A description of the research project. If it is not obvious, state how the research is Quaternary-related (2 pages maximum [not including figures or reference list], single-spaced with a minimum of 11 pt font).

Introduction, Background, and Project Description:

This project is an in-depth geoarchaeological analysis of the Mead site (XBD-071), located in Interior Alaska. The objective of this study is to investigate correlations between occupations at the Mead site and climate change in Alaska through analysis of the site's sediments and soils. This study will attempt to discern if occupations at the Mead site correlate with regional and local climate amelioration or deterioration. This work will ultimately inform a greater understanding of paleo-climate/human interactions on the occupational landscape of interior Alaska

The Mead Site is one of three multi-component sites with Paleo-Indian occupations in the Tanana River Basin (Holmes 2001) (Fig. 1). Located on a 10 meter high bluff overlooking Shaw Creek, the site has four cultural zones that date from the Late Pleistocene to the Late Holocene (Fig. 2). The site has three paleosol complexes (Fig. 3), excellent faunal preservation, and multiple cultural features (Dilley 1998; Holmes and Yesner 1992; Potter, et al. 2010; Yesner, et al. 1992). This site is important in the prehistory of Alaska as it is one of a few deeply buried Paleo-Indian sites in the state and further investigation will contribute greatly to theories of timing and duration of the Peopling of the New World.

Dilley (1998) presented a study of the geoarchaeology and a general climate history of the Tanana River Basin, but did not investigate the site formation processes at the Mead site or the relation of the artifacts and faunal remains to their surrounding contexts. Intra-site spatial patterns are used in archaeological studies to designate activity areas at sites and are the basis for higher level theory regarding human behavior and site function (Schiffer 1972). As taphonomic processes such as rodent burrowing and freeze-thaw cycles can shift the location of artifacts after burial as well as distort the stratigraphy and natural features at a site, it is extremely important to separate the taphonomic post-depositional effects from the cultural processes that formed a site.

At the Mead site this is being carried out through analysis of the macrofossils, micromorphology, magnetic susceptibility and geochemical data of the sediments and soils in conjunction with spatial analysis of the cultural remains from the site. The geochemical and magnetic susceptibility analysis has been completed; macrofossil, micromorphology (thin section) and spatial analyses are ongoing. I am seeking assistance from the Hopkins Fellowship for the creation of soil thin sections which will be used for micromorphological analysis.

Micromorphology, the study of *in situ* soils and sediments at the microscopic scale, will reveal information about site formation processes and past climate at the Mead site not obtainable by routine archaeological practices. For example, past landscape surfaces can be reflected in the pedofeatures found in thin sections (French 2003). By examining the orientation of laminated clays, illuviation can be discerned. Illuviation of clay necessitates periods of wetness (when the clay becomes mobile) followed by periods of dryness (when the clay is deposited) which are indicative of seasonality/ climate variations (Schaetzl and Anderson 2005).

Micromorphological analysis will also aid in interpreting the geochemical and magnetic susceptibility data already collected and analyzed. For example, element quantities (%'s) of calcium carbonate were determined through geochemical analysis for each stratigraphic horizon at the site. What these percents do not show is the amount of calcium carbonate that is primary calcium carbonate and the amount of calcium carbonate that precipitated down into the soil horizon at a later date (secondary calcium carbonate). Through the micromorphological examination of the thickness and quantity of calcium carbonate coatings in a given horizon, secondary calcium carbonate can be distinguished from primary calcium carbonate.

Magnetic susceptibility can indicate areas of intense human activity (feature areas) within a site; especially hearth features (Ellwood, et al. 1996; Johnson, et al. 2009 ; Tite and Linington 1975). At the Mead site there are a series of thin, undulating paleosols located in the Lower Loess and associated with Cultural Zones 3 and 4 (Fig. 2). Micromorphological examination of these paleosols will help to determine if they formed through cultural activities, natural soil forming events, or a combination of the two.

The micromorphology of pedofeatures, microstructure, and microfacies of the sediments at the Mead site will aid in distinguishing pedogenic and diagenic features, interpreting the site formation processes, and can be used as a proxy for climatic events.

Methods:

Fieldwork for this project took place from May 18th 2009 to June 20th2009, when the site was excavated during the University of Alaska (UAF) Archaeological Field School (Fig. 4). Additional fieldwork was conducted in September when the applicant returned to the site to collect more samples and draw excavation unit soil profiles. The spatial location of all samples collected was recorded and all *in situ* soil samples were photographed in place for later spatial correlation and control. In addition to daily notes, detailed site wide data and observations were collected. A total of 52 1x1m^2 units were excavated during the field school, and from these geoarchaeological samples were collected from 11 profiles (Fig. 5). Additional analyses resulting from this excavation at the Mead site (not conducted by the applicant, but available for her use) are multiple new AMS radiocarbon dates, optically stimulated luminescence (OSL) dates, and faunal and lithic analysis. This information will be incorporated into the site wide spatial patterning analysis.

