

United States  
Department of  
Agriculture

Forest  
Service

Gallatin NF

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REPLY TO: 2520

Date: December 3, 1986

SUBJECT: Archaeological Site Investigation

TO: S. Sollid, Co-Staff Officer, TAG

On August 19, 1986, Mike Ryan (Forest Archaeologist) and I visited an archeological site near West Yellowstone, Montana. Mike Ryan requested the following soil description, classification and interpretation of site history and surface stability.

The interpretations were based on soil descriptions and classifications, bedrock, soil, and landscape history, and Pleistocene and Holocene climatic history of the area. Conclusions are preliminary.

#### Site and Soil Characteristic

Geographic Setting The site lies within a mile of a major drainage divide. The overall landscape consists of rolling hills with stream cut valleys. The subject valley is approximately 1/10 mile wide, with obvious stream cut sides and a small "underfit" intermittent stream. Dry channels are common in the area. Uplands are composed of glacial till, probably of Bull Lake age (110,000 to 150,000 y.b.p.). The site itself is on the floor of the valley. Bedrock in the area is volcanic in origin and composed of rhyolite, welded tuff, and obsidian. Streams are generally intermittent in this area. Slopes range from 0 to 45 percent. The elevation is approximately 2100 m (7000 ft) m.s.l. Natural vegetation on the uplands is lodgepole pine forest, and in the valley, willows and other shrubs and grasses. More information is available in the Gallatin Forest Soil Survey (Map Units 66-1A, 54-1E, and 88-1A).

The site itself is located in a vertical bank of a recent, intermittent stream. This stream is excavating a medium to moderately fine textured overbank deposit in the floodplain, and has exposed several artifacts in the process. The artifacts are located on an apparent discontinuity in the sediments, approximately 35 cm above the base of the active stream channel, and 85 cm below the soil surface.

Location The soil profile classified below is located directly adjacent to the archaeological site in southwest Montana, Gallatin County, South of West Yellowstone, Montana. The pedon has formed in stream alluvium derived from rhyolite and welded tuff. Surrounding vegetation is grass and willow.

Classification Argic Pachic Cryoboroll, Fine-loamy, mixed

(Colors are for dry soil unless noted.)

- Ah (0-22 cm) dark brown (10YR 3/3) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; common silt films on peds; many, very fine roots; many very fine pores; slightly acid (pH 6.3); 3 percent coarse fragments; smooth clear boundary.
- AB (22-43 cm) dark brown (10YR 3/3) silt loam, very dark brown (10YR 2/2) moist; strong medium angular blocky structure; slightly hard, friable, slightly plastic, slightly sticky; common silt films on peds; few thin clay films on peds; common very fine roots; many very fine pores; 1 percent coarse fragments; medium acid (pH 5.7); smooth clear boundary.
- Bt1 (43-57 cm) dark brown (10YR 3/3) silt loam, very dark grayish brown (10YR 3/2) moist; moderate coarse angular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common silt films on peds; few thin clay films on peds; common very fine roots; many very fine pores; 2 percent coarse fragments; medium acid (pH 5.9); smooth clear boundary.
- Bt2 (57-70 cm) dark brown (10YR 3/3) silt loam, very dark grayish brown moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common silt films on peds; few medium and few fine roots; many very fine pores; 0.4 percent coarse fragments; medium acid (pH 5.8); smooth gradual boundary.
- Bw1 (70-83 cm) dark brown (10YR 4/3) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common silt films on peds; few medium and few fine roots; many very fine pores; 3 percent coarse fragments; medium acid (pH 6.0); very abrupt, wavy boundary.
- 2Bw2 (83-101 cm) yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few fine roots; 0.2 percent coarse fragments; medium acid (pH 6.0); smooth gradual boundary; few charcoal fragments near the top.
- 2Bw3 (101-119 cm) yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few fine roots; 0.6 percent coarse fragments; slightly acid (pH 6.2).

