MIDDLE HOLOCENE ALLUVIAL HISTORY OF THE FRANK SLAVEN ROADHOUSE SITE (CHR-0030), YUKON-CHARLEY RIVERS NATIONAL PRESERVE, ALASKA

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Submitted to the National Park Service, Fairbanks, AK

June 2015

This is the final report for Cooperative Agreement #H8W07110001 between the National Park Service (NPS) and Central Washington University (CWU) titled *Geoarchaeological Context of the Mid-Holocene Human Occupation at the Frank Slaven Roadhouse Site, Yukon-Charley Rivers National Preserve, Alaska.* This describes the work at Slaven's Roadhouse (CHR-0030) between August 2014 and May 2015. Data generated by these efforts are used to interpret depositional environment and past environmental conditions at the site. We combine these with radiocarbon dates on all, and species identification of most, wood samples collected from the stratigraphic profile to provide an assessment of the landscape context of the previously discovered middle Holocene archaeological component at the site.

The summer 2014 field work at Slaven's included CWU staff Steve Hackenberger, Ian Buvit, Sydney Hanson, and Eric Wakeland, as well as NPS archaeologist Jillian Richie. Also, Tommy Urban and two other geophysicists carried out activities at Slaven concurrently with, but independent of, the CWU team. Laboratory work was carried out by Buvit in Ellensburg, WA and Richie in Fairbanks, AK.

Slaven's Roadhouse is located in an area, the Yukon-Charley Rivers National Preserve, with very few publications dealing with its late Quaternary geology, and especially, its archaeology (Figure 1). We know that humans inhabited the Yukon-Charley Rivers corridor at least during the Holocene (Griffin and Chesmore 1988:108-114; Reynolds and Jordan 1983:41-50). We also know that, except for some alpine ice in higher elevations of the preserve (e.g., the headwaters of the Charley River), the area was unglaciated during the Pleistocene (Weber 1986; Froese et al. 2003), and the potential exists for older archaeology. Previous investigations in 2008 at Slaven's produced a lanceolate projectile point in a dated context (Buvit and Rasic 2011).

Another broad research topic that work at Slaven's addresses is to understand the sequence of alluvial terraces along this stretch of the Yukon River. Using aerial photography, Thorson (1982) identified at least two distinct series of terraces associated with the Yukon River and its tributaries, respectively. Based on his study, Slaven's is located on the second Yukon River terrace that he presumed dated to more than 13,000 BP, and work there since 2008 builds on Thorson's (1982) geomorphic mapping to build a better predictive model for for archaeological resources along this stretch of the river.

METHODS

Field. Fieldwork occurred between August 1 and August 10, 2014 to understand the sedimentology of the Slaven terrace through auguring and stratigraphic profiling. Another goal was to collect samples for soil analysis and radiocarbon dating. One of the driving questions is how much, and when, each Coal Creek and the Yukon River contributed to the development of the formation on which Frank Slaven constructed his roadhouse. A 50-cm wide stratigraphic profile recorded late Quaternary sediments at the terrace riser adjacent to the Yukon using criteria set by the North American Stratigraphic Code (North American Commission on Stratigraphic Nomenclature 2005). Pedogenic nomenclature is derived from the Field Book for Describing and Sampling Soils (Schoeneberger et al. 2012), while sedimentary texture is classified according to Folk (1974:28–30). We also gathered nine wood samples opportunistically, extracting what we encountered from stratigraphic profiles. Local elevation data were collected to reveal differences in natural and human-modified topography around the site. Attempts at constructing a geomorphic map were abandoned due to poor visibility and inaccessible terrain.To laterally map subsurface lithology, pedology, and general stratigraphy, crew members extracted 27 bucket augers to a maximum depth of 160 cm.

Granulometry. Lab work occurred at CWU between October 2014 and January 2015. Grain-size statistics were calculated using a combination of wet screening through the following mesh sizes—>4 mm (pebbles), >2 mm (granules), >0.5 mm (medium sand), and >0.25 mm (fine sand), and laser diffraction for smaller particles using a Malvern Mastersizer Laser Diffraction Particle Size Analyzer. This apparatus measures particles into 64 class sizes between 0.01 µm and 880 µm. Subsamples for laser diffraction were pretreated to remove inorganic C with 10% HCl and organic C using 3% H_2O_2. Immediately before introducing the soil into the Mastersizer, particles were dispersed in an ultrasonic bath for 1 min.