Geochemical soil analysis was completed by the applicant at the UAF Department of Geology and Geophysics Labs under the supervision of Dr. Ken Severin (Director- Advanced Instrumentation Laboratory (AIL)). Magnetic susceptibility analysis was completed by the applicant at the UAF Paleomagnetism Laboratory under the supervision of Dr. David Stone (Director). Macrofossil analysis is currently being conducted by the applicant at the AIL.

In situ soil samples were collected from 3 profiles for micromorphological analysis (Table 1). The outline of each block was scored in the loess and then carefully carved out (FIG. 6). Orientation and location were recorded for each sample and drying, impregnation, and curing was completed by the applicant over an 8 month period following Courty et al. (1989) and Murphy (1986).

Due to the swelling of clays and subsequent distortion of the microfabric that can occur when exposed to water, samples will be sent to Spectrum Petrography (a professional petrography lab in Washington) for sectioning, as all methods for sectioning at UAF involve exposure to water. Proper sectioning of soil samples requires a kerosene or paraffin lubricated system, which is not available at UAF. Samples will be prepared so that analysis under plain, polarized, reflective and transmitted light is possible. Micromorphological examination will be conducted by the applicant.

Project Significance:

The thin sections created for micromorphological analysis from the soils at the Mead Site are a permanent reference collection of the site's sediments and soils. These sections will eventually be housed with the rest of the Mead collection at the University of Alaska Museum of the North, and as they persist through time it will be possible for other researchers to re-examine these thin sections in the future. This is a rarity in the realm of archaeology, where most samples must be destroyed to be analyzed and whose *in situ* structure is lost once they are removed from the ground. Through time, if thin sections are collected from multiple sites in a region, comparisons of occupation and climate between sites will be achievable and allow the possibility of enhanced understanding of site formation processes on a regional as well as site specific scale.

At this time in Alaskan archaeology the majority of sites are surface lithic scatters with little or no depositional context. Because of the depth of the Mead site and its excellent preservation it is the ideal site on which to perform micromorphological and geoarchaeological analysis. The results of this study will be presented at the 2011 Alaska Anthropological Association annual meeting. This study is an integral part of the author's Masters thesis and upon completion the findings from this study will be submitted to a peer reviewed academic journal for publication.

