et al. 2000). Documenting important events in rock art was dependent upon symbols which could be understood by not only the artist, but by other individuals. This requires a somewhat consistent symbol set or manner for telling a story. The extreme of this documentary view is considering rock art as a form of writing with universally consistent symbols used by one culture. This interpretation has been difficult to sustain, although LaVan Martineau (1973) presented detailed descriptions of how translation might be possible.

Astronomy

The basic premise of an astronomical interpretation of rock art is that heavenly occurrences were of importance and thus depicted within rock art. This could be in the form of panels showing stars, sun, moon or heavenly bodies or in the form of rock art designed to be lit by the sun on important days such as a solstice or equinox. Reagan (1922) noted that on the kiva walls of some historic pueblos of the American southwest there were paintings of the sun, moon and morning star. There was an importance for these people in examining the heavens, so it

would be a logical extension to find this theme in earlier rock art. One example can be found in the Anasazi area of Chaco Canyon, where there is one petroglyph on which light patterns would have allowed an observer to distinguish both solstices and equinox. (Plog 1997:101). Representations of the 1054 supernova which was recorded in China are said to occur in rock art throughout the American west (Brandt and Williamson 1979). Many panels have been located which could possibly depict the location of the moon and supernova as they would have been positioned, however since rock art is difficult to date none are confirmed. One of the possible sites is at Chaco Canyon in New Mexico (Plog 1997:101).

Doodling

Doodling has been proposed as another interpretation of rock art. This would involve designs made for no specific purpose. Occasionally it is assumed that creation of rock art was an activity of leisure time. Colton (1960) believed that the abstract designs made by the Kayenta living near the Sinagua in the Southwest were doodlings. Colton (1960: 81-83) proposed that, "since may of these designs were made near habitations, we might class them as 'doodlings', drawings made to pass time away".

Aggregation sites

Differing from other interpretations, the areas of aggregation model relies upon the movements of human populations. Aggregation sites of hunters and gatherers have been understood as locations for group economic activities, as can be identified through the archaeological record. Conkey (1980) suggests that social and ritual aspects of aggregation must be considered. "Resources and geographic locations are linked with social relations and food exchanges, presumably based upon reciprocity. ... In the case of the !Kung San, specific resources, such as water, in particular locations (permanent or dry-season water holes) are linked with specific social events and processes: curing, initiation, trading, mate exchange" (Conkey 1980:611). Art can help support the study of these sites. The fact that a unique diversity of art exists at one site, in relationship to site duration, does not prove its function as an aggregation site, however it helps to support such a hypothesis (Conkey 1980). Areas of aggregation should be recognizable archaeologically by a much broader range of stylistic elements than are present at non-aggregation sites and by their larger size and broad range of activities.

Component of a settlement system

Rock art can also be viewed as one component of a settlement system. As part of a settlement system, the archaeological site is the unit of study rather than the traditional emphasis on individual sets of rock art images. Rock art sites are therefore documented in terms of location and artifact feature association. This allows for reconstruction of the range of sites as well as their placement in a regional settlement system. Approaching rock art as a component in a settlement system can address site based questions. These questions include, do rock art sites represent large residential sites, are rock art sites located in places where long-term residence was unlikely, or does the spatial distribution of rock art sites differ markedly from camp or hunting sites suggesting that rock art sites were ceremonial sites. Interpreting rock art based upon its location within a regional settlement system can address which, if any, activities were occurring in conjunction with the creation of rock art.

Regional Archaeological Context

The aforementioned interpretations for rock art are not mutually exclusive. However, to determine that one or more of these interpretations apply to an area of study, petroglyph sites must be examined as an integral part of the archaeological landscape. The carved designs of petroglyphs can be found on rock outcroppings, boulders, cliffs and caves. Similarly with other surface finds, without associated, datable material, petroglyphs can primarily be analyzed in a broad context related to ethnography and aspects of the landscape, both environmental and archaeological.

The Owyhee uplands, where this study takes place, are located in the southeastern corner of Oregon, in Malheur County (Figure 1, Figure 11). The Owyhee uplands are part of the Columbia Plateau drainage system, however the vegetation and animal life closely resemble that found in the northern Great Basin. The Owyhee uplands are located "between two ethnographically documented cultural zones" (Andrefsky 2000:6). These are identified by Kroeber (1939) as the Great Basin cultural zone to the south and the Columbia Plateau cultural zone to the north.

Aikens (1982:139) states, "Most of the northern Great Basin as just defined lies within the northern boundaries of the Great Basin physiographic province, but the Klamath-Modoc

country on the west and the Owyhee uplands on the east are included by reason of cultural affinity, even though they occupy drainages with outlets to the Pacific that are not hydrographically speaking, part of the Great Basin."

Archaeology of the Owyhee uplands and adjoining regions

Archaeological research allows for an understanding of the prehistory which cannot be derived from historic documents. The Great Basin area of eastern Oregon has been inhabited for more than 13,000 years (Aikens 1986). The archaeological record for early sites is from excavations of stratified cave sites. Since the Owyhee uplands are currently semiarid, there is little soil formation. The archaeological record lies on the surface of the land and multiple periods of occupation can possibly overlap in the same site. Sites found in the Owyhee uplands include lithic scatters, house pits, petroglyphs and rock alignments.

One excavated cave site, Dirty Shame Rock Shelter, is located in the Owyhee uplands. Dirty Shame has six cultural layers and represents the chronological depth of the area; "Twenty-two 14C dates span a period from 9500 to 365 BP, but a gap in the dates between 5850 and 2750 BP indicates that the site saw little or no human occupation during that 3000-year interval" (Aikens 1986:15). An interesting conclusion from this site was the concentration on vegetative foods, available in the late spring and summer, starting between 9500 and 7500 years ago and corresponding with milling stones (Aikens 1986). No other sites have been dated in the Owyhee uplands. To the south the archaeological record is similarly long and subsistence depended upon purposeful semi-cyclical wandering between known locations for finding food. To the north, on the Columbia Plateau, semi-subterranean circular houses appear around 5000 BC with increased sedentism from dependence on annual fish runs and the collection of nutritious roots (Ames et al. 1998, Roll and Hackenberger 1998).

Within the study area, there has been a long term dependence on gathering vegetative food resources. While a climatic dry spell, loosely corresponding to the altithermal, disrupted the environment, it did not eliminate resources. The Owyhee uplands probably were not abandoned by native people. To the south, occupation continued with some changes. A dramatic example is Surprise Valley, California where about 4500 BP the inhabitants abandoned large semi-subterranean homes in favor of wickiups made of brush (Aikens 1982).

In the Owyhee uplands one of the interesting questions is that of cultural continuity. The archaeological record provides a technological series consisting of artifacts, however the reconstruction of past culture is difficult. The Dirty Shame rock shelter showed continuing technology for the periods it was occupied, and similarity between the early and later occupations despite a 3000 year gap (Aikens 1986). Cultural continuity in the Owyhee uplands may mirror that in the rest of the Great Basin. There is no general consensus among either those who use archaeological artifacts to determine the spread of culture or those who use linguistics.

Within the Owyhee uplands, after a hiatus in research, an excavation is in progress along the Owyhee River at site 35ML181 (Andrefsky and Presler 2000). The excavated area has produced a pit house dated to between 2725 and 2335 BP and an occupation level below the pit house dated to between 5315 and 4865 BP. The preliminary information, while incomplete, shows this site may have been occupied from 7,000 to 2,300 years ago. In addition to the dating, in initial archaeological analysis, Andrefsky and Presler (2000) have not encountered any small projectile points or pottery indicative of habitation in more recent periods. Analysis of artifacts from this site will provide more information on the Owyhee uplands.

Rock art research in Oregon and the Great Basin

Many petroglyph sites are known to exist in the Owyhee uplands and along the Owyhee river. This area is located in Oregon and on the northern edge of the Great Basin. Since very little work has been published on the Owyhee uplands area, the rock art research in Oregon, east of the Cascades, and the Great Basin forms the background for examining sites in the Owyhee uplands. Of particular interest are studies concerning petroglyphs and the theories which have been applied to interpreting them.

The first systematic inventory of petroglyph sites in the Great Basin was conducted by Steward (1927). *Petroglyphs of California and Adjoining States* does not include sites in Oregon. The analysis was based upon the distribution of specific elements. Since this work covered such a large area, Steward (1927:219) divided the physical landscape into four different areas with distinct characteristics. What is considered the Great Basin falls into area "A". It is described thus, "The petrography of this area is characterized by a large number of geometric elements. The curvilinear designs are of the widest distribution. ... Rectilinear figures--rectangular gridirons, cross-hatching, angular meanders, etc.-- are more restricted in

distribution and center in the Owens valley region" (Steward 1927:219-220). This stylistic description laid the foundation for later work in the Great Basin. Steward (1927:225) did not present a concrete interpretation for the petroglyphs, however he guessed that they had a religious or ceremonial purpose.

Oregon was uncharted territory until Luther Cressman (1937) created an inventory of rock art in the state. He collected locations and photographs for 60 sites throughout the state, a couple of which are located in the study area along the Owyhee river. Most of the sites Cressman reported were based on information supplied by individuals living and working near sites. Cressman's study looked at the distribution of rock art sites over the state by designs located at each and by comparison of the styles of designs, much in the same manner as Steward's study. For his comparison, Cressman placed designs in categories, such as humans, humans with horn, mountain sheep and rain symbols. From the distribution of designs, Cressman (1937:76) divided the state into four areas and identified the influences on each of these areas which are, "(1) the Willamette Valley, a petroglyph area; (2) the southeastern part of the state, a petroglyph area; (3) the northern part of the state, a pictograph area; (4) the Klamath Basin, a petroglyph and pictograph area". This second area, the southeastern area, corresponds with the lake basins of central Oregon and the Owyhee drainage. Cressman (1937:70) observed that "The designs of the southeastern part of the state are an extension of the Great Basin type of design". Cressman based his work on examination of the designs common to rock art sites rather than on the function or meaning of the rock art.

The next significant study was Heizer and Baumhoff's (1962) analysis of Nevada. This has since been regarded as an authority by many other researchers who utilize their system of stylistic classification. Heizer and Baumhoff (1962) proposed the following styles for areas of Nevada: Great Basin Painted, Great Basin Representational, Great Basin Abstract with the subdivisions of Rectilinear and Curvilinear, Pit and Groove, Great Basin Scratched and Puebloan Painted. These styles are founded initially in the method by which the art was made and in the appearance. The two painted styles refer to pictographs which were created using pigments. The Great Basin Scratched style includes any petroglyph made by abrasion with a sharp tip, which results in thin lines scratching the rock surface. The other methods of making petroglyphs are by pecking, repeatedly hitting a rock surface, and by abrasion, rubbing a rock surface. The representational, abstract, and pit and groove styles are all created by pecking or abrasion.

Besides stylistic divisions, Heizer and Baumhoff (1962) presented evidence for a relationship between petroglyph sites and hunting magic. Many sites, they argued, are in locations which could be used to surprise game. These conclusions are a result of examining the locations of sites and the annual migration routes and ranges of large game animals (Heizer and Baumhoff 1962:223-225). In southern Nevada, sites are often near springs where bighorn sheep would drink. To the north, draws were locations where antelope and deer travel along their migratory trails. Some of the sites in Nevada have rock fences or hunting blinds (in the nature of stone circles). Other locations might have had constructions of wood or brush. Additionally, Heizer and Baumhoff note that very few of the sites are located in conjunction with villages.

One of the best known current researchers in rock art of the Southwest is Polly Schaafsma. Much of her work is focused on the Pueblo areas to the east of the Great Basin (Schaafsma 1980, 1971), however Schaafsma (1986) also reviewed the work which has been done in the Great Basin. Her synthesis presents current, prevalent views on styles and functions of rock art. Within the Great Basin proper, she notes increasing support from multiple researchers of the theory of hunting magic advocated by Heizer and Baumhoff for the pecked styles of petroglyphs. However, other authors who work in the Great Basin have questioned this hypothesis after finding rock art in association with occupation sites and other localities which do not seem associated with rituals (Schaafsma 1986:220-222). The contrasting views about the function of rock art underscore questions about the location and function of rock art sites. Information on what artifacts are associated with rock art and if the locations would be favorable for certain functions (ambush, camp, aggregation, or sacred) needs to be collected to answer these questions.

Following these broad studies, most researchers have narrowed down to concentrate on specific locations and the rock art found therein. Some of the research which has been done close to the Owyhee plateau includes Plew's work on sites in southwestern Idaho and Ricks's study in Lake County, Oregon.

Mark Plew's work is in the format of inventories from Owyhee County, Idaho. This area is located directly to the east of Malheur County across the state line. Plew's (1976:39) work does not include interpretations, but he surveyed design elements. "With the exception of the shield motif [Plains shield bearing warrior], which marks its western most extension in the

Camas Creek drainage, the other motifs are those generally characteristic of the Great Basin". Another report which covers multiple creek drainages in Owyhee County reaches similar conclusions on the association of petroglyphs with Great Basin styles (Plew 1980).

In the Warner Valley of south central Oregon, Mary Ricks (1995) studied the association of petroglyph sites with many factors of the landscape. Her analysis was executed by determining statistical correlations. Ricks' analysis compared rock art sites to site distribution, site elevation, plant communities and big game habitats. Ricks found that rock art sites were not randomly distributed and that the bigger sites tended to be at higher elevations. Using the winter habitats for antelope, mule deer and bighorn sheep, Ricks found each were uncorrelated or negatively correlated to occurrences of rock art. In other words, she found no support for the hypothesis that rock art was related to hunting proposed by Heizer and Baumhoff (1962). Instead, Ricks (1995:186) discovered that the rock art of Warner valley was closely correlated with plant communities, specifically, "Positive and moderately high correlations were found between rock art sites and low sage plant communities at high elevation. A similar, but somewhat weaker correlation was found between big-sage/bunchgrass communities in the lowlands." The high elevation low sagebrush communities are where root crops could be gathered in late spring and early summer, while the lowland big sagebrush communities are where grass seeds could be harvested in the late summer.

Ricks (1995) believes and has evidence that some of the high elevation rock art sites were aggregation sites for the procurement of root crops. This supports the settlement system which Ricks proposes for the Warner Valley where there would not only be a winter base camp in the lowlands, but a summer base camp at high elevations. However, she notes a lack of information from other large high elevation sites which have not been excavated. Information on these sites could support Ricks' aggregation hypothesis and proposed settlement system.

History of rock art perspectives in Oregon and the Great Basin

Rock art research in Oregon and the Great Basin has visibly changed in tone from the early pioneers of the field to later researchers such as Ricks. Steward and Cressman sought to record and classify rock art sites as a portion of the archaeological record which could stand apart. They also took their sweeping inventories of broad areas and used these to deduce different styles, from the different areas, based upon inventories of designs. Intermediaries in the

progression, Heizer and Baumhoff developed a hypothesis for one style of petroglyph in Nevada. They used the material around the sites, but did not rely upon the whole archaeological record. This differs from the work of Ricks which incorporates multiple aspects of archaeology, vegetative resources and animal behavior within a more confined area. The general trend over time has been toward including rock art in more comprehensive studies which are spatially confined. Spatial confinement allows for exploration of environment as well as the diversity of petroglyph designs and site locations which might be overlooked when generalizations are made concerning larger areas. Also, Ross (2001) notes a growing body of research that examines rock art within a larger context, including style, ethnography, landscape and cultural materials.