Information gained from this procedure can provide clues to the transport mode, origin, and post-depositional history of sediments (Stein 1987). Moreover, transformation of particle size into ϕ ($-log_2[mm]$) allows for statistical calculations such as mean, skewness and sorting which are much more informative about past depositional environments than simple histograms showing relative amounts of sand, silt, and clay. Table I shows the statistical measures used here. Such procedures would be cumbersome with values expressed in mm (e.g., a typical sample might have particles ranging from 2.0 mm to 0.00006 mm in diameter) (Boggs 1995:86–90).

Soil Chemistry. We carried out pH tests on soil samples in the Geoarchaeology Laboratory. For this project, a hand held pH meter was used on a 1:2 soil:distilled water solution. Total carbonates (inorganic C) and organic matter content were determined in the Paleoecology Laboratory by calculating loss on ignition at 550°C (organic C) and 950°C (inorganic C).

Dating and Species Identification. In total, nine wood samples were collected and submitted for identification and dating.

RESULTS

Stratigraphy and Sedimentology. The stratigraphic profile records 9.0 m of sediments at Slaven (Figure 2) divided into three major units based on differences observed in the field and laboratory, labeled Units 1, 2, and 3 from oldest to youngest. Lab work indicates that, other than Unit 2, the profile is dominated by fine-grained, deposits, except for samples 4, and 22-24, which did not yield adequate sample to generate the particle size-spread needed to generate quantifiable data (Table II). Excluding those five samples, average graphic means range from 0.24 mm (fine sand) to 0.02 mm (silt). Grain size generally fines upward. Likewise, inclusive standard deviation falls between 0.8 ϕ (moderately sorted) and 3.0 ϕ (very poorly sorted) with generally better sorting lower in the profile. This is unexpected for alluvium, which is generally well sorted, but the systematic approach to sample collection mixed material from different lithostratigraphic beds. Skewness ranges from -0.9 (strongly coarse skewed) to 5.3 (strongly fine skewed), with expectedly the vast majority of samples around 0.5 ϕ (nearly symmetrical). Unit 2 is poorly sorted gravel with maximum clasts pebble- to small cobble-sized. Access to Unit 3 for analysis at the profile was hampered by the unstable nature of Unit 2 gravel. Descriptions can be found in Buvit and Rasic (2011:68-69). Essentially, the top 70 cm the profile comprise massively bedded muds with an organic rich layer containing well-preserved wood that produced the isolated projectile point.

Soil chemistry (pH and carbon content) showed usual trends. Of interest is an increase in pH and inorganic carbon content deeper in the column. Combined, these can indicate less precipitation at the time, and perhaps an environmental shift around 7000 cal. BP. Soil pH was also expected to generally decrease upward through the profile due to increased humic acid from decomposing organic matter.

Auger Probes. Results of the auger probes are shown in Figures 3 and 4. Figure 3 shows stratigraphy of eight cores west of the roadhouse. While detailed correlation between different units identified in the auger probes is difficult, meaningful statements about the profiles are still attainable. First, there is a general textural coarsening toward the Yukon River. Second, the amount of oxidation tends to increase away from the Yukon. At the base of each probe is pebble-sized gravel likely the same as Unit 2 in Figure 3. The generalized profiles in Figure 4 confirm these interpretations.

Topographic Mapping. Efforts to construct a topographic map

Geochronology and Arboreal Species Identification. In order to better understand the geological history of the landform, nine wood samples were collected from the stratigraphic profile and submitted to the University of Georgia Applied Radiocarbon Lab. Results range from 6900±25 ^{14}C bp (UGAMS-18666) to 5280±25 ^{14}C bp (UGAMS-18663) (Table III). Stratigraphically, the oldest age appears out of place. Likewise, UGAMS-18662 is also incongruent with ages above and below by what appears to be just a few decades. Samples 3, 4 and 5 are statistically equivalent at two sigma, at just less than 5580±25 ^{14}C bp. The out-of-place dates are likely redeposited material dislodged during floods. Unit 1 predates ~6500 cal bp. Unit 2 began forming 6500 cal bp and ended just after ~6000 cal bp. Unit 3 dates between 6000 and ~4500 cal bp. Unit IV is at least 4500 cal years old. Table III also shows the presence of boreal species during the formation of the landform.