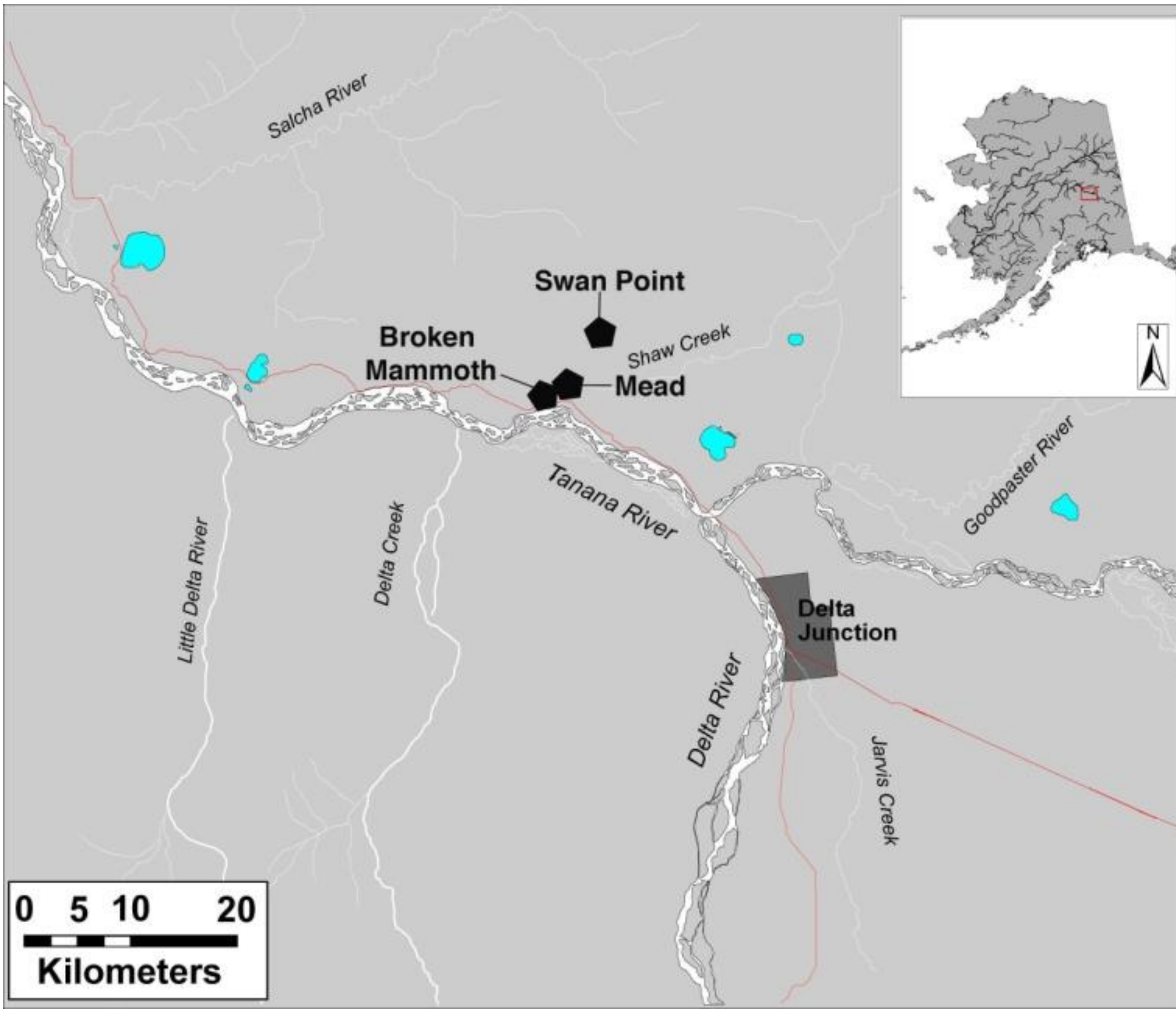


Figure 1- Regional overview of the middle Tanana River Basin and the multicomponent archaeological sites of Broken Mammoth, Mead, and Swan Point

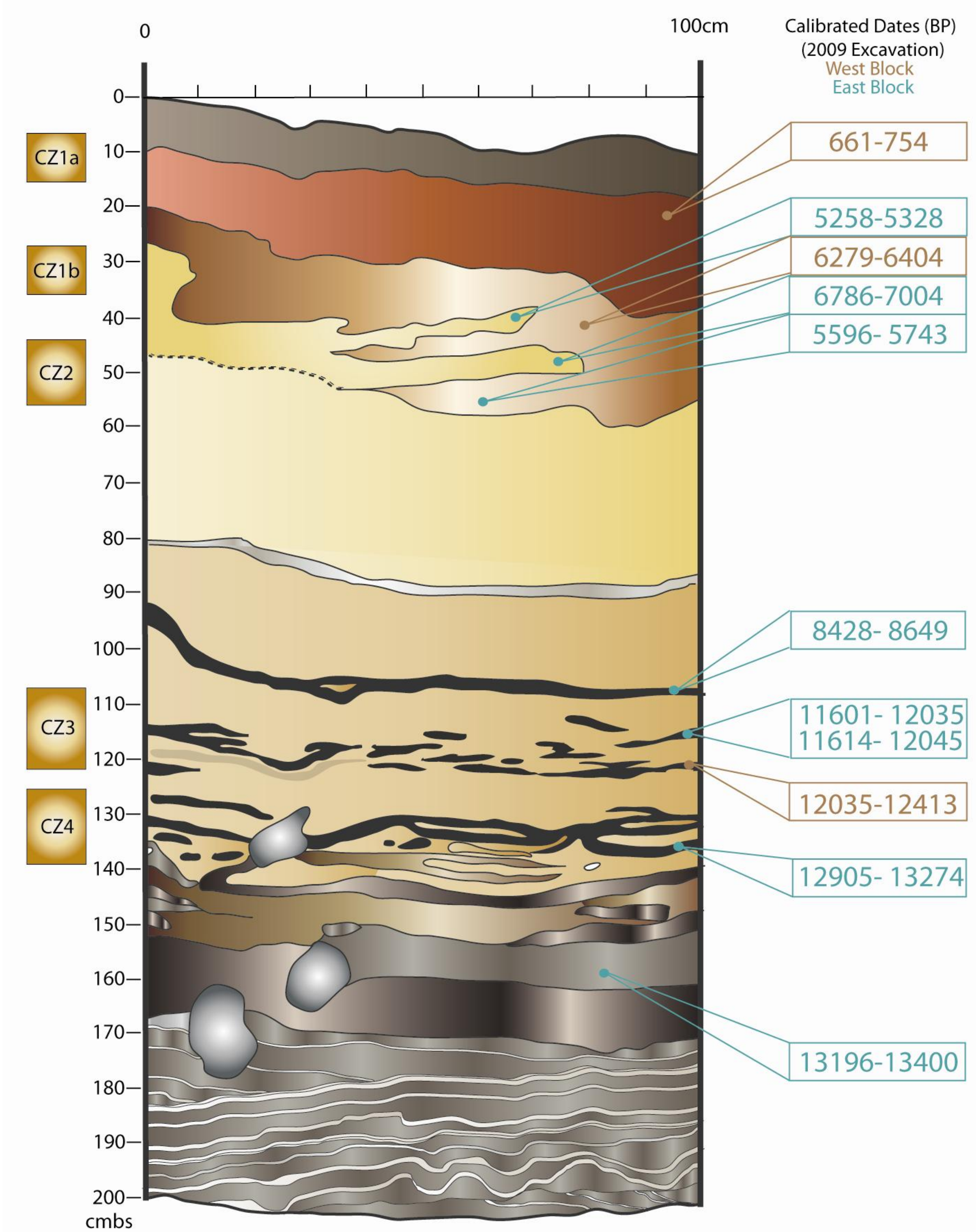


Figure 2- Mead Site cultural zones (CZ) and calibrated radiocarbon dates. Dates were calibrated using Calib version 9.0 to two standard deviations.