### Soil Laboratory Characteristics

Hor- izon	Depth (cm)	clay films	coarse fragments	soil texture	sand (%)	silt (%)	clay (%)	organic matter(%)	CEC (meq)
Ah	10-22	silt films	3.2%	silt loam	27	63	10	1/2 6	22
AB	22-43	few, thin	1.2%	silt loam	18	63	19	4.2	22
Bt1	43-57	few, thin	1.8	silt loam	19	60	21	3.1	24
Bt2	57-70	silt films	0.4	silt loam	20	59	21	2.5	23
Bw1	70-83	silt films	2.6	silt loam	31	51	18	1.5	25
2Bw2	183-101		0.2	loam	40	45	15	0.6	32
2Bw3	101-119		0.6	loam	51	35	14	0.5	30

Base Saturation (by sum of cations) is greater than 15% throughout. There is a large difference in color, films on peds, rock fragments, soil texture, and organic matter at the 83 cm depth. The 70-83 cm horizon also has a very abrupt, wavy boundary; other horizon boundaries are indistinct. There is some soil mixing at this level. This mixing is very distinct, and could be related to animal use or other surface disturbance.

#### **Other Site Characteristics**

There is a gravel bar located at right angles to the stream channel and approximately 10 meters to the south. This also has been partially exhumed by the intermittent stream. The gravels and sands are poorly sorted and are subangular to rounded. They have a crude horizontal stratification, and appear to be a flood bar deposit. Orientation of the gravels is consistent with the 70-83 cm horizon described above. This type of bar is common in braided, high energy stream environments at flood stage.

The material surrounding the bar (the 83 to 119 cm material described above) is sandy with very few coarse fragments. This is common in channels carrying water in low and intermediate stages.

The material above the 83 cm mark (see above) is unstratified, and is relatively consistent in particle size distribution. Soil development has probably obscured any stratification. Overall particle size distribution is consistent with slow water or overbank deposition during high water or flood events. The increase in clay with depth is due to development of an argilllic horizon (a soil formation process). This clay increase is consistent with the presence of clay films and increase in structure grade.

### **Pleistocene and Holocene History**

The subject landscape was probably covered by glacial till of Bull Lake age (110,000 to 150,000 YBP). The absence of Pinedale-like features in the area indicates more recent glaciation did not reach this area. Near glacial conditions existed in the area, however, as recently as 11,000 YBP (the end of the Pinedale glaciation). This is indicated by the large flat bottomed stream valley, which could have carried much more water in the past than is presently available. The regional climate was probably warmer and drier until about 5,000 YBP, when conditions became cool and moist. Current indications of minimal amounts of surface water at the site include; the intermittent nature of streams, high permeability of the bedrock, and the drainage divide located in close proximity to the site.

### **Interpretations**

Stability of the Present solum The profile developed at this site is the result of relatively stable conditions existing over a long period of time. The cool, moist environment allows for weak to moderate levels of soil formative processes. The dark A horizon could have formed in as little as 100 years, however the high base saturation, grade of structure, depth and thickness of the clay enriched Bt horizons suggest that 5,000 to 10,000 years could be needed for formation.

Stability of the buried surface The upper boundary of the 83-101 cm horizon was most likely a soil surface at one time. Evidence of this includes; a very abrupt change in soil properties at that depth, charcoal present near the boundary, mixing of the layer consistent with surface disturbance, and a boundary which is nearly level and is extensive in the area.

Age of buried surface The age of this surface is difficult to establish with the limited data available. However, some general interpretations can be made.

The surface is probably less than 11,000 years old (post Pinedale). The stream valley cuts into the older Bull Lake till surface, and this valley is consistent with large stream flows present in post glacial environments. The presence of flood bars also indicates the surface was possibly formed in a high energy, braided stream environment, consistent with hydraulics of melt water streams.

The minimum age is much harder to determine. Erosion and/or soil development could have obscured many events. None the less, there are at least three major events evident; (1) the original flood events that emplaced the gravel bar and channel deposits, (2) the flood or overbank deposits that covered the site with a relatively uniform layer of material, and (3) the erosion produced by the intermittent stream channel that exposed the site. The present soil is probably quite old, and may indicate a minimum age of 5,000 to 10,000 years. Holocene stream flow has probably been very low with most runoff occurring as deep groundwater due to the bedrock and soil characteristics. Paleoclimatic evidence also supports this.

More work is needed for conclusive verification. Additional soil descriptions and multiple auger holes would clarify the real extent of the deposits. Use of radiocarbon age dating or obsidian hydration is suggested for absolute age determinations if those options are available.

/s/ Henry F. Shovic

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cc: Shovic  
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