The process by which research methods have changed in Oregon and the Great Basin, mimics the history of archaeological thought. Despite early explorations for antiquities in Europe and the scientific excavations of Thomas Jefferson, only in the middle of the 19th century was archaeology established as a discipline. The approach of 19th century archaeologists was to describe in a qualitative manner the sites which were known to exist. Outside of excavating ruins of great civilizations, one of the goals of this era was determining culture areas and their chronologies (Renfrew and Bahn 1991). Working in North America, Kroeber established the basic cultural areas in the United States, by which archaeologists define their studies. Following in this tradition, Steward and Cressman classified petroglyph styles in relation to culture areas.

The 1960's brought about changes in archaeological methods. The "processual" approach advocated collection of quantitative data to test a specific hypothesis. This lead to the designing of research to answer specific questions for a limited area, rather than to collect data to see if it had relevance (Renfrew and Bahn 1991). The utilization of scientific methods which are now considered standard is much more apparent in the work of Heizer and Baumhoff and Ricks than the earlier catalogers of petroglyph sites.

For rock art, a significant scientific study requires the understanding of other aspects of archaeology. These would include settlement patterns, resource procurement activities, social-political organization and known archaeological sites. This holistic approach considers the problems in dating rock art and the documentation of rock alignments (Heizer and Baumhoff 1962).

Difficulties in dating rock art

As with any aspect of prehistory, it would be wonderful to place a date on rock art. There are two methods of dating rock art, relative and chronometric. While neither is fool proof, a selection of the methods and the assumptions they make are discussed below.

Relative dating methods include superimposition, rock varnish and ethnographic knowledge. Superimposition uses the principle of stratigraphy, art is carved over existing designs. This method depends upon the existence of multiple clear cases of overlap. Differences in rock varnish, like the dark layer which forms on basalt, can also be used.

> "... rock varnish can sometimes provide relative dating clues, because the rate of varnish formation is slow so that petroglyphs cut into the same surface at different times will show different amounts of revarnishing. Thus, petroglyphs that are lighter are generally younger than others on the same surface of the stone. Since the rates of varnish formation vary widely from one surface to another, revarnishing is a reliable dating technique only for images on the same panel or, sometimes , on closely associated panels (in the same microenvironment) that have experienced nearly the same rate of varnish accretion." (Keyser 2001:126).

Another avenue of relative dating is ethnographic knowledge. This can provide clues in some instances where individuals of a cultural group can identify that they made certain designs, but that others were there before they arrived (Keyser 2001). These techniques are only valuable if they separate styles or traditions and can be replicated on multiple panels or at multiple sites.

The methods of chronometric dating include accelerator mass spectrometry (AMS), radiocarbon dating and cation ratio dating. In order to use AMS radiocarbon dating, organic matter is needed. Some studies have recovered usable samples from beneath the varnish layer on petroglyphs (Francis et al. 1993, Dorn 1994). AMS radiocarbon dating relies upon the assumption that when the petroglyph was made all of the previous varnish was removed and organic material incorporated into the patina is contemporary (Dorn 1994). Cation ratio dating has its own different set of problems (Dorn 1994). Both of these methods require samples of the petroglyph to be taken by someone who knows what they are doing. Taking samples of a petroglyph requires removing a portion of the petroglyph so that it can be sliced into thin sections in a laboratory; taking a sample does not guarantee that datable material will be found. In

conclusion, "All petroglyph dating techniques are experimental - with the exception of excavation," since uncertainty of accuracy and methodology remain (Dorn 2001:182).

Rock alignments in regions surrounding the Owyhee uplands

The existence of rock alignments is well documented in the Great Basin. In many cases rock alignments are overlooked because there is no way to date piles of rock. Additionally, sites very rarely contain associated artifacts which can be used to help identify their use. Heizer and Baumhoff (1962) propose that some of the rock walls could be hunting blinds. In draws the rock walls would hide the hunter from his prey and also help to direct the movement of a herd during group hunting. At some locations they (Heizer and Baumhoff 1962) encountered circular rock walls on rim edges where they could have been used as overlooks. The occurrence of rock alignments in association with petroglyphs, which they interpret as associated with hunting ritual, supported the above proposed uses (Heizer and Baumhoff 1962).

Rock alignments are not confined to the Great Basin. Agenbroad (1989) remarks upon the usage of extensive rock alignments in opportune locations on the Plains to assist in driving bison. Rock piles would be used repeatedly to force bison near cliffs. However, the Plains alignments are of a much larger scale than those in the Great Basin.

Rock alignments are also present in Idaho directly to the east of the Owyhee uplands. Plew's 1976 survey of Camas Creek, Idaho recorded sixty sites with rock alignments. He classified these alignments as cairns, circular alignments, semicircular alignments, linear alignments, alignments of stone piles and large circular alignments. Cairns are small piles of stone, while alignments of stone piles can be as much as a mile long, consisting of stone piles every three or four meters, approximately half a meter high. The long alignments of piles are located above the canyon rim and could have been used to drive animals toward the cliff for a jump, like those used on the Plains. Plew (1976) distinguishes between circular alignments which are approximately a meter in diameter and occur in groups on the canyon rim and large circular alignments which are up to nine meters in diameter and the interior is cleared and flat. This second type is only one or two stones high, while the smaller circles are presently 3 to 4 stones high and show signs of collapse. Semicircular alignments have the same general characteristics as circular alignments of one meter. The linear alignments which Plew (1976:39-42) recorded ranged in length from three to thirty meters long. Plew (1980:141) also

describes two more complex alignments which combine elements from more than one of the above types. The larger of the two is described thus; "The mesa top which covers an area of c. 40 x 40 meters is totally enclosed by a wall c. 1/2 meter high. The wall has a series of openings. Within the walled area are cairns, circular, semicircular and rectangular alignments".

The function of the two larger, unique alignments has been debated. The Five Fingers and 'Y' alignments are unique because they are dissimilar to the other alignments which Plew (1976, 1980) refers to in his work. Five Fingers and 'Y' are more than 2/3 of a mile long and have associated corrals. Therefore, they required a much greater investment of human labor than any of the smaller locales (Agenbroad 1989). These alignments were interpreted by Plew (1987) as jumps for animals such as sheep and cattle. However, Agenbroad's (1989) analysis is that they were used as bison jumps similar to those known from the Plains region. This region could have been inhabited by bison when their range also included northern Nevada, because there is no physical barrier keeping them out.

Regardless of the interpretation for these large alignments, many smaller rock alignments are known. Because the smaller alignments are widespread, it is possible for ethnographic records to shed some illumination upon their use, in particular whether or not they were used in hunting practices (Heizer and Baumhoff 1962). While some of the research concerning rock alignments seems to be speculative in nature, an explanation for the existence of rock alignments could be drawn from associated archaeological features and positioning in the landscape. If rock alignments were used for hunting, they would be placed in the landscape where the chance of finding game is very high.

Debate over expansion of the Numic language family

One question that must be addressed for the Owyhee uplands is which groups of people lived in the region over time. Ethnographic records show that Paiute and Shoshone groups spoke languages of the Numic family. Therefore the debate about the languages concerns the length of time that these bands inhabited regions such as the Owyhee uplands and who might have come before them. This debate is important for understanding the chronology of the local habitation and determining the cultural affiliation of archaeological sites.

In 1958 Lamb proposed that the Numic languages, spoken by inhabitants of the Great Basin, were of a relatively new origin. From studies of linguistic change over time, he proposes

that the Numic language spread occurred around 1000 years ago from an area in eastern California and extended out into Nevada, Idaho and Utah with the Paiute, Shoshone and Ute populations. Lamb's (1958) propositions have been met with considerable debate over the years (Goss 1977, Holmer 1994, Miller 1986).

Recent investigations present a window through which to reflect on the Numic theories. In the Carson Basin no disruption in the subsistence or settlement strategies has occurred in the last 3000 years as can be determined by sites with time-sensitive projectile points (Raven 1994). Additionally there is no marked increase in the artifact assemblages (Raven 1994) that would indicate additional population influx. Along the Snake River, a continuous assemblage has been found spanning 4000 years (Holmer 1994). One of the distinct artifacts is the Wahmuza Lancelote spear points, which have a unique form. Not only are they found in contact era sites, but they are confined to the last 4000 years within the Northern Shoshone region. This suggests that throughout the Great Basin, the subsistence pattern has been stable for longer time periods than advocated in Lamb's (1958) theory of Numic spreading. One Numic theory accounts for the archaeological continuity within the Great Basin. Goss (1977:62) proposes that Numic languages developed in situ through a process of fission and fusion.

To explain how one group could successfully expand into a large territory, Bettinger and Baumhoff (1982) propose that the Numic and Prenumic subsistence strategies required different amounts of labor to meet dietary needs. In the extreme this would suggest reliance on scattered seed crops and irregular game for the Numic and emphasis on large game for the Prenumic (Bettinger and Baumhoff 1982). However subsistence has remained unchanged for three to four thousand years (Raven 1994, Holmer 1994). Bettinger and Baumhoff's (1982) theory is not reflected in the archaeological record assuming a date of expansion of approximately 1000 years ago. However, it could apply to population spreading at an earlier date. It is possible that subsistence change followed large game extinctions in the altithermal, 6000 to 4000 years ago (Holmer 1994). At this time, groups dependent on seed crops would have an advantage over those following a diminishing number of large game animals. In the manner proposed by Bettinger and Baumhoff (1982) the Numic could have expanded, gathering labor intensive food products, namely seeds, tubers and berries.

The largest argument in opposition to a spread around 3000 or 4000 years ago is the glottochronology (Lamb 1958). This method of tracing language shows that the Numic languages are not three to four thousand years old. One point which is grossly overlooked is the nature of Great Basin subsistence. Population density was low and family groups traveled to gather and hunt. It is possible that through intermarriage and festivals, bands from a large area interacted often enough that their languages were more related than sedentary populations occupying a similarly large area. In fact, along the Northern Paiute - Shoshone border, the current day Oregon - Idaho border, it was common for the people to be bilingual (Miller 1986). Additionally, the boundaries between dialects of each language were widely spaced and difficult to distinguish (Miller 1986).

Another line of research is oral tradition, however information on a limited number of bands is available (Sutton 1993). The human origin myths and migration legends known from Great Basin populations indicate movement from the southwest, the direction from which Lamb (1958) proposed the Numic expansions originated. Place names, sacred areas and myth as history indicate no support for the migration hypothesis (Sutton 1993). Oral history is traditionally said to reflect the recent past (Sutton 1993), however opinions vary among researchers in oral history. Echo-Hawk (1997) provides an example of how the unwritten record documents a much longer time period. Sutton (1993) may be taken as support for a recent movement of population, or a long lasting record of migration.

Linguistic and archaeological evidence agree that there was a change in the linguistic and cultural groups in the Great Basin. The estimated time for expansion is in the neighborhood of 1000 to 3000 years ago, meanwhile some locations experienced more recent expansions or movements that were recorded in oral traditions around the borders of the Numic territory. The debate over Numic expansion has affected the construction of chronologies for inhabitants of the Great Basin as well as the Owyhee uplands.

Generalized Owyhee River chronology

Chronology is an important part of reconstructing the past in a location. The chronology is often developed through archaeological investigations of stratified sites. By reviewing many of the cave sites for the northern Great Basin, Aikens (1982:146) finds that the research has, "established a continuum of occupation at least 11,000 years and probably 13,000 years in

duration. Most if not all of the same functional classes of artifacts have remained in use throughout the period of the record." Aikens (1982) notes the one major technological shift is from atlatl and dart to bow and arrow around 3,000 years ago as seen in the reduced sizes of projectile points around that time. The styles of projectile points and sandals temporally overlap and gradually change over millennia. On the Columbia Plateau, one of the greatest changes came around 5000 BC when semi-subterranean circular houses were introduced (Ames et al. 1998, Roll and Hackenberger 1998). In association with increased sedentism, there was an increased reliance upon annual fish runs and collection of roots, like the camas. These changes influenced the following periods on the Plateau until the arrival of horses brought new changes.

Chronologies have been developed for the Northern Great Basin and the Columbia Plateau (Fagan 1995, Ames et al. 1998, Roll and Hackenberger 1998). However, since the Owyhee uplands sit on the edge of the Great Basin, Andrefsky and Presler (2000) developed a model for the regional chronology in the Owyhee uplands (Table 1) which melds changes in the Great Basin and on the Columbia Plateau.

Table 1: Generalized Owyhee River Chronology - adapted from Andrefsky and Presler 2000:16

Period Name	Phase Name	Ages
Ethnographic	Ethnographic	AD 1,850
	Expansion	300 BP
Southern Snake River	Southern Snake River	1,000 BP
	Rosegate	4,500 BP
Early Archaic	Uplands Camp	6,000 BP
Paleoindian	Windust	8,000 BP
		11,000 BP

Each of the phases in the chronology is characterized by different attributes (Andrefsky and Presler 2000) . The Windust phase is characterized by large projectile points and few grinding stones. The subsequent Uplands Camp phase is noticeable in small lithic scatters at upland sites, but the assemblage of lithic tools, like projectile points, has more items and there are more grinding stones. A marked dichotomy between upland sites and riverine sites is introduced in the Rosegate phase with greater concentration on riverine resources, including the introduction of pit houses on the Snake River. Andrefsky and Presler (2000) see this phase as bringing increased influences from the Columbia Plateau related to fishing technology and pit

houses. The Columbia Plateau influence grows in the Southern Snake River phase with changes in projectile point technology, some of the styles indicating a greater reliance on the bow and arrow. The Southern Snake River phase ends with the expansion of Shoshone/Paiute from the Great Basin in the Expansion phase. These groups continued utilizing the same resources of the area and characteristics introduced from the south did not obliterate earlier forms.

Regional Ethnographic Context

During the early 1900's, studies of ethnography were published based upon consultation with some of the natives who recalled the 'older ways' . Although no work was done in the Owyhee uplands, neighboring bands have ethnographic records. Documentation of both other Northern Paiute and Shoshone bands is appropriate because of the intermediary location of the Owyhee uplands between the two linguistically distinguished tribes.

Settlement and subsistence pattern as represented in Paiute and Shoshone ethnography

Broad settlement patterns are not described in detail in any ethnography, however there are some common trends in housing for groups bordering on the study area. In the historic period, many groups on the Snake River plain adopted tipis and wood lodges. Previously and in groups to the south, the most common house type were wikiups, conical structures covered by various materials (Lowie 1909, 1924; Steward 1941, 1943). Although the wikiups had fireplaces in the middle and faced the same direction, they were scattered without any regular plan (Lowie 1924).

Northern Paiute groups were broken into small bands who identified themselves with other Paiutes. The head of each band was normally a family elder (Stewart 1939). The bands were family groups which would have been on the move between locations with limited resources. The population density throughout the region was very low.