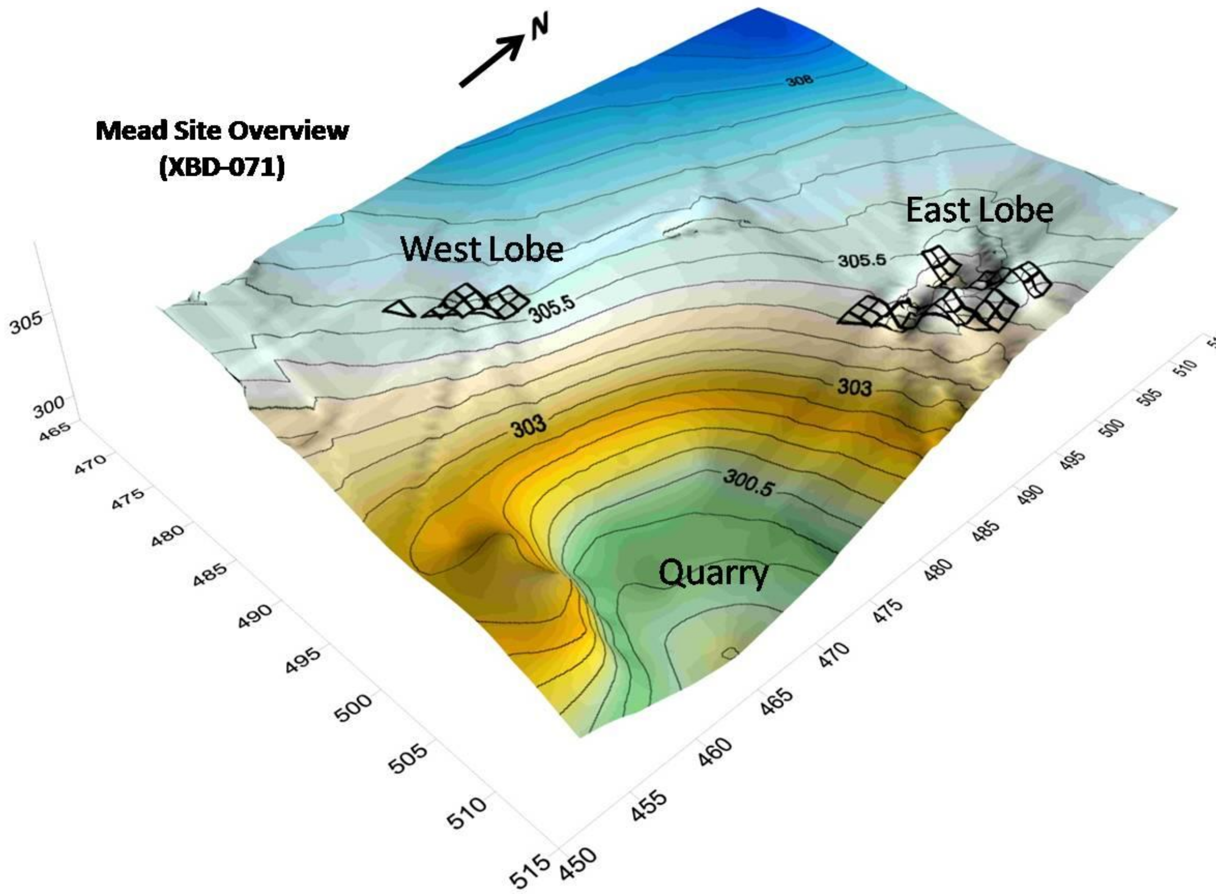
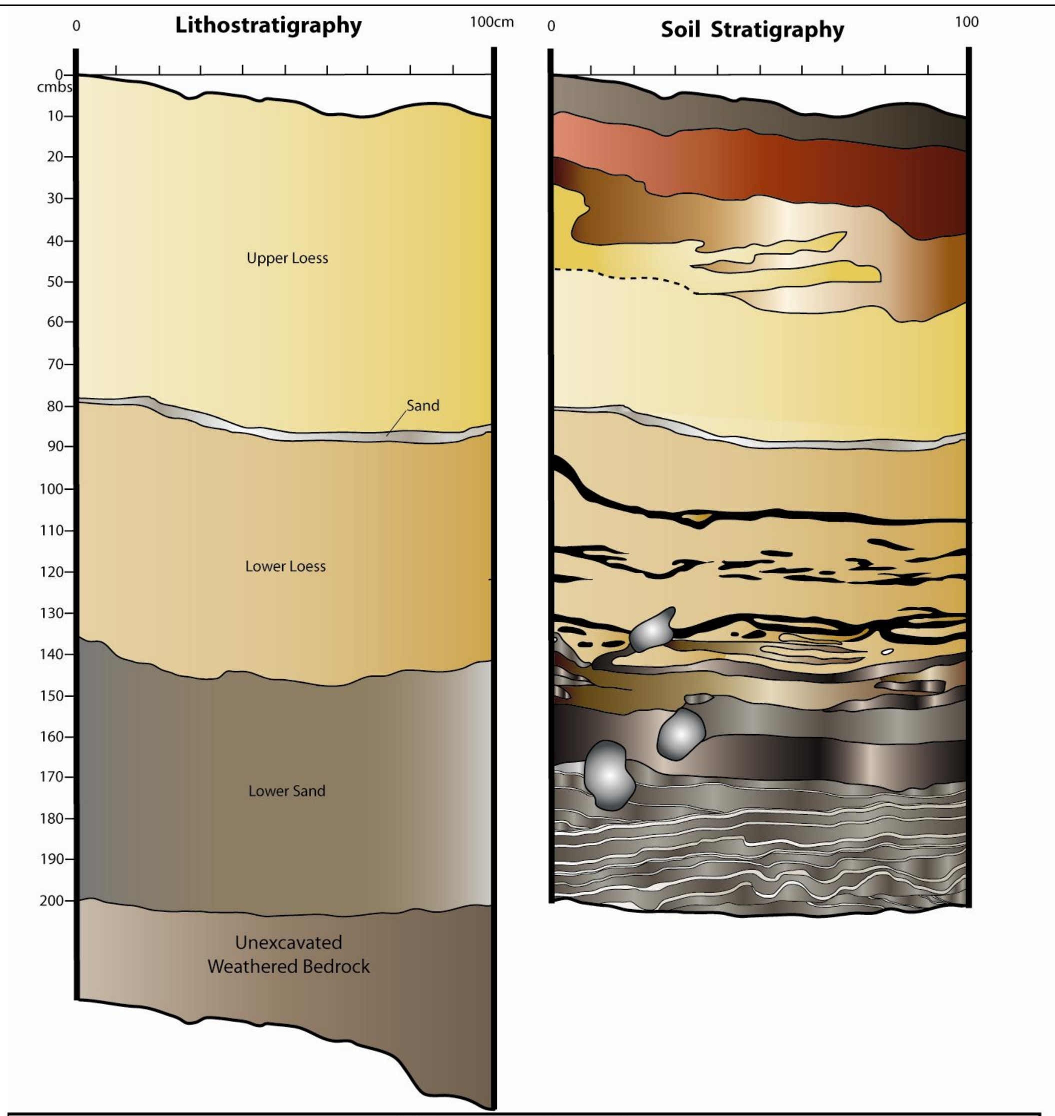


