IS THERE A LONG-TERM RECORD IN THE STINKING SPRINGS ROCKSHELTER, JACKSON HOLE, WYOMING?

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28 April 2006

PROBLEM STATEMENT

Over the past two decades the value of organic remains has increased tremendously based upon new and emerging laboratory techniques and recovery methods. For example, McFadden and Cerling (1996) used stable carbon isotopes of mammalian herbivores to supplement studies of functional morphology in the interpretation of diet and trophic level. The results revealed a major global change in climate and vegetation during the late Miocene that was not observed in other data sets. Organic remains, such as basketry, preserved under unique circumstances also allow us to fill in gaps in the human material record that is usually not available in most sites of prehistoric age (e.g., Adovasio and Andrews 1983). Detailed studies at rockshelters in the Bighorn Mountains of Wyoming have produced high resolution information on Late Holocene climate change (Finely 2001). To the northeast of Teton County, Mummy Cave provided one of the first long-term record of human settlement in the mountains (Husted and Edgar 2002), as well as detailed record of sheep hunting (Hughes 1988; 2001). However, only a small population of prehistoric sites produces such remains.

The paucity of vertebrate remains from Quaternary deposits is of particular interest to scientists studying issues of post-glacial biotic community structure and Native American economies in the region. However, despite intense work on the precontact archeological record in Jackson Hole, and northwest Wyoming (e.g., Wright 1984; Connor 1998; Cannon et al. 2001), the recovery of organic remains (e.g., botanical and faunal remains) has been elusive. Preservation and site location are probably key factors. Soils in northwestern Wyoming tend to be shallow, acidic, and subject to bioturbation thereby accelerating chemical and mechanical destruction of organic remains (Cannon et al. 1997). Sites with particular geologic settings, such as caves and rockshelters, provide research opportunities for extracting organic remains that provide direct evidence of paleoenvironmental conditions and subsistence patterns that are not typically preserved in open mountain sites.

With few open site exceptions (e.g. Goetz site [Cannon and Cannon 2003]), other site types that have proved important in producing organic remains are dry cave and rockshelter sites. These types of sites have produced long-term records of human occupation, but more importantly, provide evidence of perishable materials that allow a more complete understanding of the biotic resources available to native groups and how they were incorporated into their economies. These types of sites also provide unique research opportunities for understanding long-term patterns of environmental and cultural change that are usually not available from open sites. Therefore, I am proposing to limited investigations at the Stinking Springs Rockshelter in August 2006 to assess the potential of the site to yield stratigraphic deposits. Professional archeologists have not investigated the rockshelter, but evidence in the form of charcoal smudges on the ceiling and flaking debris suggest it could have buried components. Other evidence to support its potential is its relative large size, protective overhang and shelter, and its location adjacent to the Hoback River. The floor of the rockshelter has been buried under road deposits by the original, but long abandoned, road that traversed the Hoback Canyon. This historic circumstance has probably protected the record from destruction by unauthorized excavation.

RELEVANCE OF THE STINKINGWATER ROCKSHELTER

Northwestern Wyoming is not known for the preservation of organic materials, nor for the presence of caves and rockshelters. This may be due to the friability of the volcanic substrates. This is in sharp contrast to areas such as the Bighorn Mountains to the east where over 150 rockshelters have been documented (Finley 2001) and the Snake River Plain to the west (Plew 2000). As such, the presence of caves and rockshelters in the region is significant for their potential. While it is far from certain that the Stinkingwater Rockshelter will provide significant deposits, its characteristics, location, and the wide-range of research topics that can potentially be addressed suggest that preliminary investigation is warranted.

1) The rockshelter is fairly large in size.
2) Surface evidence suggests the shelter has archeological deposits.
3) Caves and rockshelters in the region are rare, but the few that have been excavated provide a wealth of information in the form of stratified, organic remains that are typically not present in open sites.
4) The location of the shelter along a natural bottleneck at the entrance to Hoback Canyon is, and probably has been for millennia, a migration route for ungulates between summer and winter ranges. Geographic bottlenecks can be key areas to ambush and hunt migrating ungulates, as demonstrated by research at the Trappers Point site in the Upper Green River (Miller et al. 1999).
5) The rockshelter is within a kilometer of several life-zones or biotic communities that may have been sampled by human hunters or other predators (e.g., raptors) increasing its relevance to addressing questions concerning the evolution of community structure in post-glacial Jackson Hole
6) The site potentially provides an important contrast to Lamar Cave (Hadly 1990) in northern Yellowstone National Park which was under different climatic regimes at different times in the Holocene according to Whitlock and Bartlein (1993). This site provides an important test of their model which is based upon vegetation records.
7) As the FAUNMAP Working Group (1996) has demonstrated, animal communities are of relatively recent age due to individual tolerances of the species. The vertebrate record of Jackson Hole is poorly known (Cannon et al. 2000). This is notable considering all that is known concerning glacial history (Good and Pierce 1996), climate, and vegetation (Whitock 1993)

METHODS

Our goals for the 2007 field work are modest and involve the initial assessment of the rockshelter for buried deposits. To accomplish this task we will employ geophysical survey and soil auger probing.