The subsistence for these Northern Paiute and Shoshone areas is described as a hunting and gathering pattern which is dependent upon the seasons. Those groups which had access to horses engaged in procurement over a broader area and depended more heavily on large game. In many ways their contact era life is comparable to that of Plains groups (Lowie 1909). In the

Snake River valley, the Shoshone cycle focused upon summer fishing and winter hunting, meanwhile retaining a large dependence on vegetable plants.

To the south in the Great Basin, Steward (1933:238-239) describes the seasonal activities of the Owens Valley Paiute.

> "*Summer*. People kept headquarters in valley villages, fishing, seed gathering in the valley or hills. . . *Fall*. When seeds were gathered, people of large districts assembled at certain villages for a week or so of dancing and gambling and communal rabbit drives. These were the only communal endeavors, except occasional hunting and fishing parties. *Winter*. Pinenut expeditions of small groups wintered in the mountains in the timber when crops were good. When pinenuts failed, they wintered in the valley villages, eating stored seeds gathered in summer and fall. *Spring*. People wintering in mountains moved to valleys, bringing remaining pinenuts."

Although pinenuts are not available in all of the Great Basin, other groups had very similar seasonal movements. Winter was always a time for consumption of cached food resources (Kelly 1931). Another interesting observation by Kelly (1931:76) is that, "Their wanderings did not follow any set scheme; they roamed wherever the food supply seemed the most promising. A considerable range was necessary, however, for roots such as camas are essentially swamp plants, and others such as epos occur only in higher and drier country." Recent research work has compiled a detailed seasonal round for Paiute groups; in general, the research specifies available food resources and their collection periods (Aikens 1986, Walker 1978).

Rock art and rock alignments as represented in Paiute and Shoshone ethnography

The ethnographic informants from both Northern Paiute and Shoshone bands had no information to report upon the making of rock art. It is assumed that the practice had stopped prior to contact or was the result of a different cultural group that occupied the region in earlier times (Steward 1941, 1943).

Steward's (1941, 1943) extensive inventory of the techniques for hunting notes the construction of blinds and corrals from brush for the hunting of antelope. These constructions would have taken less time and effort than building from rock, especially since sagebrush is

common in many areas and often plentiful. While rock is not noted, it could have been used, particularly in an area which was often frequented by animals.

Shamanic activities as represented in Paiute and Shoshone ethnography

In order to address the issue of shamanism leading to the creation of rock art, recorded shamanism must be considered. One interesting facet of ethnographic studies are the descriptions of shamanism. The most comprehensive study concerns the Southern Paiute. Kelly (1939:151) notes that none of the bands distinguish between game shamans and regular shamans; they use the same word for the two. "To become a shaman, persons of either sex derive their power from dreams, which ordinarily come unsolicited. They confer with a familiar spirit, sometimes human, but more frequently animal, from which they receive songs and instructions for curing. Shamans alone have such guardian spirits" (Kelly 1939:166). Shamans are often specialized in the ailments they can treat, the most recognized is the rattle snake shaman. Other forms of sickness can be treated by many medicine men and a common element of treatment is sucking out the object which causes illness.

An earlier ethnography has a slightly different opinion on shamanism. Lowie (1909:225) reports that for the Northern Shoshone, "it seems that to speak of Shoshone shamanism would be misleading". Individuals had different abilities, however they were obtained in similar ways, so a chief who had war-medicine was similar to the medicine-man who could treat a specific ailment such as snakebite or barrenness (Lowie 1909). Despite differences of opinion, it seems that the practices of the Shoshone and Southern Paiute are very similar in nature and some shamans exist in both groups. These specialists could address only specific issues and were like other members of the community. This illustrates that shamanism, like what Whitley (1994) discussed as resulting in rock art, was recorded as part of the Paiute and Shoshone way of life, even though rock art was not.

Historic cultural affinity of the Owyhee uplands

In environmental respects, the Owyhee upland parallels areas of the northern Great Basin, so it is no surprise that in ethnographical records, this area pertained to a Northern Paiute band, the inhabitants of the Northern Great Basin. At the time of contact (1850), the area of the Owyhee uplands fell into the area inhabited by the Tagötöka ("tuber eaters") band of the Northern Paiute (Stewart 1939). According to the same reconstructions, the Koa'aga'itöka lived

to the northwest in what is now the Snake River plain. To the west were the Wada in the Harney Valley and Tsösö'ödö in the Steens mountains. In some instances the northeastern most bands were called "Snakes" or "Bannock", however Stewart (1939:127) notes that their band names are distinctly Paiute and the collective name for Paiutes, nömö (meaning "people"), was used by these bands. In conclusion, "Occupying a single physiographic province, speaking similar dialects of one linguistic family, possessing cultures and traditions in common, the Northern Paiute bands, without doubt, formed one tribe" (Stewart 1939:144).

In the historical period, the Owyhee uplands blossomed for some of the early settlers when the silver and gold deposits were discovered in the Owyhee Mountains of Idaho in 1863 (Hatton 1988). However, there were considerable conflicts with native populations at this time (Hanley and Lucia 1998). The mineral deposits in the mountains led to boom cities, however shortly thereafter population stabilized at a lower level with cattle ranching; immigrants to the area in the early 1900's were involved in the Basque sheep herding. This tradition of cattle ranching on the plateau regions continues through today. Commercial silver mining closed in the 1990's.

Environmental context of the Owyhee uplands

The Owyhee uplands are located in the southeastern-most corner of Oregon (Figure 2). This locale is confined by the Idaho border to the east, Nevada to the south and the Steens Mountain range and high lava plains on the west. The region is immense. Malheur County is 6.35 million acres in size, larger than Vermont with 6.15 million acres. The Owyhee uplands cover about the southern two-thirds of the county, or approximately 4 million acres. The watershed of the Owyhee River extends into extreme southwestern Idaho and northern Nevada.

The identification of natural variables is an important facet in describing the placement of archaeological sites. These variables can also be used to compare the locations of sites within the environmental landscape. With such an extensive area to cover, the sections which follow refer to general trends of the mesas and canyons. The mountain environments are not included.

Geological setting

The Owyhee uplands are part of the Basin and Range physiographic province. The Basin and Range is an area of fault-block topography, mountain ranges running north to south separated by broad basins (Orr and Orr 1999).

> "The Owyhee uplands lie in the northwest corner of the Great Basin. This region differs from the rest of the province in that it is a flat deeply dissected plateau with little interior drainage where fault-block topography is less pronounced. The drainage basin of the Owyhee River encompasses the uplands. Originating in Nevada, the Owyhee River flows northerly through Idaho and Oregon to join the Snake River near Adrian, Oregon. In spite of low rainfall in the area, steep gradients give the the [sic] river and its tributaries well-defined drainage patterns and deep canyons. Cutting through the uplands over 6,000 feet above sea level, the river drops to approximately 2,000 feet where it joins the Snake. Small streams flowing in from the hills are largely intermittent." (Orr and Orr 1999: 79)

The geological background of this province is based in volcanic activity which started in the Miocene. There are deep volcanic deposits of basalts, tuffs and tuffaceous sediments. While basalt is prevalent, other features include rhyolite, diatomaceous deposits, new sedimentary deposits and new surface lava (Beaulieu 1972, Orr and Orr 1999). The episodes of deposition affecting the Owyhee uplands include the Owyhee Basalts that erupted onto the plateau 13-12 million years ago and the ash-flow tufts from the Steens mountains around the same time. In a few areas there has been relatively recent volcanism, of special note is Jordan Craters (Orr and Orr 1999).

The Jordan Craters lava flow is located in the Owyhee uplands on the plateau. It is a 75 square kilometer olivine basalt flow that is extremely recent by geological time. Potassium argon (K-Ar) dating shows that it is no older than 30,000 years (Hart and Mertzman 1983). However, "studies based on growth rates of lichen and weathering rates of exposed and unexposed basalt suggest that the flow may be between 4,000 and 9,000 years old" (Otto and Hutchison 1977:126). "Additionally the southeasterly flowing lava altered ancestral drainage patterns, giving rise to a natural dam and the formation of two small lakes (Upper and Lower Cow Lakes)" (Wood and Kienle 1990:211).

Soils

Overlying the geological foundation is the soil. In general desert soils vary widely in chemistry as well as pH. Important in soil formation are fluvial and eolian processes (Smith et al. 1997). Deeper soils have accumulated along river terraces. Soils on the mesas are generally shallow and some areas are stripped to bare rock by wind and water. A more detailed description of soils would depend upon the existence of a regional soil survey. As of December 2000, the majority of Malheur County, Oregon had not been surveyed (USDA, National Soil Survey Center). "Soils on the plains are moderately sloping, clayey, very stony or rocky, and shallow to very shallow over basalt bedrock or hardpans. On the buttes and mountain slopes, soils are relatively steep, loamy, stony and moderately deep" (Anderson et al. 1998:94)

Soil sampling from Birch Creek Ranch, along the Owyhee River, had the following results.

> "The highest terrace (Terrace 3) is believed to be late Pleistocene in age and is comprised of colluvial gravels interfingered with Owyhee River alluvium. .... Terrace 2 soil development is very different from that of Terrace 3. Parent material on Terrace 2 is primarily stratified Owyhee River sand, overlying Mazama tephra (6,700 ^{14}Cyr. B.P.) and flood gravels. .... Terrace 1 contains a very young soil with minor indications of soil development. The stratified Owyhee alluvium parent material is slightly modified by discontinuous coatings of carbonates (Stage I) and lacks soil structure" (Andrefsky and Presler 2000:82)

The further difference in Terrace 3 is evidence of clay translocation which suggests a wetter climate in the late Pleistocene (Andrefsky and Presler 2000:85). These results are only for one location of riverine soil in the Owyhee uplands.

Climate

The climate of the Great Basin is semiarid, characterized by an mean annual temperature of 9°C (48.2°F) and between 100 and 200 mm (3.94-7.88 in.) of precipitation annually (Smith et al. 1997). The majority of this precipitation comes during the winter and spring. The current climatic conditions of Rome, OR on the Owyhee River at 3400 feet (1036 m) of elevation best reflect recent climatic conditions of the Owyhee uplands. Average annual precipitation over the last 50 years is 8.21 inches (20.85 cm). The average daily maximum temperature in the hottest

month, which is July, is 92.0°F (33.3°C). The average daily minimum temperature for January, the coldest month of the year, is 18.1°F (-7.7°C). Data from further to the south at weather station McDermitt 26N (located 26 miles to the North of the Oregon/Nevada border along US 95) reflects similar conditions at 4500 feet (1371 m) of elevation. Average annual precipitation is 9.43 inches (23.95 cm). The temperature ranges from an average daily maximum of 91.1°F (32.8°C) in the month of July and the average daily minimum for Jan of 18.9°F (-7.3°C). The averages for this station are for the last 45 years (Western Regional Climate Center).

The environment of the Owyhee uplands is comparable to that of the Great Basin. The main difference between the two is hydrological. While the Owyhee uplands have drainage into the Pacific Ocean by way of streams and rivers, the Great Basin has internal drainage. These two areas indeed have many similarities. The plant communities which can be found in the two regions are similar (Murphy and Murphy 1986:285). In turn animal communities are similar with the notable exception of different varieties of fish that inhabit the Owyhee River in comparison to inland lakes.

Local wind patterns

High winds come up in the morning and evening across the plateau regions of the Owyhee uplands. These winds, anabatic and katabatic, are driven by gravity and the heating and cooling associated with morning and evening, respectively (Christopherson 1997). In the evening as layers of the surface cool, the cold surface air is denser and sinks, moving down slope across the mesa. The downward movement is called a katabatic wind. The reverse happens in the morning as the air at lower elevations warms and rises, pushing air the opposite direction across the mesa as an anabatic wind.

Vegetation complexes

Most of the North American deserts fall within the Basin and Range province, the most northern of which is the cold desert or Basin and Range. The cold desert is primarily semiarid with steppe vegetation (Smith et al. 1997). The plant community is dominated by the evergreen *Artemisia* spp. (sagebrush) complex.

> "This complex segregates out along moisture, temperature, soil depth and chemistry, and soil-texture gradients. Important associates with *Artemisia* include shrubs such as *Purshia tridentata* [bitterbrush], *Chrysothamnus nauseosus* [gray

> rabbitbrush], *Chrysothamnus viscidiflorus* [green rabbitbrush] and bunchgrasses of the genera *Pseudoroegneria* [wheatgrass], *Elymus* [wildrye, wheatgrass, bottlebrush], *Festuca, Leymus* [wildrye], *Oryzopsis* [ricegrass] and *Stipa* [needlegrass]." (Smith et al. 1997:22)

Throughout the desert environment, there is high spatial variability of plants (Smith et al. 1997), in other words, species appear in patches and these can abruptly change to another patch with a different species composition.

The Owyhee uplands are dominated by big sagebrush scrub (Figure 3). Grasses which are associated with big sagebrush, in the area of study, include bluebunch wheatgrass (*Pseudoroegneria spicata*), Sandberg bluegrass (*Poa sandbergii*), bottlebrush squirreltail (*Sitanion hystrix*) and Idaho fescue (*Festuca idahoensis*) (Anderson et al. 1998). "The Idaho fescue will usually be found in slightly higher and moister spots; the wheat grass is able to tolerate drier environments" (Hatton 1988:23). Within this range of the *Artemesia* steppe, the economically important species, all of which have edible parts, include: basin wildrye (*Elymus cinereus*), biscutroot (*Lomatium* spp.), camas (*Camassia quamash*), bitterroot (*Lewisia rediviva*), cattail roots (*Typha latifolia*), chokecherries (*Prunus virginiana*), wild rose (*Rosa* spp.), wild onions (*Allium* spp.) and currants (*Ribes* spp.) (Elias et al. 1982). The plant community has changed in recorded history with the invasion by exotic species, including Russian thistle (*Salsola kali*) and cheatgrass (*Bromus tectorum*). Western juniper (*Juniperus occidentalis*), a native species, is expanding from higher elevations onto the steppe due to fire suppression (Miller and Rose 1995).

Within the *Artemisia* complex, there are three subspecies of *Artemisia tridentada*; these are associated with different elevations, soils and edible plants (Anderson et al. 1998; Jean Findley, personal communication). The mountain big sagebrush (*Atremesia tridentada vaseyana*) are found at elevations of over 5000 feet (1500 m) where the annual precipitation exceeds 12 inches (30 cm); these areas in the Owyhee uplands are the Mahogany, Spring and Trout Creek Mountains. The other two subspecies are Wyoming big sagebrush (*Artemesia tridentada wyomingensis*) and basin big sagebrush (*Artemesia tridentada tridentata*), both of which are found in the lower elevations. Wyoming big sagebrush is found on the shallow soils. Basin big sagebrush is found in deeper soils; associated with it are basin wildrye (*Elymus cinereus*), yellow currants (*Ribes aureum*) and squaw currants (*Ribes cerium*).