Figure 3- Overview of area excavated during the 2009 UAF Field School. Quarry was excavated during the 1950's and 1960's.



Lithostratigraphy

- **Upper Loess- silt to sandy silt, massive bedding with occasional sand lenses and a weakly expressed clay lamellae.**
- **Lower Loess- silt , massive bedding, contains the paleosol complexes, increaseing iron oxid mottles and carbonate feature with depth.**
- **Lower Sand- laminated and interbedded sand and silty sand, low angle horizontal bedding. Quartz ventifacts present at lower contact with bedrock.**
- **Weathered Bedrock- Birch Creek Schist, angular bedrock that grades upward into small pebbled mixed with sand.**

Soil Stratigraphy

- **O/A- Organic soil, 10YR 4/2 to 10YR 2/2 (brown to very dark brown) fine loam overlaying a 10YR 3/3 to 10YR 3/4 (dark brown) fine loamy silt mineral soil**
- **B1- 10YR 4/4 (dark yellowish brown) fine silt**
- **B2- 7.5 YR 4/4 (brown) fine silt**
- **C1- 10YR 4/6 (dark yellowish brown) silt**
- **C2a- 10YR 5/4 (yellowish brown) fine silt with rare iron oxide mottles**
- **C2b- 10YR 5/4 to 10YR 5/3 (yellowish brown to brown) silt with common mottles of iron oxide nodules and laminations of calcium carbonate, contains the paleosol complexes**
- **Transitional Zone, C2b and Lower Sands**
- **Fine Sand, 10YR 7/1 (Light Gray)**
- **Coarse Sand ,10 YR 6/1 (Gray)**
- **Very Coarse Sand, 10YR 5/1- 6/1 (Gray)**
- **Laminated Coarse and Fine Sands**
- **Paleosols**
- **Krotovinias**