GEOARCHAEOLOGICAL ASSESMENT

Geolgoical History and Site Formation. We assign Unit 1 to the Yukon River. It is the only source for the available amount of silt and very fine sand comprising the lower part of the terrace. Unit 1's mean clast sizes, ranging from 0.24 to 0.02 mm, are indicative of point bars in rivers of western North America (Allen 1965:138-143, 1970). Preserved wood and other organic material was prevalent within the within Unit 1. Gravel of Unit 2, however, likely derived from Coal Creek. Modern analogies of Coal Creek gravel beds are visible around Slaven at its confluence with the Yukon. Combining earlier results (Buvit and Rasic 2011) with results of the auger probes, we conclude that Unit 3 is likely very low-energy Yukon River alluvium.

At about 7000 cal. BP, the Yukon River flowed through a landscape covered by spruce, birch and willow, and began laying down the gravel and sandy sediments that would form Unit 1. Soil chemistry suggests conditions might have been slightly drier at this time. As deposition continued, a sand bar eventually formed at the mouth of Coal Creek. The muddy nature of Unit I is consistent with large, silt-bearing meandering rivers of western North America (Allen 1970). Periodically, after being entrained and transported from upriver, very well-preserved driftwood came to rest on the surface. This organic rich material was quickly buried by more mud. This lasted for around 1000 years until just after 6000 cal. BP when Coal Creek became the dominant contributor to the terrace.

The five or so meters comprising Unit 2 gravel was deposited relatively briefly during a period from 6000 to about 5000 or 4500 cal BP. It is difficult to say if Unit 2 represents a climatic shift or simply the usual meander of the Coal Creek channel at its mouth. This could be tested by examining exposures along the stream bed, but one would run into difficulty with this because of historical dredging. By the middle Holocene just before about 4500 cal. BP, the tributary channel shifted again and once again lost its dominance as the primary contributor of sediments.

Unit 3 represents the most recent development of the landform. Clues to its origins come from the auger profiles that show a general textural fining away from the Yukon River. Conceivably, flooding from the release of ice dams could deliver Yukon River alluvium along with redeposited organic debris to the terrace height. Potentially, Coal Creek has no influence on the continued development of the terrace. It is during the formation of Unit III that the only confirmed human occupation occurred. The preserved wood observed in the lower sections of the stratigraphic profile lend support for the argument that the feature associated with the lanceolate projectile point in Unit 3 (Buvit and Rasic 2011:69) is natural, likely deposited during flooding of the Yukon River.

It appears Frank Slaven's Roadhouse sits atop a Holocene-aged Yukon River terrace, T1, that was buried relatively rapidly by high-energy gravel, likely from Coal Creek, around 6000 cal bp. Slightly poorer sorting upwards through the column might reflect additional sources of deposits, such as wind, adding to the mix as the terrace stabilized and floods became less frequent. Because of its height, it was misidentified as an older T2. As such, humans could not have occupied the formation where Slaven is situated before (6000-7000 ^{14}C bp). Also, access to cultural material older than ~5000 years will be extraordinarily difficult or impossible because of the instability of the Layer 2 gravel. One solution might be to identify the lateral extent of the middle Holocene gravel and attempt to excavate where they are lacking.