Outside of the Artemisia complex, some other important vegetation groups are found in the Owyhee uplands (Jean Findley, personal communication, Anderson et al. 1998). In clay soils with standing water the low sagebrush, or *Artemisia arbuscula*, thrives. It is a key to the locations where bitterroot (*Lewisia rediviva*), biscutroot (*Lomatium* spp.) and often onions (*Allium* spp.) are found. Additionally, Indian rice grass (*Oryzopsis hymenoides*), which has a large, heavy seed, grows on sandy soils throughout the Owyhee uplands. Riverside vegetation is marked by a narrow band of willow (*Salix* spp.), rushes (*Juncus* spp.), sedges (*Carex* spp.) and riparian grasses. In some locations along the rivers edible plants can be found: yellow and red currants (*Ribes aureum* and *cerium*), wild rose (*Rosa* spp.), hackberry (*Celtis* spp.), and chokecherries (*Prunus virginiana*).

Camas (*Camassia quamash*), which were extremely important to Native Americans in nearby regions, only grow along the Cow Creek drainage in the Owyhee uplands (Jean Findley, personal communication). Cow Creek is one of two bottomlands in the Owyhee uplands, the other is Jordan Creek. "Originally, these bottomlands likely produced a dense, vigorous stand of basin wildrye" (Anderson et al. 1998:95). Cow Creek's drainage pattern has been altered by volcanic activities. Jordan Craters now covers the wide valley through which Cow Creek used to run from the mountains of Idaho, westward until it reached the Owyhee River. Cow Creek is now confined in the Cow Lakes before the drainage turns south to join Jordan Creek. Jean Findley (personal communication) believes that because of the low gradient across what is now the Jordan Craters, Cow Creek used to pass through a wetland, rich in camas and basin wildrye.

Paleobotanical research provides a record of the environment in the Great Basin desert. The dominant vegetation reflects the climatic conditions which are favorable for its growth. The following time periods are noted by differences in the dominant vegetation (Smith et al. 1997, 27): Late Wisconsin - subalpine coniferous forest (21,000 - 11,000 BP); Early Holocene - *Pinus-Juniperus* woodland (11,000 - 8,000 BP); Middle Holocene - *Juniperus* woodland / *Artemisia* steppe (8,000 - 4,000 BP); Late Holocene - *Artemisia* steppe / *Atriplex* desert scrub (< 4,000 BP). This change from juniper woodland to sagebrush steppe has yet to be confirmed for the Owyhee uplands.

Animal community

Settlement of the area did not eliminate all species of animals which were present prehistorically. Species which would be valuable to any population are those which could be food sources. Large mammals of the Owyhee uplands today include pronghorn (*Antilocapra americana*), white-tailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), bighorn sheep (*Ovis canadensis*) and cougar (*Felis concolor*). Some smaller animals are cottontails (*Sylvilagus* spp.), jackrabbits (*Lepus* spp.), badgers *(Taxidea taxus),* rattlesnakes (*Crotalus viridis*), gopher snakes (*Pituophis catenifer*), chipmunks (*Eutamis* spp.), sagebrush voles (*Lagurus curtatus*) and coyotes (*Canis latrans*). Another food source would have been birds like sage grouse (*Centrocercus urophasianus*), hawks (*Buteo* spp.), and migratory birds like ducks (Anatidae spp.) and geese (*Branta canadensis*) (Trimble 1989: 102). These animals are routinely observed in the area. Earlier inhabitants could also have had access to animal species no longer present.

The Owyhee uplands are semiarid and have been so for most of the last millennia. Precipitation is low and water is scarce in most locales. Paleobotanical research reflects an environment which has supported *Artemisia* steppe / desert scrub communities for the last 8000 years. The dominate vegetation of the area currently is big sage scrub which includes a number of plants which have edible parts. This vegetation supports several types of large and small mammals, particularly the pronghorn. Both the edible parts of plants and the animals could have provided valuable resources to earlier inhabitants of the area.

IV. Research Methods

Malheur County covers a large area, 6.35 million acres. Before recording archaeological sites with petroglyphs, the locations had to be chosen and the methods for recording had to be determined. The Owyhee uplands in southern Malheur County were chosen as the study area (Figure 2). To compare archaeological sites with petroglyphs to all other archaeological sites, a database of the sites was also compiled.

Site selection

It was difficult to find and select rock art sites to visit in the Owyhee uplands which cover approximately the southern two thirds of Malheur County, especially with very little existing information. The entire existing record of known rock art sites totaled ten locations along the Owyhee River and five locations on the mesas. For these recorded sites, the site forms contained the locations, a short description of the site and some pictures; only one of the sites had been surveyed. Archaeologists at the Bureau of Land Management (BLM) Vale, Oregon had additional notes documenting where some "Indian drawings" were with more or less accurate locations. From this initial status, the research proceeded using known sites and ideas of where other sites might be located. Because of the paucity and sketchy nature of the rock art record prior to 2000, the research reported here was originally conceived in the narrow context of finding, documenting, and describing rock art features at undocumented sites in the Owyhee uplands.

A limiting factor to recording rock art and other surface archaeological features is accessibility of the sites. Most sites along the Owyhee River are only easily accessible by raft in brief spring rafting seasons following wet winters. Mesa sites, if roads are nearby, are accessible almost year-round, so research started at mesa sites which were thought to have "Indian drawings", i.e. undocumented sites. All of the locations visited by the author were relatively close to established gravel roads or more or less passable jeep tracks.

No systematic scheme was applied to choose sites to record. However, the mesa sites were easier to reach and therefore chosen more frequently. Many of the sites recorded in the present work were entirely undocumented or discovered by the author. Of the sites with site forms prior to the start of this project, the author visited six of the fifteen. At four of these six

sites, information specific to the rock art panels was added to documented information. Because of these factors, the sample of petroglyph specific data accumulated for the Owyhee uplands by the author has a greater emphasis on newly recorded sites and sites on the mesas. At the end of recording in 2001, twenty eight sites are documented for the county and twenty five of these are in the Owyhee uplands. Personal communications with amateur archaeologists led the author to believe that there are at least four well known, undocumented rock art sites along the Owyhee River and its tributaries.

Site documentation

Recording rock art at archaeological sites is primarily a three step process: surveying, recording the rock art and post-processing of data. However the recording step has many aspects, some of which are site dependent. Rock art sites in the Owyhee uplands are located primarily on two types of features: basalt rim rock and basalt boulder fields. The survey method used was different for the two types of sites.

Field procedures

The rock art sites had not previously been surveyed. The first aspect of surveying was determining the extent of the site and which archaeological features were a part. While petroglyphs were the focus, other archaeological features were noted. When a site was located, all sides were walked to find and record associated features. It was expected that some lithic scatters or ground stone might be associated with the rock art sites, however to the author's amazement rock features were also discovered and documented at some sites.

Basalt rims are essentially cliff faces, so there is usually only one surface upon which petroglyphs can be made. Therefore a rim containing petroglyphs is surveyed by walking from end to end and recording rock art as it is encountered. Fields of boulders pose a slightly more difficult scenario because there are many possible locations where petroglyphs may be found. These include all faces of the boulders and associated basalt rims if the boulder field is located in a draw.

One of the aspects which could be distinguished in areas of boulders were places with prominent growth of grass. If these could be found, plastic tent stakes were pounded into the ground so that a colored string between them delineated a width. With two parallel strings in

place from side to side across the boulder field, the area between was canvassed. This involved walking back and forth between the strings marking each petroglyph panel with a florescent colored flagging tape. Once all of the rock art in one area was located, it was recorded before proceeding to the adjacent rectangular area. In a draw, the strings could run from the rim rock, so portions of the rim were included with each section of the boulder field. Each boulder or piece of rim rock that faces in one direction is called a panel or face. More succinctly, "A rock art panel is defined as any rock surface containing art and oriented, for the most part, in one direction" (Loendorf 2001:61)

The first step of the petroglyph recording process was to determine the location of the panels. This was done using a hand held Global Positioning System (GPS) unit. During the 2000 field season, a Lowrance Global Map 100 GPS was used. A waypoint (record of the position) for each rock art panel was created using the averaging function to eliminate some of the introduced variations. A Trimble GeoExplorer3 and Beacon on a Belt was used during the 2001 field season to record locations in a similar manner. For sites located along a basalt rim, the GPS unit was set away from the cliff face. This allowed the unit to locate satellites throughout the sky. The distance and direction between the GPS unit and petroglyph panels were recorded. When operating in a boulder field, the GPS unit was placed on top of the boulder. In some instances of proximity, two adjacent boulders were recorded using the same position as designated by a waypoint.

In both types of locations, along rim rock and in boulder fields, the recording of panels proceeded in the same manner. The first step was to record general data for each panel of rock art (Appendix 1). The dimensions of the panel were recorded, along with its distance from the ground. A compass reading was taken to determine the direction from true North which the rock was facing. An inclination of the face was measured using a protractor and plumb bob from vertical, so zero degrees was vertical. This implies that an overhanging panel would have a negative degree measurement, while boulders would have a range of positive degree readings. At least one photograph was taken of each panel from an angle where all elements were visible (Appendix 2). The data included for each panel were similar to those in Loendorf's (2001) example rock art recording forms. Both the inclination and the compass direction involved human judgment for selection of a spot for the characteristic measurement because few rock faces are completely flat.

The next step was to determine what constituted a single element within the panel. This procedure could be subjective. However, to facilitate recording a general set of guidelines were developed. Distinguishing elements started in the broad reference frame of the entire panel. The first observation was whether or not superimposition was present as verified by the differential coloring of pecked lines. In any case where there were obviously lighter and darker lines, elements were distinguished by their color (one lighter, one darker). The next and more utilized principle was whether or not line, circle, and other design touch. In any instance when it was impossible to distinguish a clear space between designs, they were recorded as one. (One example is three circles connected by a line.) So far, an element was defined as consisting of one color and being connected to its other parts by contiguous lines.

This however was not sufficient because many panels were complex. One general rule of thumb was that if the composition of the designs was identical, a larger area could be designated as one element. This was often seen in the case of circles, for example when four parallel, vertical chains of circles of similar patina were encountered, they were recorded as one element. The same was true with the occurrence of vertical or horizontal lines which lay parallel to one another. Upon panels where dots were prevalent, it was assumed that the dots composing one element would be close in size and have a general theme, such as line of dots, jumble of dots, rectangle of dots, or multiple parallel lines of dots. This designation was subjective, but the occurrence of a group of identical elements with similar lengths and color warranted their classification as a single element. This subjectivity is recognized by Loendorf (2001:61), "A row of dots could be considered a single element, or each dot could be considered an element in itself."

Once the elements had been determined, their width and height were measured to the nearest centimeter using a meter stick. The range of the apparent line width was recorded to a tenth of a centimeter using calipers. A small sketch was drawn on the recording sheet to give a general idea of the design element when the photographs were developed and examined. Any superimposition of elements or distinctively different coloring of designs was recorded in the sheet for the panel (Appendix 1). Elements were also classified using a modified version of Heizer and Baumhoff's (1962) styles. First the elements were split by method of production, all elements produced by scratching the rock surface were designated "scratching" (Photo 1), a broad classification. The petroglyphs produced by pecking (Photo 2), or hitting the rock surface, were

further separated by design type: elements which were dots were called "dots" (Photo 3), elements which were judged to be abstract designs were called "abstract" (Photo 4), elements which were judged to show a human, four legged animal, human hand or footprint were called "representational" (Photos 5 and 6), and elements which were deeply pecked dots, over 1 cm deep, were called "pitted" (Photo 7).

The recording method was basically the same for both years of fieldwork. However in 2001 a new section of data was accumulated. The condition of the individual panels was recorded in a yes/no or present/absent format. The categories and specific items were: material - basalt, other; rock surface - even, uneven, smooth, rough; rock condition - holes, cracked, spalling; sources of deterioration - wind, water, rockfall, lichen, patina. Most of these are self-explanatory. The category which presented the most problems for interpretation was rock surface; the difference between even and smooth was that even and uneven referred to the whole panel and whether it looked flat or not, while smooth and rough referred to the texture of the surface. Spalling is a geological term for flat, thin sheets breaking off of the exterior surface of a rock through weathering (Photo 8). Since basalt naturally tends to have spalling, whether or not it was recorded tended to be a judgment call. Spalling can be as damaging to rock art as when large chunks of a rock break off. These additional observations can be valuable on future visits to the sites, however since similar data was not recorded in 2000, these observations have not been included in the current compilation of the data.

Preparation of the data

Following field work, data was processed in a manner to prepare it for later analysis. The information from the data sheets was entered into a Microsoft Access spreadsheet. Photographs were curated in digital format by scanning the three by five inch color prints at 400 dpi and saving both a color and gray scale copy. GPS information was processed in the Arc/Info software package on a UNIX system.

The processing of site forms and photographs was for analytical purposes as well as creating an archive of the previously undocumented archaeological sites containing rock art.

While the placement of petroglyphs and associated features at an archaeological site is interesting, a more significant GPS analysis would compare distribution of petroglyph sites to the

other archaeological sites in the Owyhee uplands. This analysis was conducted in Arc/Info (Appendix 5, Appendix 6).

Procedures for cataloging artifact associations of all sites in the Owyhee uplands

In order to make a comparison between sites with petroglyphs and other archaeological sites in the Owyhee uplands, a summary of known sites was needed. The Vale Bureau of Land Management had not compiled a summary of site locations and types, however they have a site form for every site. Therefore all the recorded sites have been compiled by the author into a summary as part of this research project. Data from site forms was entered into a Microsoft Access database (Appendix 4).

Prior to entering data from the site forms, the following were designated as fields for the database: Smithsonian number, a unique number assigned by the State Historic Preservation office (SHPO), northing and easting for location in Universal Transverse Mercator (UTM) zone 11 projection, excavated, bearing, area in hectares, and then designations for features that the site could contain. These features were petroglyph, pictograph, lithic scatter, lithic tool, shelter/cave, campsite, ground stone, rock wall, rock circle, rock feature, weaving, bone fragments, shell fragments, source rock, pit house, refuse midden and ceramics. These features cover all known site types in the Owyhee uplands.

Since the data was pulled from site forms, the recorder acted as a skeptic in accepting information on these forms. The following were cases where the author exercised the right of interpretation. Bone and shell fragments were only recorded if the site was an excavated or potted cave, or if the bone and shell were associated with lithics in an eroding bank. A campsite was defined by having fire cracked rock at surface sites, charcoal in a excavated site or a combination of lithic scatter and ground stone.

Rock wall and rock circle are self explanatory, but why is rock feature, a broader classification, included? Many rock features are of historic origin: cairns were built by Basque sheepherders and some large rock circles were constructed by Scotch sheepherders. So all cairns were thrown out, and then if the picture or description was such to indicate that the feature was historic, it was thrown out. Therefore the designation of rock feature was used by the recorder if the feature was possibly of prehistoric origin and it was not well defined or pictured in the site forms. A rock feature that was well documented or pictured and clearly of prehistoric origin

could be classified as a rock wall or a rock circle. It is unfortunate that this precaution was necessary, however some areas with rock strewn in a single layer on top of other rock have been recorded as "rock features". The author observed this type of layering of single rocks on top of base rock occurring naturally, particularly on basalt. For this documentation, rock features were only identified as such if there was a consistent design of one rock piled atop another or if there were three or more rocks stacked. Areas with structures three, four and five rocks high were not made by natural erosion of basalt.

