Sediments in a Slump: Depositional Dynamics in and Around Alpine Sag Ponds

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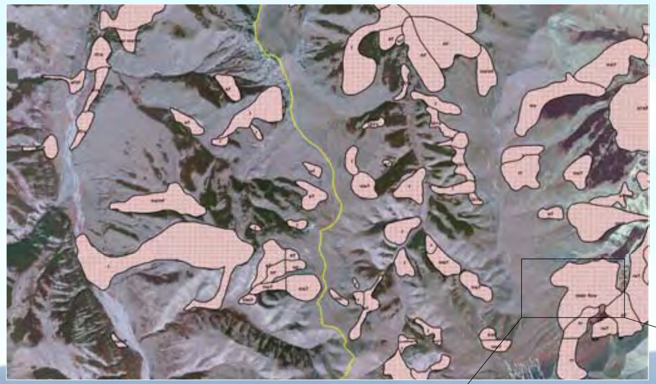
64th Annual Plains Conference
Topeka, Kansas



Introduction:

The Eocene volcanic that form the Absaroka Mountains in northwestern Wyoming present a dynamic substrate upon which the archaeological record has been deposited. One of the more dramatic components of this landscape is the prevalence of mass wasting events (slumps, landslides, flows, etc.) that form and reform the landscape. Site 48PA2874 is located on one of these massively altered surfaces. The site is adjacent to a sag pond formed by a Pleistocene mass wasting event known as a slump. A slump is the downward and outward sliding of a mass material, with some backward rotation of the land surface at the top of the slide, which is where undrained depressions, swamps, and small ponds may collect. This can be caused by earthquake shocks (which are common in the tectonically active Absarokas), freezing and thawing, and thorough wetting (Easterbrook 1993: 75-76). Many such events occur relatively often in this area because of the geologic instability associated with the greater Yellowstone area. We know human occupation began after this event since the surface assemblage contains several Paleoindian points, which makes sense because the slump made the landscape attractive to people that lived in the area. We can infer that the slump occurred probably during the late Pleistocene and that occupation began sometime during the early Holocene (Paleoindian) and continued until late Holocene (Late Prehistoric). Radiocarbon dates from the excavation units show that the slump occurred well before 3500 years B.P. and sediment analysis gives us good evidence for the slump model as the formational process of the landscape.

Abstract:

One of primary landscape altering features of northwestern Wyoming's Absaroka mountains are numerous mass wasting events representing many temporal and spatial scales. During the 2005 and 2006 field seasons, research at a high elevation (3100m) archaeological site (48PA2874) on one such feature has investigated human landuse patterns relating to features of the terrain created by a late Pleistocene or early Holocene landscape altering event. The slump produced a hummocky surface with several depressions that allowed for ponds and steams to develop as snow melted and rains came in the summer months. These ponds became a focus of human use, from late Paleoindian through the Late Prehistoric periods. There would have been good sources of food and water, and even some shelter with the hilly landscape of the slump. Examination of the sediments in two 1x2 m test excavation units provides satisfactory evidence for the slump model. The profile of the excavations exhibit difference in soil types as you move from the top to the bottom of the units, and even more differences when you compare one unit to the other. For example, when we look at the unit outside a sag pond we can see the large rocks and the lighter brown colored soil originating from the original mass wasting event. The unit on the side of the sag pond, which often contains year-round water, but in summer 2006, dried up completely, had darker soil with a depth of at least 1.5 m, and much lower artifact frequency. These alpine sag ponds as effective sediment traps provide a unique opportunity for incorporating cultural materials into an otherwise shallow, high elevation archaeological record.

Methods:

Two 1 x 2 m test excavations were begun at site 48PA2874 in 2006. These were labeled U27, which was at the edge of a dried up sag pond, and T26, which was higher up slope from the sag pond. These spots were chosen to better understand depositional processes that occur at the site, and to get a range of soil profiles and samples that reflect human occupation as well as the formation of the site as we see it today. As the excavation began, the sediments were removed in 50 x 50 cm quadrants going down 5 cm in each level. Sediment was screened through 1/8" dry screen. It soon became apparent that the U27 unit was much easier to dig than the T26 unit and, to get down as far as time allowed, we proceeded to excavate 1 x 1 square meters, going down 5 cm in each level. The T26 unit went much slower, due to the large clasts deposited as a result of the original slump event, and we did not get down as far as it was much more cluttered with large rocks. Sediments were screened for artifacts and when possible artifacts were mapped in place. A total of eight soil samples were taken from the units each at different levels. Sediment analysis was done on each of the eight samples to get a percent sand, silt, and clay with the help of the Soil and Crop Science department of Colorado State University. A profile of each unit was also assessed and recorded as to determine the depositional processes of sediment within the area. Once the excavations were complete the test pits were photographed and filled back in.