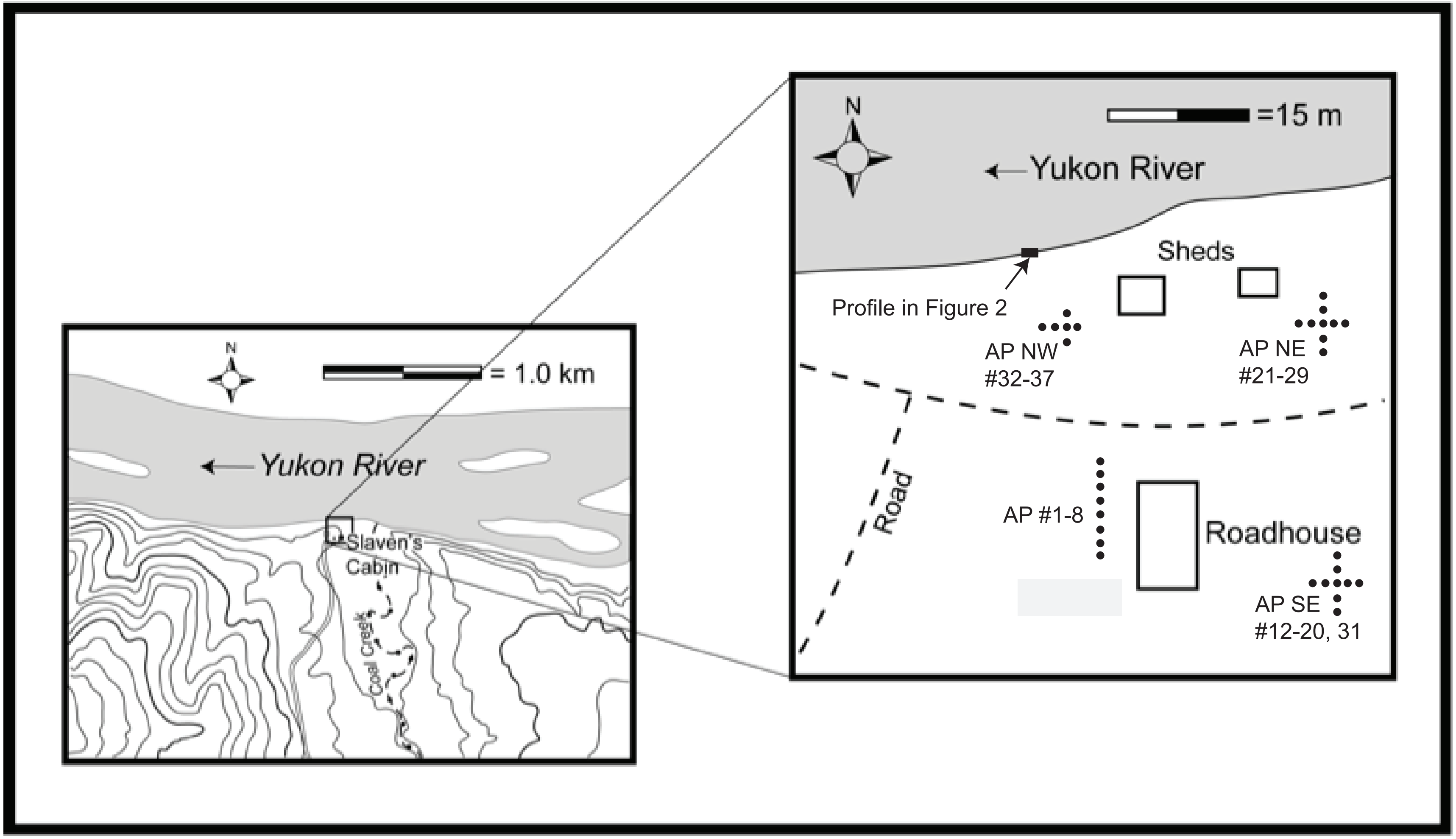


Figure 1. Map showing the locations of the stratigraphic profile in Figure 2 and auger probes (AP) in Figures 3 & 4.