For this database, lithic tool was also a closely defined category. Tool was marked whenever mentions were made of projectile points, knives, blades, scrapers, etc. The designation of tool was not used for mentions of bifaces unless a clear picture or sketch accompanied the report showing bifacial working. This was because some of the pictures of "bifaces" included with site forms were pictures of unaltered flakes.

In order to carry out spatial analysis, the locations and features of archaeological sites in the Owyhee uplands were exported from the database and imported into Arc/Info (Appendix 5).

V. Results and Discussion

Archaeological sites

The archaeological sites in the Owyhee uplands were cataloged by artifact feature types present at each site. These sites were counted and compared on the basis of features present. The distribution pattern of sites within the Owyhee uplands was analyzed, along with possible causes for the distribution.

Summary of known archaeological sites in the Owyhee uplands

In the Owyhee uplands of southern Malheur County, 511 archaeological sites are known (Appendix 4). Each of these archaeological sites can have multiple associated features, such as lithic scatter, lithic tools, ground stone, rock shelter and pottery. The counts and proportions of sites with some of these features show the frequent occurrence of lithic scatters (94.1%) and the low frequency of elements like pottery, pit houses and woven items (Table 2). These differences are partly a result of time depth (the extent of time over which people have made stone tools and pottery are different, so stone tools will show up more frequently) and partly a result of the lack of excavations. While lithics have been made into tools since people started inhabiting the Owyhee uplands, pottery was introduced around 500 AD in southeastern Idaho (Butler 1983). The only pit houses and woven items known for the Owyhee uplands are the result of two excavations. Items which only become visible in the archaeological record following excavations are found in low frequency in this summary because only four partial excavations have been conducted (35ML6, 35ML7, 35ML8, 35ML181). At seven other sites test pits have been dug where the sites have been potted (disturbed by collectors). Therefore surface features visible at surface sites are better represented in archaeological records from the Owyhee uplands. Petroglyphs, which are the focus of this study, only occur at 4.9% of archaeological sites in the Owyhee uplands.

Table 2: Counts and Frequencies of features at archaeological sites in the Owyhee uplands.

All archaeological sites	511	100%
Feature	Count	Frequency
Lithic Scatter	481	94.1%
Lithic Tools	201	39.3%
Rock shelter	44	8.6%
Ground stone	78	15.3%
Petroglyphs	25	4.9%
Pictographs	0	0%
Rock features	24	4.7%
Pottery	3	.6%
Pit house	1	.2%
Woven items	1	.2%

Distribution of archaeological sites in the Owyhee uplands

The distribution of known archaeological sites in the Owyhee uplands clusters in two areas with greater concentrations (Figure 4). These are in the Trout Creek Mountains (southwestern corner) and along the Owyhee river. The rest of the study area is covered by scattered sites at low densities. The pattern seen in the region may not accurately reflect a thorough site distribution for this region, but it does reflect some of the trends in site distribution.

It would be unrealistic to say that the distribution of sites reflects settlement distribution, because the known sites are not a result of an unbiased sample. Some areas have been extensively surveyed while other areas have been surveyed on a sporadic basis or are relatively unexplored. The Bureau of Land Management (BLM) manages approximately 63% of the land in Malheur County, so their work and records are extremely important for understanding the archaeology of the area. The areas of private land around Jordan Creek and the town of Rome are not well represented in archaeological data because there is no obligation for private landowners to report archaeological sites. Most of the archaeological work which has been done in the county has been under the direction of the BLM on BLM lands. Archaeological surveys have been conducted for long swaths along the Owyhee River from Rome to the reservoir, an area very accessible for rafts. However, the sites on the mesa or less accessible river courses have been sporadically noted in BLM records, only as a rancher or BLM employee tells the archeologist that they have seen a site. It is possible that hundreds of sites wait to be encountered on isolated mesa tops and in smaller river drainages. Throughout BLM land, archaeological surveys are done with other goals in mind: e.g. fire rehabilitation projects, placement of a

pipeline, reservoir or fencing or infrequent land transfers. These factors contribute to the distribution of known sites (Figure 4) but do not accurately reflect the density of prehistoric habitation.

Another factor which affects site distribution is site preservation. While lithic scatters may remain in the landscape for extended periods of time, other site types may disappear from the record. Throughout the area, there is very little soil accumulation, so sites remain exposed on the ground surface. The only locations with soil accumulation are the flood plains of the rivers. It remains unclear how the preservation process works in the Owyhee uplands, but it has an effect on the nature and distribution of sites. Sites along river courses are also disturbed by the wide and erratic fluctuation in river flows.

Despite inaccuracy in the distribution pattern, one obvious trend in site distribution emerges. The greatest site concentrations are in areas with contemporary perennial water sources. An arbitrary distance of 1500 meters away from perennial water sources was chosen and plotted in comparison to the distribution of sites (Figure 5). Out of the archaeological sites in the Owyhee uplands 361 of the 511 fell within 1500 meters of perennial water sources. The Trout Creek Mountains (or Oregon Canyon Mountains, southeastern corner of Malheur County) and the Owyhee River system show concentrations. Stream systems starting in the Trout Creek Mountains are fed by higher rainfall than areas of the mesa, but in general they run out of the mountains onto the mesa and dissipate.

Rock art sites

Rock art occurs at 4.9% of the archaeological sites in the Owyhee uplands (Figure 6). As the focus of this study, a selection of petroglyph sites are examined based on rock art designs, location in the landscape and associate archaeological features.

Selection of sites from Malheur County

Initially the recording of archaeological sites with rock art for this project was based upon the whole of Malheur County. However, current political boundaries do not coincide with features of the landscape, namely drainage basins and plant communities. Of the twenty eight known archaeological sites with rock art in Malheur County, Oregon, twenty five lie within the Owyhee uplands (Appendix 3). The twenty five sites from the Owyhee uplands can be analyzed.

While a comparative analysis with surrounding areas would be interesting, the small sample size of sites outside the Owyhee uplands would make a comparison with adjoining areas unrealistic at this time.

Location of rock art

Petroglyphs in the Owyhee uplands are made on exposed basalt. All locations that the author has visited have hard, fine to medium grained basalt without air holes. Although the area is largely basalt, very little of it is fine grained or exposed. The basalt flows are largely covered with sagebrush. In addition not all rock in the Owyhee uplands is basalt. Rhyolite, tuffs and sedimentary deposits are also found. Exposed basalt on which petroglyphs are made in the Owyhee uplands includes rim rock, blocky boulders and water worn boulders.

Design elements

Rock art design types for the Great Basin were designated by Heizer and Baumhoff (1962). In the Owyhee uplands all the petroglyph designs fit these broad classifications: Great Basin Representational, Great Basin Abstract with the subdivisions of Rectilinear and Curvilinear, Pit and Groove and Great Basin Scratched. Out of twenty five sites, the styles were evaluated at the sixteen sites that were visited (Table 3). All of the sixteen sites include elements of the Great Basin Abstract style executed by pecking. Ten sites have representational elements and three sites have pit and groove elements executed by pecking. Scratched elements are present at five sites. Of these sites, there is no systematic duplication of representational elements between sites. Remnants of pigment were found in two petroglyph designs at one location.

Table 3: The occurrence of Heizer and Baumhoff's (1962) petroglyph styles at sixteen archaeological sites in the Owyhee Uplands.

Smithsonian Number	Abstract	Representational	Pit and Grove	Scratched
35ML130	Yes		Yes	
35ML168	Yes	Yes	Yes	
35ML605	Yes	Yes		
35ML688	Yes	Yes		
35ML850	Yes			
35ML992	Yes	Yes		
35ML1044	Yes	Yes		Yes
35ML1045	Yes	Yes		Yes
35ML1046	Yes	Yes		Yes
35ML1049	Yes			
35ML1050	Yes		Yes	
35ML1051	Yes	Yes		Yes
35ML1052	Yes			
35ML1053	Yes			
35ML1054	Yes	Yes		
35ML1057	Yes	Yes		

Thirteen of the rock art sites were recorded in greater detail, with information on every face and design. These sites range in size, relative to the number of rock faces used and the number of petroglyph designs (Table 4). The smallest sites have five faces and twenty elements or six faces and seventeen elements. The largest site, 35ML1045, has 163 faces and 584 designs. Between the extremes are many sizes of petroglyph sites.

Table 4: The counts of petroglyph faces and elements from thirteen archaeological sites in the Owyhee Uplands.

Smithsonian Number	Number of Faces	Number of Elements	Elements per face
35ML153	10	70	7
35ML605	5	20	4
35ML688	59	222	3.76
35ML850	21	125	5.95
35ML1044	79	293	3.71
35ML1045	163	584	3.58
35ML1046	21	50	2.38
35ML1050	50	153	3.06
35ML1051	57	263	4.61
35ML1052	33	107	3.24
35ML1053	11	42	3.82
35ML1054	6	17	2.83
35ML1057	7	22	3.14

Of 1969 designs recorded at thirteen sites, the majority are abstract in style (81.4%). Small percentages represent the other styles (4.3% are representational, .5% pitted, 1.6% scratching, 11.8% dots). Since the proportion of elements other than abstract are extremely low

at all sites, barring 35ML1057, the stylistic classifications based upon the method of production and subject matter do not assist in classifying the sites in the Owyhee uplands. As Francis (2001) suggests for the Great Basin, the different chronological periods Heizer and Baumhoff (1962) designated for these styles are not apparent. There are no regular instances of superimposition or differing coloration which would lead the author to place these stylistic classifications into different chronological periods, even at petroglyph sites in the Owyhee uplands where abstract, representational and scratched elements are all present. However the stylistic classifications can be used as a reference frame to describe the designs found in the Owyhee uplands.

Abstract designs

The majority of petroglyph designs in the Owyhee uplands are abstract. This designation corresponds to the Great Basin Abstract style. Abstract designs could have multiple meanings, both in current interpretation and intentions of the original artists. The pecked designs which are not clearly similar to humans, four legged animals or hand or footprints are considered abstract. Designs that could be the sun, plants or animal tracks might have other interpretations. Since no ethnographic records connect the modern interpretations of these designs to the artists intentions, the designs were called abstract. This does not mean that the designs had no meaning when they were made, just that the meaning has been lost with the passage of time.

Designs of anthropomorphic (human-like) figures

Anthropomorphic or human like figures have been well documented in the rock art of surrounding areas and, unlike abstract designs, are easy to classify. Despite the low percentage (4.3%) of all representational figures in designs of the Owyhee uplands, the anthropomorphic designs deserve comment. Three different types of anthropomorphic figures are found. These are stick figures (Photo 9), stick figures with lines coming out of their heads (Photo 10), and stick figures where the body of the figure is represented by a circle (Photo 11). The first of these types is recognized throughout the world. The second type is recognized as occurring on the Columbia Plateau and along the lower Snake River in Idaho (Boreson 1998, Nesbitt 1968). The third type is often called the "shield-bearing warrior", this design is found to the north and east of the Owyhee uplands along the Salmon and Snake Rivers (Boreson 1998). The human like figures in the Owyhee uplands reflect styles which are known to occur in areas to the north and east.

Scratched designs

The scratched designs in the Owyhee uplands consist of thin lines, probably created using a sharp rock. Common compositions are zigzags, vertical or horizontal lines, crosshatching and fans. However there are other compositions including one four legged animal (Photo 12). The Great Basin Scratched style was made with a sharp rock. "Its elements are straight lines, sun figures, and crosshatching" (Heizer and Baumhoff 1962:208). On the Columbia Plateau, similar compositions of lines, crosshatching and fans have been recorded (Boreson 1998).

Occurrences of pitting

Pitted designs were only found at one (35ML1050) of the 16 sites where the elements were detailed (Photo 13). Thus, pitting accounts for an extremely small percentage of the petroglyph designs (0.5%). However two of the riverside petroglyph sites 35ML130 and 35ML168, which were visited by the author, had very deeply pitted petroglyphs on a few boulders (Photo 7). The pits, or circular depressions, which seem to be randomly placed on a rock face, vary in depth from one to multiple centimeters. Many of the pits are very dark in color, similar to the basalt around them. Based on the coloration, or patination, Heizer and Baumhoff (1962) proposed that the Pit and Groove style, which they found at six sites in the northern half of Nevada, was the oldest petroglyph style. Pits are also found on boulders at the rivers edge along the Columbia river system (Boreson 1998).

Relative dating methods

The antiquity of the Pit and Groove style described by Heizer and Baumhoff (1962) was based on relative dating methods. They utilized the coloration, or patination, of the petroglyphs as a method for determining age. Both patination and superimposition are relative dating techniques (Keyser 2001). These techniques can be employed primarily on individual panels of rock art to determine which designs are older and which are younger. Older designs will be a darker shade, under a newer design, or both.

Petroglyphs in the Owyhee uplands could provide a few clues which could be used in relative dating, if the petroglyphs differed significantly in composition or in method of construction. However the instances of differential patination and superimposition were not frequent and did not show a consistent trend. Often designs which could be classified as abstract

were superimposed on or lighter than other designs which could be classified as abstract (Photo 14).

Location of rock art at sites

Petroglyphs are located on either basalt boulders or basalt rim rock. The smoothest boulders or rim rock at the petroglyph sites are often the ones chosen for petroglyphs. Additionally, petroglyphs were made on the clearest side of the rock, not the sides where the most lichen and moss accumulates. Petroglyphs in the Owyhee uplands were made in accessible and visible locations.

While it has been noted that the petroglyphs occur on both basalt outcroppings and basalt boulders, the sites and the individual rock faces are in accessible locations. Not only is it possible to walk up and around all of the cliff faces, it is possible to scramble through the boulder piles. More importantly, almost all of the designs could have been made from a comfortable sitting or standing posture because they are on accessible rock faces. Most sites, including 35ML850, 35ML1050 and 35ML1054, had no awkwardly placed petroglyphs. However, occasionally some designs are slightly out of reach for a five foot five inch recorder. At 35ML1044 two petroglyphs out of 293 were above the height, on a vertical face, which the recorder could reach. Elsewhere at the site, one panel required climbing up about a meter between two rocks, however the face itself could have been used as a seat (inclination 50º degrees from vertical). For awkwardly located panels, 35ML605 also comes to mind, one of the seven rocks, used at this location for petroglyphs, is only accessible by leaning over a ledge from above. This rock with five designs, including one that looks like a deer (Photo 15), was about four meters off of the ground. In general, petroglyphs could have been made from a comfortable location to stand or sit since they are at heights easily reached from these positions.

The visibility of rock art can provide clues to the audience that viewed the art. Art along a trail could be visible to everyone, while in the dark recesses of a cave it would be less visible. In the Owyhee uplands visibility of rock art is generally good. Crisp images can be seen from 100 meters away on both basalt outcroppings and basalt boulders. Some lichen filled or patinated images are now difficult to view or photograph, but they would have been bright when created.

Relative occurrence of other archaeological features at rock art sites

Rock art sites in the Owyhee uplands do not contain only art, they can be associated with other artifact feature types. Compared to all archaeological sites, the features found at petroglyph sites occur in different frequencies (Table 5).

Table 5: Counts and Frequencies of features, a comparison between archaeological sites and petroglyph sites in the Owyhee uplands.