Figure 4- Lithostratigraphy and soil stratigraphy at the Mead Site

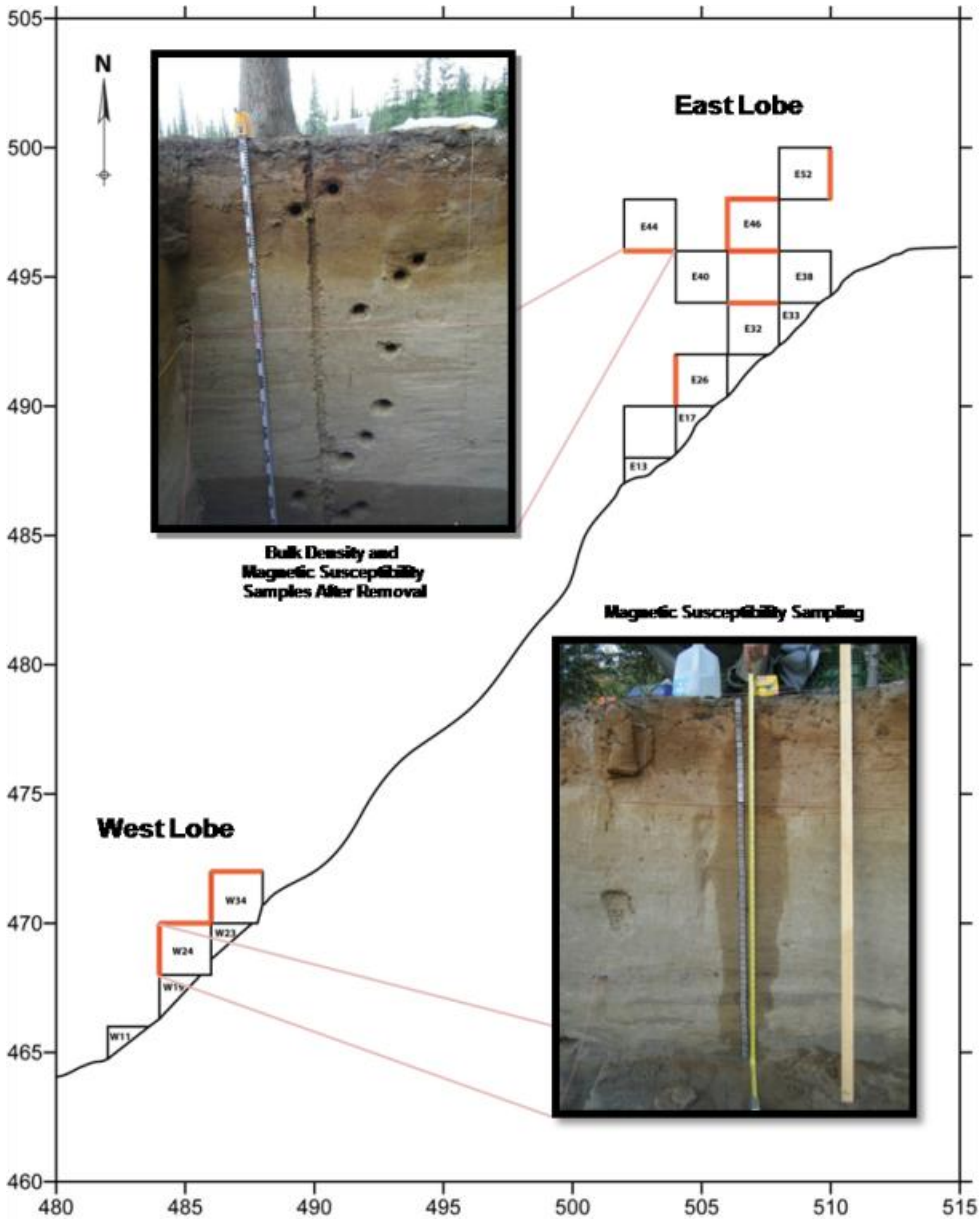


Figure 5- Profiles sampled for geoarchaeological analysis (highlighted in orange).

Micromorphological Sample Location Information							
Sample #	**Block**	**Profile**	**Northing**	**Easting**	**Thickness (cm)**	**Depth (cmbd)**	**Notes**
1	W-34	North	472	486.6-486.7	11	154-128.5	YD sand, several well developed PS
2	W-34	North	472	486.77-486.83	5	130-119	PS in upper east corner, C2b
3	W-34	North	472	486.88-486.95	6	122-110	Broke in half upon extraction
4	W-34	North	472	486.75-486.82	8-4	112-96	Contains PS stringers
5	W-34	North	472	486.32-486.39	7-5	98-83	C2b and C2a
6	W-34	North	472	486.17-486.25	5-8	25-68	C2a and sand lens in top
7	W-34	North	472	487.09-487.17	5-7	73-55	C2a, sand, contact with C1, red mottles
8	W-34	North	472	486.72-486.8	4-9	54-38	C1/B
9	W-34	North	472	487.72-487.8	8-10	32-26	B with C1 in middle
10	E-46	West	496.5-496.6	506	6-8	134-115	Contains PS stringers
11	E-52	North	500	509.42-509.44	4-5	54-47	Depth is from overburden, contains B3 lamellae

