Scratching the Surface of Prehistory in Northwestern Wyoming: An Analysis of the Dynamics of Site Formation and Alteration in an Alpine Setting

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Cultural Physical Biological

Abstract:

To gain a better understanding of the interplay between hunter-gatherer ecology and landscape dynamics in the Rocky Mountains, this research analyzes cultural materials from a lithic scatter on a site in the Absaroka Mountain range, Northwestern Wyoming. Located at approximately 3100 meters in elevation, the site contains 2471 pieces of chipped stone and diagnostic artifacts from the Paleoindian through Late Prehistoric periods. A 100x100 meter grid surrounding a sag pond (depression filled with seasonal snowmelt and rainfall) is examined for patterns indicative of cultural and geomorphic processes. The focus of this study is on colluvial, alluvial and cryoturbation events. The objective being to determine the context of the lithic deposits; that is, do the deposits imply cultural deposition or geomorphic disturbance? This research aids in an interpretation of the site and in a broader sense, site dynamics relating to alteration of cultural remains. Following this analysis archaeologists and paleoecologists will have an improved understanding of the processes affecting archaeological sites located in alpine zones, allowing for more accurate interpretations of these sites.

Figure 1: The slope and basin landscape.

Background: The alpine site 48PA2874 is characterized by slope and basin landscape. The site is located at an altitude of 3100 meters and is subject to frost heave processes. Climatological data from the nearest station, which is at a considerably lower elevation in the foothills at the western margin of the Big Horn Basin, (Western Regional Climate Center 1963-2005) has an average annual maximum temperature of 12.9°C and the annual minimum temperature of -4.3°C. These data further reveal that the surrounding area does average single-digit temperatures in the winter months. Precipitation on the site can also impact the archaeology and the soil profile. Climatological data from the nearest station has recorded annual precipitation rates averaging 35.7 cm and average annual snowfall rates of 164.6 cm (Western Regional Climate Center 1963-2005). There is a sag pond located within the site and a hectare overlapping this pond will be examined for evidence of physical processes causing sediment and artifact displacement.

Figure 4: John Rasmussen and Amanda Herron are sifting sediments from gopher holes in search for artifacts. Snow is still present on the upper slopes in June.

Hypotheses: The sloping nature of the site supports colluvial and water induced forces that may reorganize or redistribute artifacts across the surface. Since moisture concentration is greatest at the pond, the soil there has advanced more rapidly than elsewhere (Benedict 1970:33). This may lead to differential deposition and artifact exposure across the site. Artifacts may not have been deposited on the pond bottom during the course of human occupation at the site as the pond may have been full in the prehistoric past. The pond at present appears to fluctuate in moisture content quite often, thus it seems plausible that this moisture fluctuation occurred in the past. This might suggest periodic cultural deposition of artifacts on the pond surface. There is little doubt that artifact positions have been altered slightly since their original deposition. Is this disturbance significant enough to affect cultural reconstruction? If the artifacts show a pattern of "size sorting", then this would indicate geomorphic processes at work such as colluvial erosion. In this case more heavy and dense objects would move further downslope, thus the light ones would better reflect original deposition (Rick 1976:144). If a pattern fails to emerge, this does not mean geomorphic processes are not at work. Solifluction is characterized by an absence in pronounced sorting (Benedict 1970:52). Given the site does freeze in the wintertime, frost heaving processes may also affect soil and artifact deposition. An effort to understand the contributions of physical, biological, and cultural processes to the site's formation is a fundamental step in attempting to reconstruct some aspects of hunter-gatherer ecology. While this research only focuses on the physical processes affecting cultural materials, its direct conjunction with other sources such as (Herron 2006) that discuss both biological and cultural processes will aid in cultural reconstruction efforts.

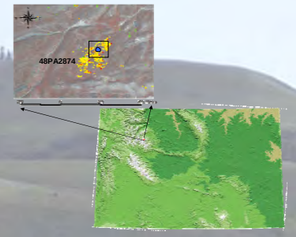

Figure 2: A map of Wyoming zeroing in on the Absaroka mountain range displaying site 48PA2874 and the hectare surrounding the pond, which is the focus of this study.

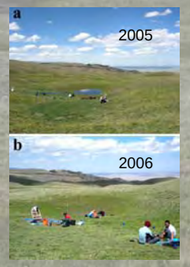

Figure 3: 2 photos of the site area (top 2005, bottom 2006) illustrating rapid changes in pond size. Both photos taken at approximately the same time of year.

Methods: The focus of this research is on an area encompassing an ephemeral pond on site 48PA2874. The pond center coordinates were used to construct a sample area one hectare in size for this study. This hectare provides a manageable zone to investigate assemblage patterns. A lithic scatter on the surface of this site has been well documented, and the defined hectare region around the pond contains 54% of this scatter. The surrounding landscape slopes inward toward the pond. In this alpine setting it is possible that the artifacts on the surface have been affected by natural processes such as: colluvial forces, needle ice, fluvial forces, solifluction, retrograde movement, and frost creep. First the hectare data were filtered from the rest of the site data. Then the hectare was divided into 10x10 meter units. Within this remaining dataset the number of artifacts was counted and the minimum, maximum, and average MLEN (maximum length) for each 10X10 was calculated. These data were used to generate a contour map emphasizing locations of the largest mean maximum length. This provides a graphic to study patterning which does appear to occur on the site.

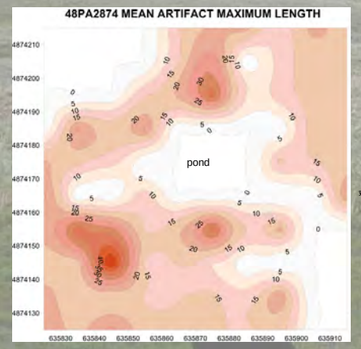

Figure 5: The overlapping hectare of the pond and surround slopes displaying mean artifact maximum length. Note the pattern of the largest means and the absence of any artifacts within the pond.