	Archaeological sites (n = 511)		Petroglyph sites (n = 25)	
Feature	Count	Frequency	Count	Frequency
Lithic Scatter	481	94.1%	16	64%
Ground stone	78	15.3%	3	12%
Rock shelter	44	8.6%	3	12%
Petroglyphs	25	4.9%	25	100%
Rock features	24	4.7%	9	36%
Pottery	3	.6%	0	0%

The artifact feature types which are found at archaeological sites with rock art are lithic scatters, rock shelters, ground stone, rock features and lithic tools.

Petroglyph sites are more frequently found in association with perennial water than archaeological sites in general. Eighty four percent of petroglyph sites (21 of 25) are within 1500 meters of perennial water sources whereas only 72% of all archaeological sites (369 of 511) are within the same distance.

Context of archaeological sites with rock art

After the discussions of design and accessibility, it is important to discuss the sites as a whole locality used by native inhabitants of the area. With twenty five sites to discuss, it is helpful to make an initial separation between sites. All archaeological sites with rock art in the Owyhee uplands lie within an area that historically was occupied by one group, the Tagötöka, tuber eaters (Steward 1939). While some of the sites with petroglyphs near the Nevada border are at elevations between 1751 and 2000 meters, there is not enough rainfall for mountain big sagebrush, so all of the petroglyph sites are within one vegetative and climatic zone. These being the same, the sites will be discussed in groups by their location in the landscape, specifically whether they are located on the mesa, in the canyons or on the mesa at a water tub.

Before breaking into these groups, it is important to note that none of the twenty five archaeological sites with petroglyphs are known to have pit houses, ceramics or woven material.

This is not surprising since each feature is known to exist at fewer than four sites. They have also not been subjected to intensive investigation for habitation sites.

Riverside sites

Eleven of the twenty five petroglyph sites in Malheur county are located along the Owyhee River and its tributary, Jordan Creek. The archaeological sites are found on the flood terraces. Some of the sites are on the terrace closest to the river, while others are on terraces over 20 meters elevation above the river. The riparian band along the river is very narrow (no more than five meters), but it contains willows, wild roses, currants and other riparian vegetation. High variability in water flow tends to scour the river banks of trees and large woody vegetation. The Owyhee River has some fish species year-round and prior to reservoir construction supported yearly fish runs. The terraces along the river are flat and open in some areas, despite the general constricted nature of the river. On the terraces away from the river's edge, the vegetation is basin big sagebrush because of the deep soils. All of the rock art located along the river is in the form of petroglyphs on water worn basalt boulders on flood terraces.

Sites along the river are not situated in the narrowest canyons, they are on fairly wide terraces, often where an intermittent drainage cuts down to the river. Much of the Owyhee River has limited access because of uninterrupted basalt cliffs which can tower over fifty meters. Where intermittent drainages join the river, the terrace area is often wide and the stream course has usually broken through the basalt. These locations provide access routes between the river and mesa as well as wider terraces; these spots are currently used for camping spots by river rafters.

Because of their location along the river, these were some of the first archaeological sites to be recorded and pillaged. Most of the large caves along riverside sites in the region have been potted. Artifacts sitting on top of the ground, like projectile points and ground stone have also been picked up. Petroglyphs located on wide terraces where rafters camp have occasionally been vandalized. Because they are near the river and visible from the water, some smaller sites have been recorded. The only recorded sites containing only one or two boulders with petroglyphs are beside the river; most recorded sites have many more boulders. This does not make small sites unique to the river course, but reflects upon how different areas have been documented. The river banks have been canvassed more thoroughly than the mesa and small stream drainages.

Sites 35ML105, 35ML130, 35ML144, 35ML153, 35ML156, 35ML164 35ML168, 35ML196 35ML197, are 35ML692 are located along the Owyhee River. 35ML1057 is beside Jordan Creek. While most of these archaeological sites have more than one feature class, four sites only have petroglyphs: 35ML164, 35ML196, 35ML692 and 35ML1057 (Table 6). In the case of 35ML1057, any other features which might have been associated with the petroglyphs have been removed by a long history of farming and the recent construction of a levee. Two boulders with petroglyphs are known to have been incorporated into the levee which was built between 1965 and 2001.

Table 6: Features associated with archaeological sites containing petroglyphs in the Owyhee Uplands.

Smithsonian Number	Excavated	Bearing	Area (Hetares)	Petroglyphs	Lithic Scatter	Lithic Tools	Shelter/Cave	Campsite	Rock Wall	Rock Circle	Weaving	Bone Frag.	Shell Frag.	Ground Stone	Source Rock	Pit House	Ceramics
35ML105	No	292.5	.25	yes	yes			yes						yes			
35ML130	No			yes	yes	yes	yes					yes	yes				
35ML144	No	360		yes	yes												
35ML153	No	180	.1	yes	yes												
35ML156	No	315	8.1	yes	yes			yes						yes			
35ML164	No	67.5	.1	yes													
35ML168	No	202.5	5	yes	yes									yes			
35ML196	No			yes													
35ML197	No			yes	yes	yes											
35ML605	No			yes													
35ML688	No	315	2	yes	yes												
35ML692	No	67.2	.4	yes													
35ML842	No	90	4	yes	yes		yes		yes								
35ML850	No	180	10	yes	yes				yes	yes							
35ML992	No	235	1.9	yes													
35ML1044	No	180	.1	yes	yes				yes								
35ML1045	No	180	9.4	yes	yes					yes							
35ML1046	No	180	6.3	yes	yes	yes			yes								
35ML1049	No	300	6	yes													
35ML1050	No	15	25	yes	yes	yes		yes	yes								
35ML1051	No	90	1.1	yes	yes	yes			yes								
35ML1052	No	330	14	yes	yes		yes		yes								
35ML1053	No	80	.9	yes					yes	yes							
35ML1054	No	270		yes													
35ML1057	No	5		yes													

The remaining seven archaeological sites with petroglyphs along the Owyhee River are associated with lithic scatters. In addition, three are associated with ground stone (35ML105, 35ML156 and 35ML168) and one is associated with a rock shelter (35ML130). While absence of ground stone is not diagnostic, because collectors remove it, its presence is diagnostic. The

four sites with ground stone or a rock shelter are indicative of habitation sites. Therefore four of the archaeological sites with petroglyphs were associated with habitation. On the other hand, four sites have only one artifact class, the petroglyphs. These differing associations with the petroglyph sites make generalizations difficult. In the Columbia Plateau region, petroglyph and pictograph sites are located within a mile of an archaeological site which was used as a fishing place or campsite. Continuing further north into British Columbia, "petroglyph sites appear to be associated with subsistence activities, while those located on the Fraser River are thought to be closely related to fishing" (Boreson 1998:611).

Of the riverside sites, only two have been extensively recorded: 35ML153 and 35ML1057. From this small sample it is currently unrealistic to examine the counts of petroglyph faces and elements as a distinct grouping, different from the other petroglyph sites with this information (Table 4).

Mesa top sites

From the sample of twenty five archaeological sites with petroglyphs in the Owyhee uplands, eleven are located on the mesa tops. Mesa top sites are located both along basalt rim rock (or out cropping) and in boulder fields (Photos 16 and 17). Some sites are a combination of both locations as the rim rock has broken over time. On top of the mesa, the Wyoming big sagebrush vegetation dominates because of shallow soil, however at the lower edge of most rim rock, basin big sagebrush predominates in the deeper soil, with its associated currants and basin wild rye.

The eleven mesa top petroglyph sites overlook water sources, normally perennial, from higher locations. At two of these eleven archaeological sites only petroglyphs have been found. These are 35ML992 and 35ML1049. 35ML992 is located about 500 meters away from 35ML1044 and has a permanent water source. 35ML1044 lacks a water source but overlooks wetlands. Essentially, the small site 35ML992 could be considered part of the larger 35ML1044. 35ML1049 is perched on the edge of the mesa overlooking the Owyhee River 600 meters (2000 feet) below. The site runs along the near edge of the basalt rim rock, next to where a very small intermittent drainage breaks through the basalt rim rock, and thus is a means of access between the mesa and river below. 35ML1049 has a paucity of petroglyphs, there are ten faces with one or two elements each, but only three faces remain legible.

If these two sites are set aside, the remaining nine archaeological sites with petroglyphs on the mesa top also have rock walls or rock circles associated with them. All of these nine sites overlook water. The rock walls are located on the mesa top, so in profile they are higher than the petroglyphs and both are higher than the water source (Figure 8). Of these eight have associated lithic scatters (only 35ML1053 lacks a lithic scatter). These sites which unite the combination of petroglyphs, rock features and wetlands or perennial water sources are 35ML842, 35ML850, 35ML1044, 35ML1045, 35ML1046, 35ML1050, 35ML1051, 35ML1052, and 35ML1053 (Table 6).

These nine archaeological sites provide a large comparative sample. The rock features, petroglyphs, wetlands and lithic scatters associated with the sites can be compared. Rock features are very unique in the Owyhee uplands. Of 511 known archaeological sites only twenty four have rock features, less than 5%. Rock features have been documented in Owyhee County, Idaho by Mark Plew (1976) but it is unknown in what archaeological contexts they occur. In the Owyhee uplands, the only well documented rock features are found in association with petroglyphs. The context in which the other two thirds of the rock features occur is unknown.

Two types of rock features are found in the Owyhee uplands, rock walls and rock circles. Rock walls are built to follow the contour of the land and often fill in gaps where the rim rock is low or crumbling (35ML850, 35ML1044, 35ML1046, and 35ML1050). The walls would only serve as an effective "fence" from the downhill side, from above they blend into the landscape (Photo 19). Rock circles are built near or at the edge of rim rock, and often stand slightly above the height of the rim rock (Photo 20). Sites where there are rock circles near the edge of the rim rock are 35ML842, 35ML1045, 35ML1050, 35ML1051, 35ML1052, and 35ML1053. The one exception to this is at 35ML850 where the circle is located in the middle of a shallow draw between rock walls (Photo 21).

The lithic scatters associated with eight of these nine archaeological sites have multiple rock types. While obsidian is very common in some lithic scatters, others are very mixed (Photo 22). The flakes in the lithic scatters are composed of obsidian, fine grained basalt, painted jasper, quartzite, opalized chert and siltstone. Many of the components in the lithic scatters are not observed in resident geological deposits at the sites where the principle rock is basalt.

Field notes for upland petroglyph sites record that almost all have currants (Photo 23). Most of these sites had basin wild rye as well, which is expected, because they both grow in deep soils (Photos 24 and 25). Both of these edible plants have ripe fruit and seeds, respectively in mid to late summer. While the sites might have other botanical features in common, a botanical collection was not made at the archaeological sites. An additional challenge is that overgrazing at the end of the 19th and beginning of 20th century resulted in a reduction of some species or reduced ranges of other species.

Water tub sites

Water tub petroglyph sites are located on the mesa top, however they are broken off into their own subsection because of the unique nature of the water tub and their dissimilarity to other mesa top petroglyph sites. A water tub acts like a trough and holds runoff water. Water tubs are located in existing intermittent drainages below shallow drop-offs formed by the drainage cutting through basalt layers (Photo 18). Because of the short drop, the water in the intermittent drainage digs a hole. This results in a small depression which holds water after the drainage runs dry.

Three petroglyph sites are located at water tubs, these are 35ML605, 35ML688 and 35ML1054. They are situated at very small rock outcroppings in intermittent drainages. Additionally the three sites are isolated on the mesa because, although they are close to the Owyhee River, a sheer cliff separates them from it. While the three sites have petroglyphs, only one of the sites, 35ML688, has an associated feature, a lithic scatter. 35ML688 is also significantly larger than the other two sites on the basis of rock art. There are sixty nine panels at 35ML688 while 35ML605 and 35ML1054 have seven and six panels, respectively. 35ML688 also covers a greater area, with more exposed basalt faces, however it is unclear why 35ML688 is a larger site. Perhaps the drainage which feeds this site runs more regularly. It appears that the attraction of these sites was the water, available in the water tubs when the rest of this mesa region was dry.

Classification of rock art sites

From the previous discussion, it has become apparent that sites are similar based upon their location in the landscape. Within the Owyhee uplands, the twenty five archaeological sites with petroglyphs are found in three locations: along the perennial rivers, at water tubs and on

basalt overlooking water holes or wetlands (Figure 12). For the three distinct locations, the landscape as well as the archaeological remains present are slightly different (Table 7).

Table 7: Comparisons between the three locations petroglyphs are found in the Owyhee uplands

Location	Count	Perennial water source (1500m)	Habitation sites	Rock features
Riverside	11	yes	possibly	no
Water tub	3	no	no	no
Mesa top	11	10 of 11	possibly	yes

In general, the sites along the river vary in size and might have been associated with habitations and therefore wintering along the river or harvesting fish. The petroglyph sites at water tubs are relatively small and only one is associated with other archaeological remains, a lithic scatter. The archaeological sites which overlook wetlands are characterized by petroglyphs, lithic scatters, rock features and are perched above a water source.

Evidence for dating of rock art

Since there is no reliable dating method for petroglyphs, rough dates for these sites with rock art must be constructed in a round about manner. The lines of evidence which could be used include chronologically diagnostic projectile points, ethnographic records and relative dating methods.

Of all the lithic scatters visited, only one site produced a datable projectile point. This point was from 35ML1050, an extensive site on the mesa top overlooking a water hole. Interestingly, this point was not found amid the lithic scatter of 35ML1050, which covers approximately 16 acres, but at least 20 meters from its edge and below the rim rock. From a field sketch, it was identified as being a broken Elko Corner Notched point. The identification was made by William Andrefsky (personal communication 2001). This type of point was used over a range of time in the northern Great Basin and an acceptable time range would be from 4,300 to 3,300 years ago. This one point can say that 35ML1050 was visited or inhabited during this time period, but it in no way places a limit on people using the site before or after this date.

In recording the ethnography of Native American groups of the northern Great Basin, Steward (1941) notes no creation of rock art. In fact Steward supposed that rock art could possibly have been made by an earlier group to occupy the region. Since the Shoshone and Paiute were relative newcomers to the areas of southeastern Oregon and Idaho, it is possible that

the petroglyph sites were not their creation, rather they were already a part of the landscape when they entered the region.

While Heizer and Baumhoff (1962) propose different dates for abstract, representational and pit and groove petroglyphs, in the Owyhee uplands both abstract elements and one representational element have accumulated varnish, since they were made, that has turned them the color of the rock (Photos 26 and 27). These elements look like the pit elements in the region. As Dorn (2001) mentions, the oldest relative date for a petroglyph is when the varnish is the same color as the rock. If the model of Heizer and Baumhoff (1962) is used, all of the pecked styles for the Owyhee uplands have been used between 5000 and 3000 BC, the dates for the Pit and Groove style. All of these styles then continue through time, because lighter versions are found at the sites, 35ML1050 even has light colored pitted petroglyphs. While Heizer and Baumhoff (1962) placed the earliest date for petroglyphs at 5000 BC, the dates from the Columbia Plateau are later, because the pit and groove forms are excluded. From comparisons between portable art and rock art designs, "the rock art tradition at The Dalles [north central Oregon] emerged as early as 1500 BC out of rudimentary pit and groove forms" (Boreson 1998:617).