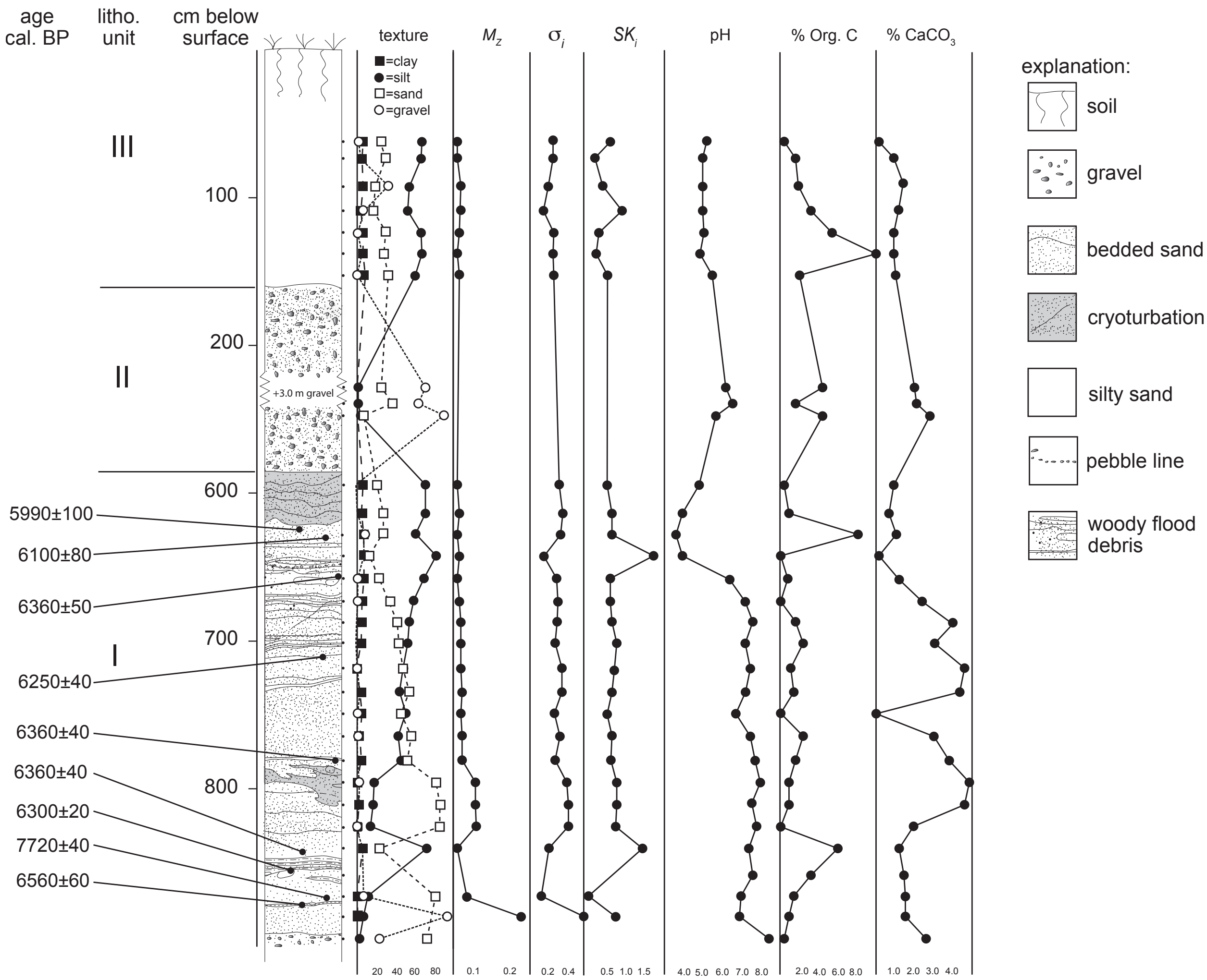