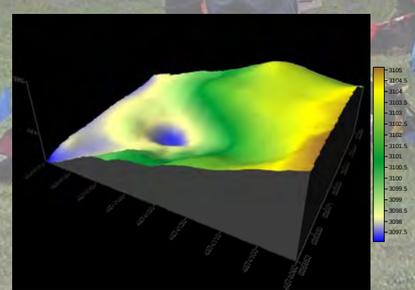

Figure 8: A 3-dimensional topographic image of the site illustrating the sloping landscape that surrounds the pond. Elevations (in MASL) are to the right of the image.

Figure 6: From Left, the u excavation unit displaying finer grains, the t excavation unit displaying larger clasts. The t-unit is upslope possibly indicating colluvial affects are negligible as larger clasts failed to move as far down slope as smaller sediment grains. As argued by Fanning and Holdaway (2001:681), smaller particles are more easily transported by overland flow and travel farther than larger particles.

Figure 7: As radiocarbon dates support accumulation of at least a meter of sediment on the slope toward the pond over the last 3700 years, this archaic projectile point may have been deposited near the pond as a result of physical process such as overland flow. This projectile point was found in the U27 excavation unit.

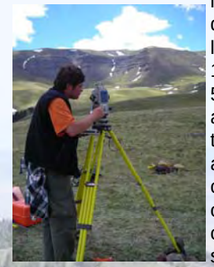

Figure 9: Careful site documentation enabled accurate measurements of both artifact/site provenience and topography.

Potential Problems: Using the mean as the primary statistical method for this study is problematic as it is affected by outliers and sample sizes. (If n=1, it could mislead the researcher into an assumption that the mean is representative of a larger population when going off of a graphic such as fig.3. If n=a large number, it could include lots of tiny debitage potentially causing the researcher to overlook possible larger artifacts within a large cluster of debitage as the mean would suggest very small dimensions).

Figure 10: One of the larger artifacts from the site, a unifacial scraper.

Interpretations: As the pond was full during the 2005 field season, no artifacts were recorded there. If colluvial processes are at work on the site, clusters of lithics would be expected to increase in mean size as there distances to the pond bottom decreases. A spatial examination of fig. 5 exemplifies that the largest mean clusters vary in distance from the pond (28m.-10m.). At 28 meters, the largest mean cluster (averaging 51.1mm) was recorded. Since these clusters are not all located at the ephemeral pond edge, the largest cluster mean being the farthest away, this may indicate that colluvial processes are minimal if even a factor and that the lithic scatters are more cultural in their representation. If fluvial processes were at work on the site, then clusters with smaller means would occur closer to the pond bottom. Fanning and Holdaway (2001:681) state that smaller particles are more easily entrained by overland flow and travel farther than larger particles. One cluster with small mean artifact size occurs at a distance of 26.9 meters away from the pond (n=93, mean=11.93mm.). This distance suggests that fluvial forces are minimal as well. It is possible that solifluction processes have occurred on the site, which would result in an unsorted sediment/artifact accumulation downslope, however both large and small clusters are widespread and there does not appear to be any accumulation downslope. Fig.3 depicts the first interval surrounding the pond with very small mean artifact dimensions, but the debitage to large flake ratio is always very large due to tool manufacture and resharpening events, thus it is likely there are more pieces of debitage widespread across the surface. The largest mean artifact dimension clusters have a sample size of n=1-2 artifacts, so they are not really clusters but rather single artifacts that cause the mean magnitude to be so large. Frost heaving would force larger artifacts toward the surface, however detailed excavation would be necessary to provide adequate support of size sorting by elevation (Byers 2002:437). While this research is only intended to be preliminary and these data are restricted in their explanatory power, initial investigation has revealed no conclusive evidence of geomorphic processes altering lithics on a grand scale. It is plausible to assume under these circumstances that the assemblage patterns on the site do retain some cultural patterning.

Future Directions: As the crime scene becomes more cluttered with other fingerprints such as that of faunal and geomorphic processes, more detailed investigation and data collection is necessary in order to tease out the different processes affecting site formation. Eolian processes can abrade the surface of artifacts causing the development of a patina (Rick et al. 2006:575). Documentation of this attribute might suggest eolian erosion. Vegetation coverage greatly affects the success of hillwash erosion, documentation should focus on detailed studies of the floral specimens on the site and their percentage of ground cover. Fire modification on lithics and lichen measurements can enhance our understanding of climatic shifts indicating perennial snowpack and drought. Byers (2002:428) noted that long axes of skeletal elements tend to align themselves either parallel with or perpendicular to the direction of force when subjected to fluvial action of sufficient intensity. It is plausible to assume lithics will behave in the same way, thus documentation of artifact alignment in relation to the slope would be crucial to analyses of this kind. Weather data from the site location itself would provide a more accurate picture of annual climatic conditions. Soil profile and soil moisture descriptions would aid in the study of frost heave, solifluction, and frost creep as these processes are dependent on moisture content and they affect different soil compositions differently (Benedict 1970). Northern Pocket Gophers (*Thomomys talpoides)* burrow tunnels and distribute sediment/artifacts on a larger scale than other modes of sedimentation. More documentation of their impacts to the site's soil profile, their burrowing locations within and around the site, and the artifacts that they resurface will yield better understanding of their fingerprint on the record. It is only with a careful research program catered to understanding these processes that we can begin to understand how hunter-gatherers lived on this landscape long ago.

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