Relative dating methods include looking at the color of the petroglyph. On basalt surfaces, petroglyphs get darker with age (Dorn 2001). Petroglyphs in the Owyhee uplands show a range of coloration from almost white to the color of the basalt. The oldest date this method allows is when the petroglyph is the same color as the rock background (Photo 26). Another method of dating is superimposition. There are a few clear examples from the Owyhee uplands (Photo 28), most superimposition is difficult to distinguish because both the early and late elements are of an abstract style (Photo 14).

Modern impact on rock art sites

While this study reports vandalism at some archaeological sites with petroglyphs close to roads or the river, the vandalism generally is not destructive (Photo 31). Rather individuals added additional modern glyphs in the form of pictures or names to rocks around those with petroglyphs and sometimes on the same rock face as where petroglyphs are already present (Photo 32). Some of the smaller rocks which had petroglyphs on them are probably not at the

sites, in one instance rocks of a manageable size have been incorporated into a monument (Photo 33)

Discussion of rock features

The only well documented rock features found in the Owyhee uplands were found in association with petroglyph sites. There are two types of rock features, rock walls and rock circles. Generally rock walls follow the contour of the land and create an impenetrable barrier from below. Rock circles are often situated at the edge of the rim rock. These archaeological features are located in positions which are above water holes or wetlands. Both rock walls and rock circles are normally constructed one rock thick and with three or more rock layers vertically (Photo 29).

The rock circles at 35ML1050 are situated near the edge of the mesa. The circles vary in size from one to three meters across and the highest sections currently stand 80 centimeters high (Photo 20). Placement of rock features near the edge of the mesa, where they overlook a water hole or wetland is also found at 35ML992, 35ML1045, 35ML1051, 35ML1052 and 35ML1045. At 35ML1052 there are 14 different rock circles on the edge of the rim rock (Photo 30).

The walls at 35ML850 follow the contour of the hill for 341 meters (Photo 19). Nine segments, ranging between seven and seventy eight meters apiece are interspersed with low rim rock. In places the walls stand over one meter tall. The labor required to build the wall, considering its length and height, suggest repeated or prolonged use of the site. Site 35ML850 is at the top of a draw which overlooks a meandering creek. From the perspective of walking up the draw, the rock wall is on the right hand side. The other side of the draw has tall rim rock. The rock walls could work like a funnel. At the end and center of the funnel there is a rock circle. This circle is 118 meters away from where the rock wall ends.

The occurrence of rock features at petroglyph sites in Nevada was noted by Heizer and Baumhoff (1962:221):

> "As for fences, we find these at four sites; of these, all have Great Basin Abstract style (both Curvilinear and Rectilinear), three have Great Basin Scratched style, two have Great Basin Painted style, one has Great Basin Representational style, and one has Pit-and-Groove style. Three of the four sites are marked as suitable for antelope [pronghorn] corrals, and it is likely that the fences were parts of the

> corrals. . . . Blinds are found at five of the sites and associated with a diversity of petroglyph styles similar to that found in combination with fences. Two of the blinds are found together with fences and must have been used in connection with corrals."

While the context in which Heizer and Baumhoff found the rock features may be different, as there are no corral like features in the Owyhee uplands, the recognition that they occur alongside rock art is important.

Proposed dates for the construction of rock features

Rock features cannot be dated in traditional manners, since they do not contain organic material. The rock features in the Owyhee uplands are covered with lichen, but lichen is a difficult dating method for rock art because growth rates are difficult to calibrate in arid regions (Dorn 2001), the same would hold true for rock walls. While most of the rock features have crumbled and look old, this is no scientific method. While Heizer and Baumhoff (1962) noted rock features at seven of fifty eight sites, they did not suggest dates. Agenbroad (1976, cited in Andrefsky and Presler 2000:17) notes that rock hunting alignments are associated with small surface lithic scatters near springs beginning around 8000 BP. The Uplands Camp Phase also has an increase in the occurrence of ground stone which suggests an increase in vegetative food processing (Andrefsky and Presler 2000).

The only other clue available for the dating of rock features comes from ethnography. The Shoshone and Paiute who lived in adjoining areas are only known to have constructed hunting blinds and corrals out of sagebrush, a plentiful desert plant which is easily acquired. Thus the ethnographic records present no leads to the dating of rock features, except that these groups probably were not responsible for the construction of rock features. Therefore it is likely that no rock features were made during the last 1000 years. In sum, a possible range of dates from 8000 to 1000 years ago can be placed on these rock features from association with lithic scatters and ethnographic records.

Hypotheses proposed before conducting research, reexamined

Considering past research, it is difficult to determine the cultural pattern of the Owyhee uplands. No specific ethnographic study was conducted on the area from which a direct historic method can be employed. Furthermore, the continued debate over a Numic spread questions the

cultural continuity of the Northern Paiute groups. Therefore, petroglyph sites within the Owyhee uplands cannot, with certainty, be ascribed a cultural affiliation nor can the rock art be dated by current methods. The following are the models which the examination of the petroglyph sites in southern Malheur County might support.

Aggregation sites of populations

The model of aggregation presented by Conkey (1980) might be applicable to the hunter-gatherers of this region. Since aggregation and dispersal occurs on a regional scale, it is necessary to include many known sites from the study area. An aggregation site would, by definition, occur in an economic, social or ritual context which would generate the population concentration. By demonstrating that sites with petroglyphs in the Owyhee uplands resulted from population aggregations, it could be postulated that a social or ritual factor contributed to the aggregation and thereby the creation of petroglyphs.

Important to aggregation are areas with the economic capacity for sustaining an aggregated population, especially for any prolonged time period. This requirement is met in neighboring regions by the pinenut harvest in the Great Basin, and in the Snake River basin by salmon runs and camas plains. In the Owyhee uplands it would be necessary to determine resources which could support an aggregation. Possible resources would include camas concentrations, grass seeds, antelope hunting and summer fishing runs on the Owyhee River. These sites would also reflect the congregation of population in remains of camps.

Research has shown that the petroglyphs are in locations which could have been used for hunting or fishing. The possible hunting sites would not be able to support an aggregated population because there is no guarantee that game would be present. Riverside sites could have been used as locations to fish, but not all are known to be campsites as well. If riverside fishing habitation sites are large, the model of aggregation (Conkey 1980) might be applicable to these rock art sites in the Owyhee uplands.

Harvest of vegetative food resources

The vegetative food resources which are available in the Owyhee uplands occur in dispersed patches throughout the landscape. The small concentrations are found in areas with slightly higher amounts of moisture, eg. near springs. This factor would be difficult to determine because of vegetation changes over time.

After conducting research, it seems likely that vegetative foods were harvested by yearly movement around the landscape to known locations. The scarcity of resources in any one location might not have allowed for prolonged stops at any of the locations. A frequently used location might be one where vegetative food resources were available and where animal food resources were possibly available.

Procurement of animal food resources

The animals which are native to the Owyhee uplands have the same constraints as humans to surviving in the habitat. They are constrained in summer range by the location and quantity of watering spots. Pronghorn (*Antilocapra americana*) commonly go to drink several times a day (Lubinski and Herren 2000). People who want to hunt could optimize the limited access to water resources by waiting at locations where animals will be required to pass. Although the Owyhee River runs year round, many of its tributaries are intermittent. Another limit is the nature of the river and its main tributaries. Many run in deep canyons which have vertical cliff sides. This makes locations with access from the rim down to the water important for both humans and animals. Experience with the landscape has shown that most of these accessible paths occur where a smaller tributary has cut a path to join a larger tributary. This landscape of the Owyhee uplands might create ready made traps in the draws which large animals must pass to reach water when it is scarce.

Very little can be said about the opportunistic procurement of small game. Small game procurement does not rely upon the landscape, but rather happening upon a rattlesnake, sage grouse or rabbit that is nearby and taking advantage of the situation.

If petroglyphs are associated with large game procurement, the locations would be those which provide water. So the petroglyphs would be near water holes, springs or canyons leading to and from water sources.

All of the petroglyph sites recorded by the author were shown to be near water sources which remain after the surrounding area is dry. While none of these sites are associated with constrained canyons leading to or from water, game could be herded from watering holes toward constricted locations at sites 35ML850 and 35ML1046. Despite a general lack of constricted locations, many of the rock circles that sit on rim rock overlooking the water could have been used as blinds for either sighting or hunting game; sites with rock circles include 35ML842,

35ML1045, 35ML1050, 35ML1051, 35ML1052 and 35ML1053. The water's edge might also have been used as a location to kill large game animals. Sites located on the Owyhee River and Jordan Creek might not be situated in positions which would take advantage of large game movements, but would have had fishing resources.

Proximity to water

For both humans and animals in the Owyhee uplands, water is a limiting factor. During midsummer and drought seasons, water becomes scarce in this semiarid environment. Therefore it is logical that human populations would prefer their semi-permanent residence for dry months to be near a reliable source of water. To conclude that sites with rock art are related to water supply, the distance of rock art sites to water must be compared to the distance of other sites to water. Also these sites would likely represent extended or yearly habitations.

Research has shown that most of the petroglyph sites in the Owyhee uplands are located close to perennial water resources, but this is also a trend with the majority of archaeological sites from the Owyhee uplands, 72% are within 1500 meters of perennial water sources. It is difficult to show that the water was the reason that individuals were at certain archaeological sites, they may have been interested in the resources which are more prolific around water sources, such as animals and edible plants.

Much of the wide expanse of grazing land has little access to water. Access is limited both by water scarcity and by the tendency of perennial streams to be incised below vertical cliffs throughout the Owyhee uplands. To the north on the Columbia Plateau, "Pictographs (paintings) and petroglyphs (carvings) are found on rock surfaces such as rock shelter walls, escarpments, outcrops and boulders, generally near a permanent source of water" (Boreson 1998:611).

VI. Analysis

Design of petroglyphs

The petroglyph designs found in the Owyhee uplands are similar to those from the Columbia Plateau, Idaho and the Great Basin. Petroglyph designs were influenced by populations on all sides. This suggests that people were not moving in only one direction across the Owyhee uplands. It is likely that if the petroglyph sites in Harney County to the west were examined, there would be similarities with the spectrum of designs. Pitted elements for example are found in northern Nevada, the Owyhee uplands and the Columbia Plateau.

Function of rock features

It is probable that the rock walls and rock circles were used in hunting. Modern pronghorn hunters who go out to Dry Creek (in the Owyhee uplands) locate a water hole along the creek and wait downwind from four in the morning until antelope show up. Some of the circles are located almost exactly at the rim (35ML1050, 35ML1052, 35ML842), locations which would be good for watching the area below without being observed. Some of the rock walls cut off possible escape routes along confined paths; if a pronghorn (*Antilocapra americana*) were spooked it could be funneled one direction (35ML850, 35ML1046, 35ML1050). Pronghorn, unlike deer, do not jump over fences unless forced to do so; today they are more often seen searching for breaks in barbed wire fences (Lubinski 2000).

The construction of rock walls at 35ML850 to act as a funnel could have aided in hunting pronghorn. Pronghorn moving up the draw from the creek are constrained by tall rim rock on the left and the right side is blocked by the wall (Figure 13). Since pronghorn do not often jump vertically, they would be hesitant to jump a manmade rock wall. As the wall became a permanent feature of the landscape, pronghorn would be accustomed to using the path they had been funneled into; a hunter could wait patiently in the rock circle for a pronghorn and probably get a better aim and closer shot.

Site location

Petroglyph sites in the Owyhee uplands can be compared to the archaeological sites. Artifacts found at petroglyph sites are lithic scatters, lithic tools, rock features, ground stone, rock shelters, shell fragments and bone fragments. Ceramics, pit houses and woven materials have not been found at petroglyph sites. Lithic scatters are found at 64% of petroglyph sites and 94% of all archaeological sites. Two types of petroglyph sites mostly lack lithic scatters: the water tub sites and riverside sites. At water tub sites, lithics are not present because the sites were not used for long periods of time. To the contrary, riverside sites were probably habitation sites which would have lithic scatters, but the site extent has not yet been explored. Lithic scatters could also be scoured from riverside sites by highly variable water flows.

Rock features are found at 36% of petroglyph sites and only 5% of all archaeological sites. However, petroglyph sites are differentially associated with rock features; 9 of 11 mesa top sites are associated with rock features while none of the riverside or water tub petroglyph sites have rock features. In another comparison, 84% of petroglyph sites are within 1500 meters of a perennial water source while only 72% of all archaeological sites are this close to perennial water. This high percentage for petroglyph sites relates to the use of both riverside and mesa top petroglyph sites as campsites and locations where resources could be collected.

Petroglyph sites in the Owyhee uplands are part of the settlement system. While the settlement system is not well understood, petroglyph sites occur in areas where there are both high and low settlement densities. The most striking example comes from the Owyhee River. Along the Owyhee River where the density of archaeological sites is high, petroglyph sites are also frequently found. On the mesa top, settlement density is low, but petroglyph sites are still to be found. However, petroglyph sites are not found in all areas of the Owyhee uplands. The Trout Creek Mountains, in the southwestern corner of the study area, do not have identified petroglyph sites. This may be due to the vegetative community in which petroglyph sites are found.

Communities of vegetation which occur in Malheur County are playa, sagebrush lava beds, sagebrush scrub and perennial bunchgrass grasslands, ponderosa pine and Douglas fir forest, and mountain big sagebrush scrub, mahogany and juniper woodlands (Figure 3). Archaeological sites are located in all of these vegetation communities except playa (Figure 10).

Petroglyph sites are all located in the sagebrush scrub and perennial bunchgrass grassland community of vegetation. The Trout Creek Mountains, where no petroglyphs have been found are in the mountain big sagebrush scrub, mahogany and juniper woodlands vegetation community.

The elevations of archaeological sites in the Owyhee uplands vary considerably (Figure 7). Archaeological sites are found at higher elevations around the Trout Creek Mountains. The cluster there is probably a result of the lush vegetation and higher quantity of moisture that characterizes the mountains, rather than their elevation. Sites also continue to occur in high densities around the Owyhee River from 750 to 1200 meters elevation. Away from the river, in this elevation range and others, the Owyhee uplands do not show clustering of archaeological sites based upon elevation. The elevation of petroglyph sites ranges from 822 to 1859 meters (Figure 9). The lowest elevations come from sites along the Owyhee River, the highest sites, around 1800 meters elevation, are further upstream on the Owyhee. Petroglyph sites do not cluster at one elevation.

This study identified three types of locations where petroglyphs sites are found. Not only do the locations differ, but the reasons for being at the locations differ.

Riverside sites

It is possible that the petroglyph sites along the Owyhee River and Jordan Creek are elements of larger site complexes associated with fishing practices. Riverside petroglyph sites could also have been the winter base camps for inhabitants in the region. It is already known that four of the sites with petroglyphs were associated with habitation sites. These interpretations would fit with the local settlement pattern because many of the archaeological sites along the river are thought to be habitation or fishing sites. In either case it is possible that riverside sites could have been aggregation sites.