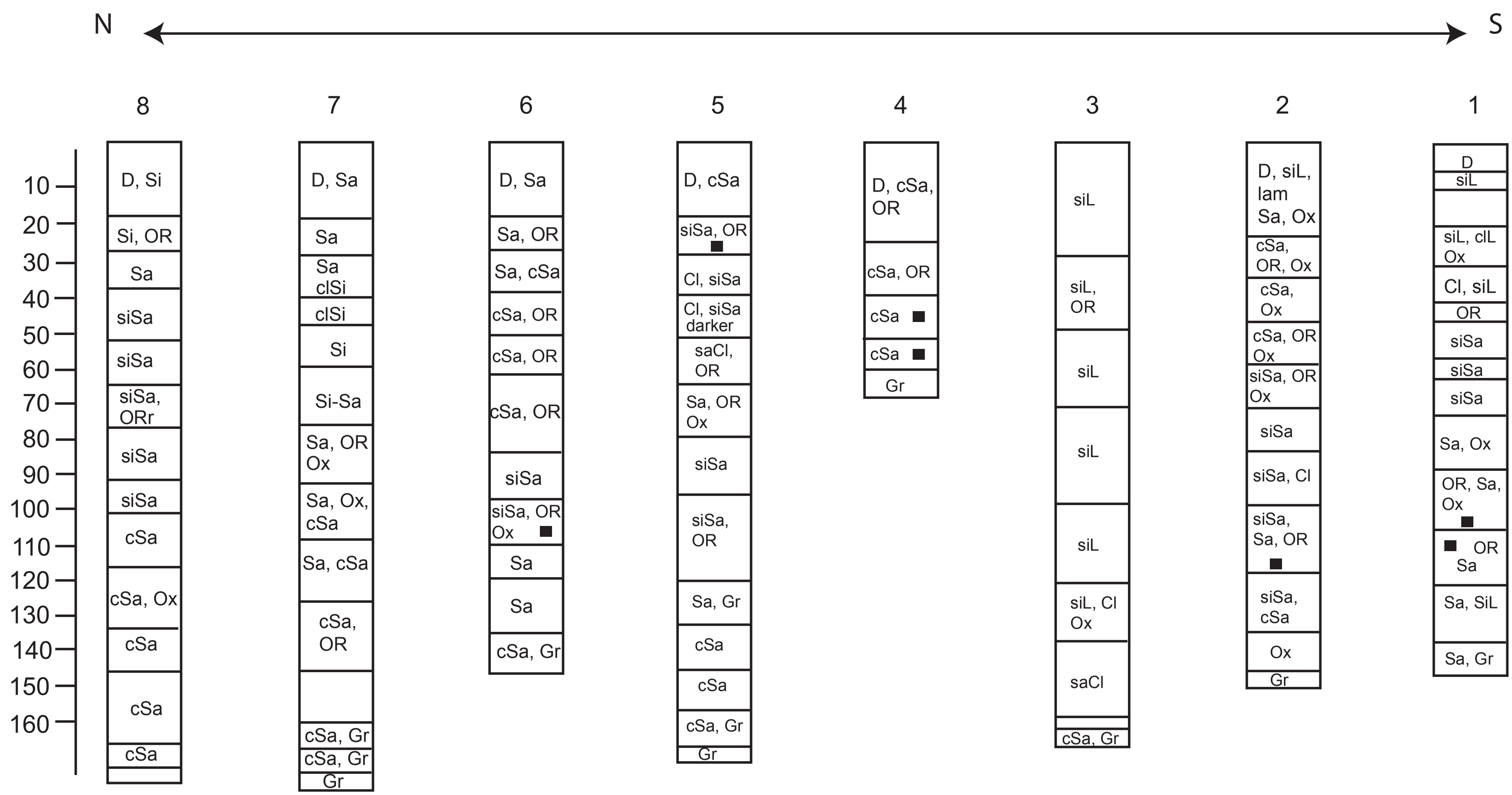