Table 1- Micromorphological sample information

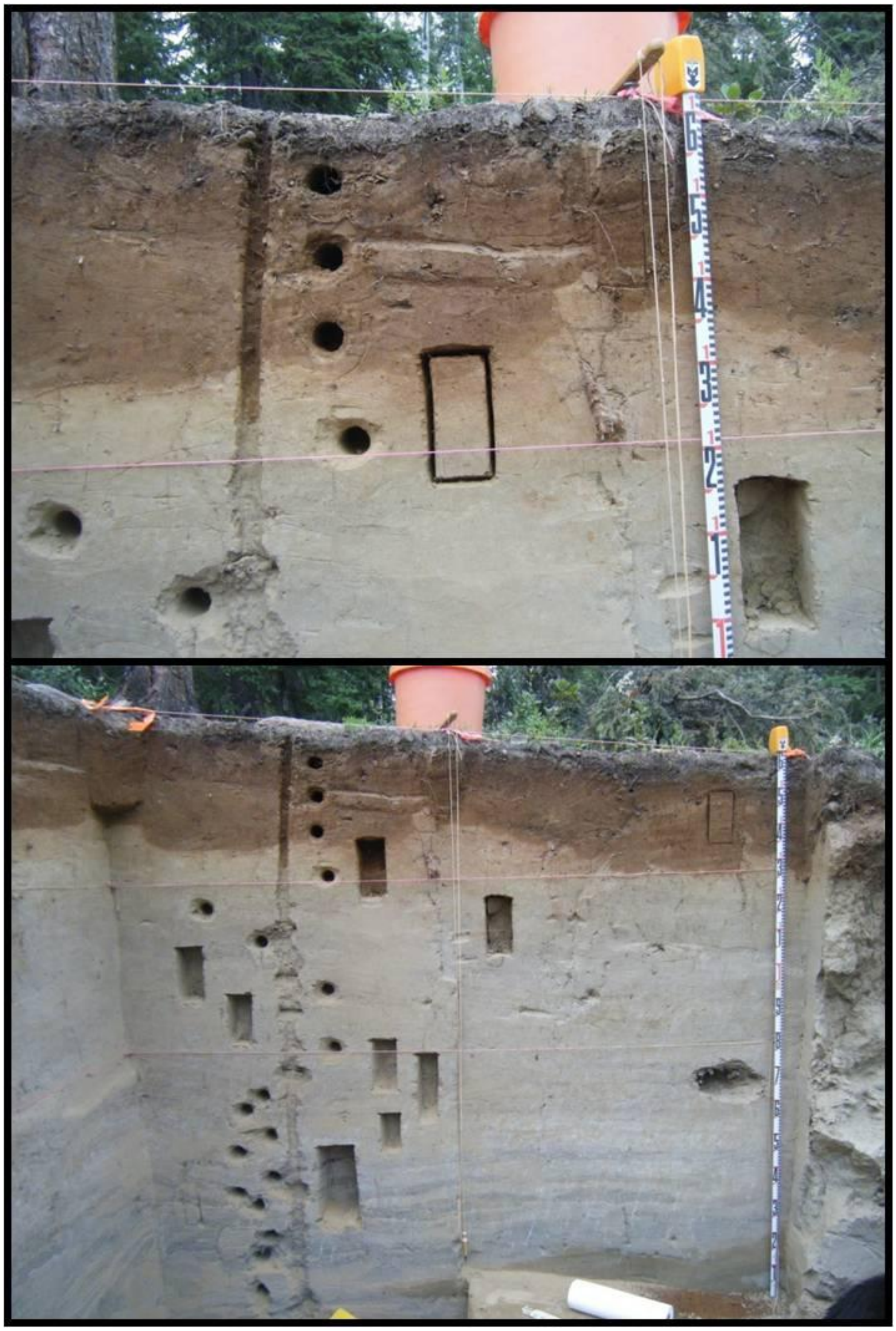


**Figure 6 (Top) - Rectangular block is a micromorphological sample before removal.
(Bottom) - W-34 north wall profile after micromorphological, geochemical and magnetic susceptibility samples were removed. Round holes are from geochemical sampling, vertical line is from magnetic susceptibility sampling, rectangular holes are from micromorphological sampling.**

References

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1972 Archaeological context and systemic context. *American Antiquity* 37(2):156-165.

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Permit- No permit is required for this study

Budget

Please include an itemized budget and budget justification being as detailed as possible (add or delete rows as needed):

Description	**Amount**	**Source of Funding**
Thin section preparation by Spectrum Petrographics, Inc.	$1,200	**AQC**
Shipping of sediment blocks to Spectrum Petrographics, Inc	$100	N/A
Misc. field supplies	$34.90	Geist Fund (2009)
Hardening agents for thin section creation	$213.62	Geist Fund (2009)
XRF (UAF Geosciences)	$300.00	Geist Fund (2009)
Wood sample ID	$150.00	Geist Fund (2009)
Paleomagnetic sample boxes (8cc)	$205.48	Geist Fund (2009)
Amount requested from AQC (max $1200)	$1,200	
TOTAL Project:	$2,104	

Budget Justification (use as much space as needed):

I am requesting $1,200 from the Hopkins Fellowship for the creation of thin sections. Total price is based on a cost of $37.50/sample for 32 samples at Spectrum Petrographics Inc., Vancouver WA. (price list obtained on 3/15/2010). This firm has been recommended to the applicant by Dr. Paul McCarthy (Professor of Geology at UAF) for their quality of service and price. As the collection and impregnation of the sediment blocks has already been completed, only cutting, mounting and polishing costs apply. Please see below for the detailed breakdown of cost for each sample. Microprobe polish is included as it allows for the possibility of future detailed geochemical analysis at a finer scale than that already conducted in this study.