Water tub sites

The water tub sites would have been stopping spots on a journey across large waterless expanses of sagebrush plateaus. This is consistent with the fact that there are practically no associated archaeological features. A small lithic scatter was noted by another observer at one of the three sites. These sites are tied to the water that would be available in the water tubs following rainstorms or snow melt. The area of the plateau where these sites are located is cut

off from the Owyhee River by sheer cliffs and there are no water sources in other directions. One of the only safe times to travel across this area would be when water fills the water tubs.

Mesa top sites

The mesa top petroglyph sites, with their rock walls and wetlands, probably functioned as hunting and gathering sites. The nearby sources of perennial water made finding animals likely and assisted in plant growth. Even if animals were not encountered, a stop at one of these sites could have been profitable because of the vegetative food resources available. Currants and basin wild rye are currently found at all sites and other edible plants went unnoticed in this study. The mesa top sites were also associated with natural shelter created by the rim rock on which the petroglyphs were made. Natural shelter would have been a desirable attribute at a short term camp site. The mesa top petroglyph sites were probably not long term camp sites because the local vegetation and animals could provide only limited resources.

The mesa top petroglyph sites also have rock walls and lithic scatters which indicate extensive use of the sites. Building rock walls would have been a major investment of time and labor. The people constructing rock walls probably planned on using them multiple times to make the effort worthwhile. Additionally the size of the lithic scatters indicates repeated use of the sites. The scatter at 35ML1050 covers 16 acres and that at 35ML1046 covers 6 acres. Despite repeated uses of these sites, the resources available would probably support a small party and not a large aggregation of people.

Some mesa top petroglyph sites appear to have better sources of perennial water and these are the locations which have more petroglyphs, larger lithic scatters, and extensive rock features, specifically 35ML1050, 35ML1044 and 35ML1051.

Environmental context of site locations

The environmental context of known petroglyph sites provides clues for where to go to find further petroglyph sites in the Owyhee uplands. The same clues also explain why petroglyphs are not found all over the Owyhee uplands.

The Owyhee uplands are characterized by sagebrush and perennial bunchgrass vegetation. Large areas of the upland plateaus are covered with this vegetation which is not very valuable to humans as resources. The areas where people could find both animals and edible vegetative resources were often associated with water. In essence people would go to specific spots in a

barren landscape. People would exploit resources in accessible areas where there was water. Petroglyphs are found where the resources were valuable enough to stop for.

On the flip side, many locations with running water are not accessible to animals or humans. Large sections of rivers and streams are deeply incised in the landscape. Where the canyon is topped by a cliff, neither animals nor humans can easily reach water. Petroglyph sites are only found where water is easily accessible to humans and animals.

The Owyhee uplands are not geologically homogeneous. Features other than basalt cover parts of the Owyhee uplands; these include rhyolite, diatomaceous deposits, new sedimentary deposits and new surface lava (Beaulieu 1972, Orr and Orr 1999). Basalt is the only material on which petroglyphs have been found in the Owyhee uplands. Locations with other geologic compositions are not likely areas for petroglyphs.

Petroglyphs are known to be made on relatively smooth pieces of basalt. Additional petroglyph sites will probably be found in locations where basalt is exposed.

Fires are important to small campsites. The Owyhee uplands are dry most of the year, except in occasional wet years. The desert vegetation is so dry that only one stray ember could start a fire across the plateau. An unprotected fire would be subject to local winds, the anabatic and katabatic winds, that blow across the plateau in both the morning and evening. Rim rock provides protection from winds; this is especially true when boulders away from the rim rock block winds from another direction. The shelter of the rim rock would make fires relatively safe, by keeping the wind from blowing embers away.

The Owyhee uplands are open flat country for the most part. During the summer, the sun is intense in the middle of the day as daily maximum temperatures of the hottest month, July, average 92°F. Also there is little cloud cover and the high elevations receive greater insolation (intercepted solar radiation) because of the reduced mass of atmospheric gasses (Christopherson 1997). The irregular splitting and erosion of rim rock at mesa top sites like 35ML1044, 35ML1045, 35ML1046, 35ML1050 and 35ML1051 provides sheltered locations from the daytime sun. The tall rim rock does not follow a straight line and some concavities create shade at different times of day. Another shelter that the rim rock at mesa top petroglyph sites can provide is from wind. Below the rim, wind is not strong. Two sites in particular 35ML1044 and 35ML1051 have large flat spaces which provided shelter in front of the greatest concentrations of

petroglyphs (Photo 34). These spots are protected on more than one side, both by the rim rock and by boulders away from the base of the cliff.

One of the easiest ways to find petroglyph sites in the Owyhee uplands would be to use topographic and geologic maps. Petroglyphs have only been found on basalt in the Owyhee uplands so areas with other compositions could quickly be eliminated. Riverside and mesa top sites, are associated with perennial water sources. Perennial water sources in areas where basalt occurs could be identified on topographic maps. While petroglyphs are not at all spots along perennial water, some areas are more likely to have petroglyph sites. Likely spots include where perennial water is present away from other water sources or where there is access between a river and plateau where rim rock limits free passage elsewhere.

Water tub locations in the Owyhee uplands are not portrayed on maps, to explore more locations of this type in search of petroglyphs, one would need to be familiar with the landscape.

In any search for new sites, it should be kept in mind that petroglyph sites were part of a settlement system. The sites were not solely for the creation of petroglyphs, other activities occurred at the same locations. Activities varied and could have been fishing, long-term residence, gathering plants or hunting.

Dating of rock art sites

Mesa top petroglyph sites in the Owyhee uplands provide indirect evidence for dating some of the petroglyphs. Ethnographically, no petroglyphs were known to be created, which indicates that the Shoshone and Paiute probably did not add substantially to the rock art assemblage recently, in the memory of their oral history. The lack of ethnographic data pushes the petroglyphs into an earlier time bracket.

The rock features which are found at 9 of the 11 mesa top petroglyph sites overlook wetlands where animals could be hunted or plants gathered. The site 35ML1045 has rock features similar to the other sites. It is logical to presume that these rock features overlooked a wetland created by the ancient path of Cow Creek. Today the rock features at 35ML1045 overlook the Jordan Craters lava flow. This lava flow is at least 4000 years old (Otto and Hutchison 1977). Therefore the rock features overlooked a wetland that disappeared when the

lava flow covered it up. The reasons for people to visit 35ML1045 to hunt and gather disappeared when the wetlands disappeared, at least 4000 years ago. The petroglyphs at 35ML1045 are at least 4000 years old.

The author believes that petroglyphs have been made in the Owyhee uplands for the last 8000 years. The petroglyphs at 35ML1045 are at least 4000 years old. The Owyhee Uplands have little microtopography which would differentially affect the weathering of petroglyphs. Most of the petroglyphs are made on basalt which would probably attain a desert varnish (patination) at a similar rate. Petroglyphs at multiple sites have darker patination (where the petroglyphs are the color of the surrounding rock surface) than the petroglyphs at 35ML1045. One petroglyph at 35ML1045 has a significantly darker patination. This petroglyph and the darker ones at other sites are significantly older than the majority at 35ML1045. The mesa top petroglyph sites are associated with activities which started in the early Archaic, or Uplands Camp phase, around 8000 years ago. The early Archaic is when rock features are first noted (Agenbroad 1976, cited in Andrefsky and Presler 2000:17), and there is an increase in ground stone. Subsistence in the Owyhee uplands changed little over time, fishing was introduced later into a hunting and gathering subsistence. If the creation of petroglyphs is part of the activities of the settlement system, then the petroglyphs have been made for at least 8000 years in the Owyhee uplands.

VII. Conclusions

Rock art interpretations applied to the Owyhee uplands

Multiple interpretations have been proposed for the context in which rock art is made around the world. These interpretations include shamanism, hunting magic, documenting important events, astronomy, doodling and areas of aggregation. Petroglyph sites in the Owyhee uplands have been examined, but would they fit any of these interpretations?

There is very little evidence that petroglyphs in the Owyhee uplands were related to shamanistic activities. Shamanistic activities tend to occur at special locations, some of which are isolated or relatively inaccessible. Petroglyphs in the Owyhee Uplands are not in isolated or less accessible locations. Rather, the petroglyph sites show use similar to other settlement and resource procurement sites. This makes the practice of shamanism at petroglyph sites unlikely in the Owyhee upland. However, if shamanism occurred at all three types of site locations in the course of regular activities it is a possibility.

As part of the settlement system in the Owyhee Uplands, the mesa top petroglyph sites are found at locations which could be used for hunting, but this does not imply that the petroglyphs were made as hunting magic. It would be expected that hunting magic would involve depiction of the animals to be hunted. The depictions might be of live animals, dead animals or the hunter. However in the Owyhee Uplands relatively few of the petroglyphs represent animals or humans. It is unlikely that petroglyphs were specifically related to hunting magic.

The interpretation of rock art, which says it can document important events, is based upon a panel of rock art telling a story. Where event documentation has been recorded, there are repeated symbols that individuals other than the artist could understand. In the Owyhee uplands there is little repetition of identical symbols in the petroglyphs.

In the Owyhee uplands, another interpretation that does not fly is astronomy. While people could have depicted heavenly occurrences in rock art, there are no examples from the region that have been linked to astronomy.

The interpretation that rock art was a form of doodling, designs made for no specific purpose, could apply to the Owyhee uplands. Petroglyph sites in the Owyhee uplands are part of the settlement system and petroglyph making is one activity at multi-activity sites. Since petroglyphs were not the one and only reason that people were at the sites where petroglyphs were made, petroglyphs could have been an activity that occupied extra time.

While Conkey (1980) suggests that areas of aggregation would have resulted in more social and ritual activities that could result in petroglyphs, an important aspect for areas of aggregation is the economic resources for sustaining the population. In the Owyhee uplands, an aggregated population might only be sustained long term by fishing on the Owyhee River. Riverside petroglyph sites could have been areas of aggregation. Only four of the eleven sites are currently known to be residential sites as well as locations with petroglyphs. This interpretation would not apply to petroglyph sites on the mesa top or at water tubs.

Rock art can also be interpreted as a component of a settlement system. This method of interpretation addresses site based questions. In the Owyhee uplands, approaching rock art as part of the settlement system was successful. Petroglyphs were one artifact feature type at sites with multiple feature types. From the multiple features at Owyhee upland petroglyph sites, three different site locations where identified and the activities occurring at each were found to be different.

In sum, petroglyph sites in the Owyhee uplands were not made as hunting magic, to document important events, or to record astronomical occurrences. There is a strong possibility that riverside petroglyph sites were aggregation sites. While shamanism can not be completely ruled out, if it is the interpretation of Owyhee upland petroglyphs, shamanism was occurring at multiple types of sites in the context of procuring multiple resources. Doodling, creating petroglyphs as a form of leisure activity, could be the reason for all of the petroglyphs at the sites, but this is hard to support.

The regional approach to rock art sites

The approach of this study was to examine the landscape and settlement system in which petroglyph sites occur. This approach has advantages over an art historical approach because it integrates the multiple activities which occur at rock art sites. An art historical approach to

petroglyphs or other rock art is substantially different in scope because it concentrates on the artistic or stylistic attributes of the rock art. Especially with rock art which is largely abstract in nature, examining the artistic or stylistic attributes cannot always explain the context in which rock art was made.

Instead of looking at petroglyphs as art, the integration of petroglyph research into the settlement system allows for examination of the activity of petroglyph making. The activity of petroglyph making is related to the other activities which are parts of a settlement system. Petroglyph making is one activity at multi-activity sites. It can occur in conjunction with lithic scatters, rock features, caves and water sources. The multiple activities which occur alongside petroglyphs provide important clues to understanding the activity of making petroglyphs.

The regional approach has the benefit of answering questions about site density in the area around rock art sites, rock art site size and resources near rock art sites. This information is important for determining if rock art sites support the aggregation hypothesis or any other interpretation of rock art. An aggregation site, for example, would be large, in an area with many resources and have many associated artifact feature types. In contrast a vision quest site would be small, away from areas with high site density, and not need to be in an area with resources. These questions also would allow a researcher to determine if rock art appears in a consistent context or if they are dealing with two or more contexts. A distinct advantage to the regional approach is that it can be used even without ethnographic documentation for a region, because it is dependent upon archaeology. The regional approach to rock art sites can provide evidence which determines the interpretation of the rock art on a regional scale using only archaeological data; it does not require subjective interpretation of rock art images.

Questions for future research

With additional analysis of the existing data on Owyhee upland petroglyph sites, two questions could be explored. The first is how different are the petroglyphs at different sites? This could be approached by examining the diversity of designs at the sites. Another question is where a concentration of designs occurs within petroglyph sites. This could be examined in a three dimensional space using the location of panels and the counts of petroglyphs for each.

While these could be approached using existing data, many of the questions raised by this research project would require additional work in the field.

Were the petroglyphs made as a form of doodling? The mesa top sites offer some protection from the heat of the afternoon sun. Is there a concentration of designs in locations where the maker would be shaded in the afternoon?

Were riverside petroglyph sites also habitation locations as is suggested by four of the eleven known sites? Return visits to all of these sites could be made with this question in mind. It is possible that habitation occurred on a flat open part of the terrace, slightly away from the petroglyphs. If habitation sites are found, excavations could determine the periods of occupation and whether or not these were fishing locations . Fish bones could provide an indication of the seasons of use and the age of the sites. A preliminary search for habitation sites would need to include shovel test pits, because terraces along the river have been subject to soil accumulation and loss. If riverside petroglyph sites turn out to be large habitation sites, they would likely be associated with aggregation, while smaller habitation sites might be temporary camps.

Mesa sites might reveal more about their age and the food source of the inhabitants by careful investigation of possible sheltered dwelling sites. Some sheltered areas at the base of the rim rock have deep soils which may have accumulated over time, so there is the possibility of finding hearth features with remains of burnt food. Excavation of these areas could provide better dates as well as verify their use by small groups of people gathering and hunting but returning to the same location multiple times.

Near some of the petroglyph sites, there are low mounds of dirt with more vigorous vegetation growing on them. Shovel test pits might identify these areas as middens. Excavation of these middens might provide access to artifacts which could be dated.

Two other avenues to dating these sites remain open. One would be to aggressively collect and date projectile points from the sites with petroglyphs. Another interesting avenue would be the initiation of intensive geological studies of the part of Jordan Craters directly below 35ML1045. An alternate approach to dating the lava flow would be to follow the drainage of Cow Creek before the lava flow. Any archaeological sites discovered along the old creek bed between the western edge of Jordan Craters and the Owyhee River would most likely date to before the lava flow changed the drainage patterns. Collection and dating of projectile points

from archaeological sites in what used to be the Cow Creek drainage might provide a date for the lava flow and also for site 35ML1045.

Not all archaeological sites with petroglyphs have been found or documented. Petroglyph sites should be found on the plateau and along the upper reaches of the Owyhee River and its tributaries. These sites will probably be within 1.5 kilometers of a perennial water source on basalt outcroppings. Another set of locations to examine would be the areas surrounding water holes on intermittent streams.

Investigation of additional river, mesa, and tub sites in the Owyhee Uplands could reinforce the observations and hypotheses put forward here. As the sites reported here were documented, the author became aware of additional sites for which time and resources were unavailable.

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