Figure 2. Stratigraphic profile at Slaven's Roadhouse.



clSi=clayey silt
lam=laminated bedding
Sa=sand

Cl=clay
saCl=sandy clay
saL=sandy loam

Ox=oxidation
siSa=silty sand
■ =charcoal

D=duff/rootmat
SiL=silty loam
clL=clay loam

Gr=gravel
cSa=coarse sand
Si=silte

Figure 3. General profiles of auger probes 1-8.

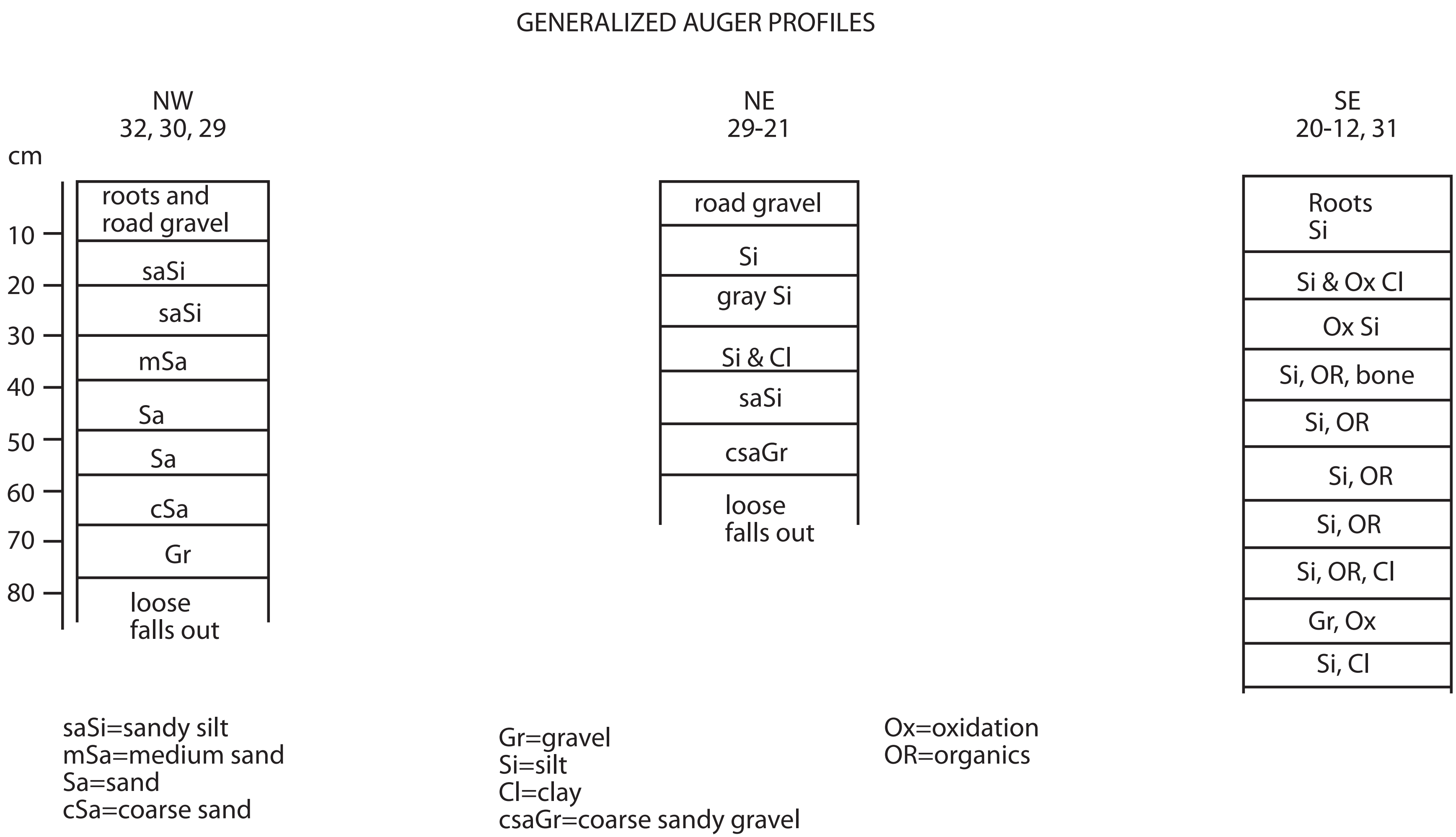


Figure 4. General profiles of auger probes 12-31.

graphic mean	$M_z = \frac{\phi_{16} + \phi_{50} + \phi_{84}}{3}$
inclusive graphic standard deviation (sorting)	$\sigma_i = \frac{\phi_{84} - \phi_{16}}{4} + \frac{\phi_{95} - \phi_5}{6.6}$
inclusive graphic skewness	$SK_i = \frac{(\phi_{84} + \phi_{16} - 2\phi_{50})}{2(\phi_{84} - \phi_{16})} + \frac{(\phi_{95} + \phi_5 - 2\phi_{50})}{2(\phi_{95} - \phi_5)}$

Table I. Grain size statistics used here.