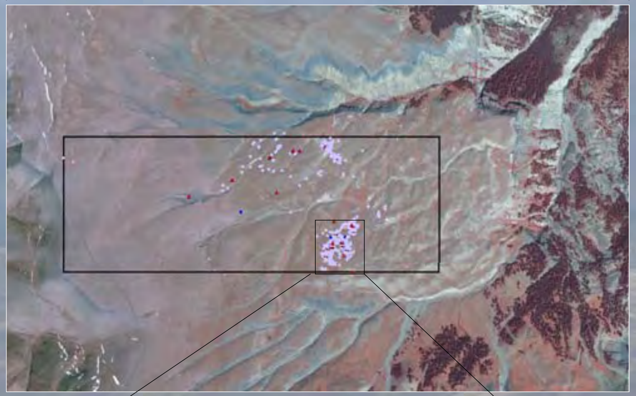
Results:

Just by looking at the excavation units we can come up with evidence for the slump model. You'll notice that in the U27 unit (figure 1) the soil is darker and there are no large rocks, the side walls are smooth and uniform, while the T26 unit (figure 2) is full of rocks and cluttered, with lighter colored soil in the corner. Sediment analysis shows that the U27 unit has relatively higher percentage of sand and clay than the T26 unit does, with about 47% sand, 34% silt and 19% clay. This reflects the movement of sediments down a slope and settling in the sag pond. The T26 shows a more even distribution of sand, silt, and clay with 35%, 33%, and 32% respectively. These data show that a lot of sediments are being moved down slope, leaving the larger rocks and more artifacts higher up on this particular site. The artifact frequency from the test excavations also reflects this model.

Wyoming Landslide Map Abbreviations:

Landslides
blsl block slide (rock or earth)
df derbis flow
f flow (earth or debris-laden earth)
mf multiple flow (earth or debris-laden earth)
ms multiple slump (bedrock, debris, or earth)
rf rock fall
rs rock slide
s slump
s/f slump/flow complex

Sediment and landform units
af alluvial fan
Qt Quaternary talus



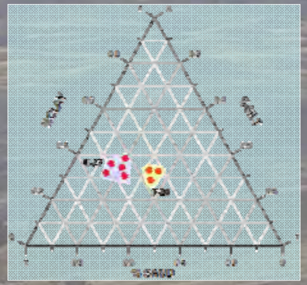
Landslide map and abbreviations can be found at:
http://www.wrds.uwyo.edu/wrds/wsgs/hazards/landslides/lshome.html

Importance of sediment analysis:

Sediment analysis can be used to reconstruct paleo-environments, and can help understand the processes that are involved in the formation and destruction of archeological sites. In this case, we use sediment analysis to see how and where artifacts get deposited in the slump. Sediments are the most abundant resource of any excavation, and they give us some kind of evidence of past environments and they allow us to reconstruct site developmental history and climatic-morphogenetic environments. It also helps us determine site-specific human activities and interpret human-land relationships (Hassan, 1978: 197)

Figure 1

Figure 2



Note:
Samples T26-7-13 and T26-7-14 are not pictured.

sample #	%clay	%silt	%sand	hydrometer
T26-6-28	31.52209	32.97323	35.50468	clay loam
T26-7-13	35.30909	32.46675	32.22415	clay loam
T26-7-14	34.04937	28.7617	37.18892	clay loam
U27-17-11	20.19513	34.04898	45.75589	loam
U27-17-12	15.29101	35.74574	48.96325	loam
U27-17-13	15.39423	31.67503	52.93075	sandy loam
U27-17-14	23.06503	30.43633	46.49863	loam
U27-17-10	19.50983	38.16964	42.32054	loam

References:

Eastbrook, Donald J.
1993 *Surface Processes and Landforms.* Macmillan Publishing Company, New York.

Hassan, Fekri, A.
1978 Sediments in Archaeology: Methods and Implications for Palaeoenvironmental and Cultural Analysis. *Journal of Field Archaeology V.* 5 No. 2: pp. 197-213

Acknowledgments:

I'd like to thank LCT, JMB and the entire 2006 field school, without whom none of this would have been possible. Also I would like to recognize the Soil and Crop Science Department of Colorado State University and Naomi Ollie, who graciously performed the sediment analysis after my many failed attempts with another method.