We will be applying two geophysical survey technologies (magnetometer and ground penetrating radar) to detect the presence of buried cultural deposits and more efficiently direct our subsurface investigations. Geophysics has many applications and uses many different technologies that range from measuring the earth's magnetic field to measuring the resistance of buried deposits to an electric current. One instrument we will use is the Fluxgate gradiometer. The Fluxgate is an instrument that measures deviations in the earth's magnetic field. These data can then be plotted to produce an image of magnetic anomalies found beneath the surface. These anomalies have positive and negative values that are compared to known values of archeological significance, such as fired rock (hearth) features and other ground disturbances (e.g., voids between rockfall).

The magnetometer that will be employed is a Geoscan FM36 fluxgate gradiometer (Clark 1996:69, 77-91). The use of magnetometers in archeological contexts or other cultural resource applications requires measurements be made at rather close intervals (0.1m to 1.0 m) and preferably on a regularly spaced grid. The FM36 magnetometer has two magnetic field sensors mounted about 50 cm (1.5 ft) apart in a vertical tube. It detects differences in the strength of the magnetic field at the height of each of the two sensors. This instrument can take and store as many as eight measurements of magnetic field strength in a second. If it is carried at a steady pace along a grid line, the result is eight evenly spaced measurements across each meter (3.3 ft) of the site. At Cove Creek (10LH144), a precontact site on the Salmon River in Idaho, the gradiometer was set to record variations of 0.1 nT (nanotesla) in the magnetic field. It was operated at eight measurements per meter along lines in the grid that were spaced one half meter apart. A similar strategy was applied at the open precontact Goetz site (48TE455) in Jackson Hole, Wyoming. MWAC archeologists have applied the use of gradiometers at numerous precontact and historic Euroamerican sites in North America over the past three decades. The data from the fluxgate magnetometer survey will be mapped with Geoplot software. Magnetometers are quite sensitive to the anomalous magnetic fields that surround iron and steel objects and to alternating-current power lines, but in many cases magnetometers can also detect the much weaker changes in magnetic fields associated with subtle cultural modification of natural soils. In some cases the magnetometer's sensitivity to iron can be used to advantage (mapping historic building sites), but when the main target is a subtle soil feature such as a man-made pit or grave, the presence of iron can be a serious source of “noise” that limits the instrument’s effectiveness.

Ground-penetrating radar (GPR) is the most recent instrument to achieve popularity in archeological applications. Although Bevan pioneered the archeological use of GPR a quarter-century ago (Bevan 1977, Bevan and Kenyon 1975) the cost of equipment and problems dealing with the massive amount of data produced by GPR surveys limited the number of archeological applications. Reductions in the cost of equipment and improvements in the software available for processing the voluminous data have helped to make GPR surveys more affordable and analysis more efficient. Most GPR units transmit a short pulse of radio-frequency energy into the ground that detect the strength of the reflections during a series of short time intervals (Conyers and Goodman 1997). In a uniform soil there would be little energy reflected (except at the air / soil interface) and the bulk of the energy would be absorbed within a short distance. Objects included in the soil or strata with contrasting electrical properties may result in reflection of enough energy to produce a signal that can be detected back at the antenna. The amount of time between transmission of the pulse and the receipt of a reflection provides a measure of the depth of the reflecting source.

A Noggin Plus GPR unit produced by Sensors and Software will be employed. The unit operates an antenna at a nominal frequency of 250 MHz (megahertz) and was mounted in a cart that records the location of the radar unit along a grid line. The cart also contains a data-logger with a display that allows the results to be viewed almost immediately after they are recorded. The GPR data will be processed by Ekko-mapper which allows both profile (cross-sections) and plan-view presentation of the data. GPR surveys often involve a trade-off between depth of detection and detail. Lower frequency antennae permit detection of features at greater depth but they cannot resolve objects or strata that are as small as those detectable by higher frequency antennae. Actual maximum depth of detection also depends upon the electrical properties of the soil. If one has an open excavation one can place a steel rod in the wall of the excavation at a known depth and use the observed radar reflection to calibrate the radar charts. When it is not possible to place a target at a known depth, one can use values from comparable soils and achieve reasonable estimates of the velocity of the radar signal in the site's soil. At the Cove Creek site in sandy loam soils, the 250 MHz Noggin generally resulted in detection to a depth of about two meters (6.5 ft) based on a velocity of 0.1 meters / nanosecond.

Based upon the information obtained from these instruments, we will conduct a series of auger probes. Soil samples from the augering will provide more detailed information on site stratigraphy and depth of deposits.

The rockshelter will be mapped using a SOKKIA Total Station and an SDR33 electronic field book. An arbitrary coordinate system will laid out in meters and oriented on magnetic north. A primary datum will be established with a metal surveyors cap in concrete and recorded using a Global Positioning System unit.

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