Sample	Depth (cm from surface)	% clay	% silt	% sand	% gravel	M_Z (mm)	σ_i (ϕ)	SK_i (ϕ)	pH	% Org. C	% $CaCO_3$
31	62	6	67	27	1	0.02	2.0	0.7	5.1	0.3	0.1
30	74	6	65	29	0	0.02	2.0	2.3	5	1.4	0.9
29	92	6	55	36	3	0.03	2.4	1.2	5	1.8	1.3
28	109	4	53	37	6	0.04	2.8	0.1	5	3.2	1.2
27	123	5	65	29	1	0.03	2.1	1.6	5.1	5.2	0.9
26	137	5	66	28	0	0.02	2.0	2.0	4.9	9.9	0.9
25	153	6	61	32	1	0.03	2.1	0.9	5.5	2.1	1.0
24	370	0	2	26	71	*	*	*	6.1	4.2	0.9
23	453	0	2	37	61	*	*	*	6.5	1.8	1.0
22	548	0	3	6	90	*	*	*	5.65	4.3	1.8
21	595	7	73	20	0	0.02	1.7	0.9	4.8	0.4	0.9
20	614	6	69	25	0	0.03	1.5	0.6	3.9	1.1	0.7
19	629	6	60	28	7	0.02	1.6	0.6	3.4	8.2	1.0
18	643	7	81	12	0	0.03	2.7	-0.8	3.9	0.3	0.1
17	658	7	69	23	1	0.02	1.9	0.8	6.4	0.9	1.1
16	674	5	59	34	1	0.03	1.9	0.7	7.2	0.3	2.3
15	688	4	53	42	0	0.04	1.7	0.7	7.6	1.7	4.0
14	702	4	52	43	0	0.04	1.8	0.4	7.2	2.6	3.1
13	719	4	48	47	1	0.04	1.6	0.5	7.5	0.9	4.6
12	735	3	44	53	0	0.05	1.6	0.7	7.2	1.5	4.3
11	750	5	50	45	1	0.04	1.9	0.9	6.7	0.3	0.1
10	765	3	41	56	1	0.05	1.6	0.7	7.5	2.5	3.0
9	782	4	43	52	0	0.05	1.9	0.7	7.7	1.7	3.8
8	797	1	17	81	2	0.11	1.4	0.4	8	1.1	4.9
7	812	2	16	83	0	0.11	1.3	0.4	7.5	1.0	4.5
6	828	1	13	85	1	0.12	1.3	0.5	7.8	0.1	4.4
5	842	6	72	22	0	0.02	2.3	-0.6	7.4	6.1	1.1
4	859	*	*	*	*	*	*	*	7.6	3.3	1.4
3	875	1	11	81	6	0.07	3.0	5.3	7	1.3	1.5
2	889	1	6	93	1	0.24	0.8	0.4	6.9	0.8	1.5
1	903	0	3	23	73	*	*	*	8.5	0.5	2.6

UGAMS Lab #	Taxa	^{14}C Age	cal Age	∂^{13}C	comments
18663	*Betula* sp.	5280±25	5990±100	-25.9	Uncharred, poorly preserved, moist, mushy, hard to see minute features
18664	unidentifiable angiosperm	5320±25	6100±80	-25.8	Uncharred, poorly preserved, moist, mushy, hard to see minute features
18662	unidentifiable	5540±25	6360±50	-25.9	Redeposited older material?, Bark
18669	Salix sp.?	5440±25	6250±40	-27.4	Uncharred, shrubby root, willow species?
18668	Betula ?	5580±25	6360±40	-28.2	Uncharred, poorly preserved, moist, mushy, hard to see minute features
18667	Spruce	5580±25	6360±40	-25.0	Uncharred, looks like part of a little spruce cone! Not actually wood.
18661	Salix/Populus sp.	5500±25	6300±20	-27.0	Uncharred, poorly preserved, moist, mushy, hard to see minute features, moldy
18666	Spruce	6900±25	7720±40	-24.6	Redeposited older wood?, Uncharred, poorly preserved, moist, mushy, hard to see minute features
18665	unidentifiable angiosperm	5750±25	6560±60	-24.5	Uncharred, poorly preserved, moist, mushy, hard to see minute features, probably an angiosperm twig

Table III. Radiocarbon AMS and Taxonomic Identification Data of Organics from Frank Slaven's Roadhouse.

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