All additional field supplies were provided by the UAF Department of Anthropology. The UAF 2009 Field school was funded through DENALI (the Alaska pipeline project). An additional $5,000 was provided by DENALI to the UAF Dept. of Anthropology for radiocarbon and OSL dating. The applicant received a standard UAF Teaching Assistant wage for Summer Sessions during the 2009 Field School.

Detail of Price per Sample

	Item	SPI Code	Unit Cost	# std slides	# 2x3 slides	TAT Factor	Extended US$	Last Price Update
Slide Format	std (27x46mm)	S	$15.00	1		1	$15.00	1/1/2007
	round (1")	R	$18.00			1	$0.00	1/1/2007
Slide Composition	glass	-	$0.00	1		1	$0.00	2/10/1992
	quartz	Q	$40.00			1	$0.00	1/1/2007
	Lexan	L	$10.00			1	$0.00	1/1/2007
Mounting Composition	Loctite Impruv 363	-	$0.00	1		1	$0.00	2/10/1992
	Epothin	P	$0.00			1	$0.00	1/1/2007
	Krazy Glue	K	$5.00			1	$0.00	1/1/2007
	Crystalbond 509	X	$10.00			1	$0.00	1/1/2007
Covering	uncovered	-	$0.00			1	$0.00	2/10/1992
	Loctite Impruv 363	I	$1.00	0		1	$0.00	2/10/1992
Finish	std	-	$0.00	0		1	$0.00	2/10/1992
	microprobe pol	M	$13.00	1		1	$13.00	2/10/1992
	2 sided microprobe polish	2	$26.00			1	$0.00	2/10/1992
Thickness	std	30	$0.00	1		1	$0.00	2/10/1992
	user specified THIN microns		$5.00			1	$0.00	2/10/1992
	user specified THICK microns		$2.00			1	$0.00	2/10/1992
Embedding Composition	EPOTEK 301	E	$0.00			1	$0.00	2/10/1992
	Spurr's resin	S	$7.00	0		1	$0.00	4/10/2008
	Epothin	P	$0.00			1	$0.00	1/1/2007
	3M Scotchcast #3	M	$0.00			1	$0.00	1/1/2007
Embedding Type	surface	S	$1.00			1	$0.00	2/10/1992
	vacuum	V	$3.00	0		1	$0.00	2/10/1992
Embedding Color	clear	C	$0.00	0		1	$0.00	2/10/1992
	blue	B	$0.50			1	$0.00	2/10/1992
	UV blue	U	$0.50			1	$0.00	2/10/1992
	UV yellow	Y	$0.50			1	$0.00	2/10/1992
	UV red	R	$0.50			1	$0.00	2/10/1992
Trim/Cut to Size	small (<1 kg)	S	$2.00	0		1	$0.00	9/1/2008
	lg (>1 kg)	L	$5.00	1		1	$5.00	2/10/1992
Stain	calcite	C	$2.00			1	$0.00	9/1/2008
	ferrous Iron	F	$2.00			1	$0.00	9/1/2008
	K-feldspar	K	$2.00			1	$0.00	9/1/2008
	plagioclase	P	$2.00			1	$0.00	9/1/2008

	Item	SPI Code	Unit Cost	# std slides	# 2x3 slides	TAT Factor	Extended US$	Last Price Update
Polish Composition								
	alumina	A	$0.00			1	$0.00	2/10/1992
Orientation Marks	number of marks	#	$0.50	1		1	$0.50	2/10/1992
Water Sensitive	Water Sensitive	W	$3.00	1		1	$3.00	2/10/1992
Heat Sensitive	Heat Sensitive	H	$3.00			1	$0.00	2/10/1992
Extra Hard/Brittle	Extra Hard/Brittle	X	$3.00			1	$0.00	2/10/1992
Petrography	Transmitted Light	Y	$100.00			1	$0.00	1/1/2007
	Reflected Light	Y	$25.00			1	$0.00	1/1/2007
	Multi-Lithologic Materials	Y	$25.00			1	$0.00	1/1/2007
	Photomicrography	Y	$25.00			1	$0.00	1/1/2007
	Extra Copies Printed Report	#	$25.00			1	$0.00	1/1/2007
	Photo CD	10	$20.00			1	$0.00	1/1/2007
Sample Numbers Engraved	Sample Numbers Engraved	Y	$1.00	1		1	$1.00	2/10/1992
Total							**$37.50**	

Price is $37.50 per slide. Based on actual sample dimensions of 20mm x 40mm per slide, 32 slides will need to be produced to create a continuous thin section profile from each of the 11 impregnated sediment blocks. Total Cost is $37.50 x 32= $1,200.