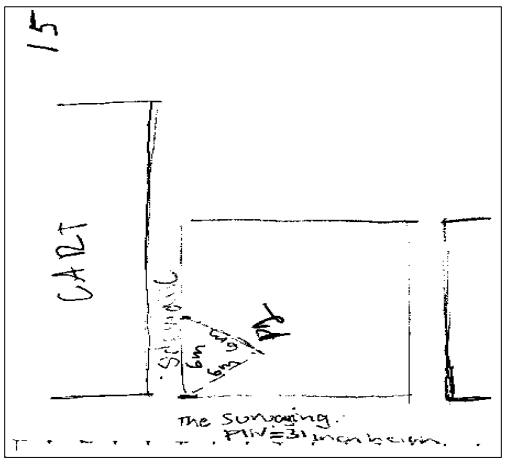
Mindy Singleton
Final Research Project

The Miller site B2 is the archeological site I participated in with my archeology class with our instructor and director, Alan Griffiths. The site we chose was located next to the CART Building on the Miller Campus. The learning goal was to analyze the strata of the different layers of cored samples we collected. If we found evidence of opaque black particles in the samples, the class then could hypothesis that perhaps the particles are remnants of pollution caused by the human population burning coal before the 1950's.

The first survey techniques we used to excavate the site during our project were triangulation. We did this to map out the sites location because it has not been studied before. In this way we can use the same technique to return to the site to take additional samples when needed. We recorded the measurements in the site notebook labeled #15, date 09/22/2011, and the sketch was not to scale. The instruments we used for the triangulation were tape measures, metal survey pins or stakes, level, plumb bob and line. We measured 6 meters on each side of the triangle; we marked each point of the triangle with a survey pin after verifying the top line was level with the bottom tape measure. We then marked the point where we would perform the coring and labeled it in site notebook as P2. (See fig.1and 2.)



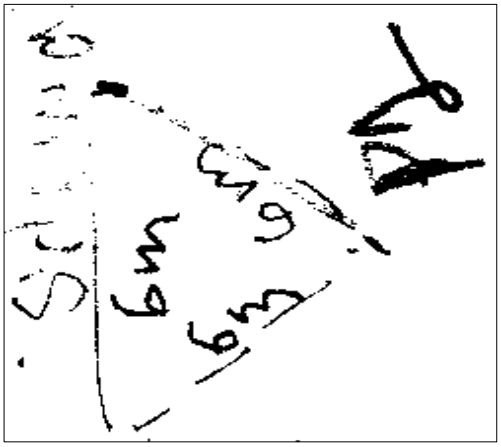


Figure 1. Full page view from site notebook #15. Figure 2. Enlarged view of point labeled P2.

We used a small trowel and clean paper to place the soil on. After cutting the grass with the trowel we analyzed the top layer of strata and labeled the core location P2.1 with 8 1/2 cm below surface of grass area. We then determined the color with the Munsell color and texture guide. We found the color of stratigraphic unit (SU) 1 to be 7.5 YR and 2.5/1 Black. The texture was smooth and soft with fine amount of organic material and the soil was wet. We entered this information in the site notebook labeled page 16, 09/22/2011. (See Fig 3.)

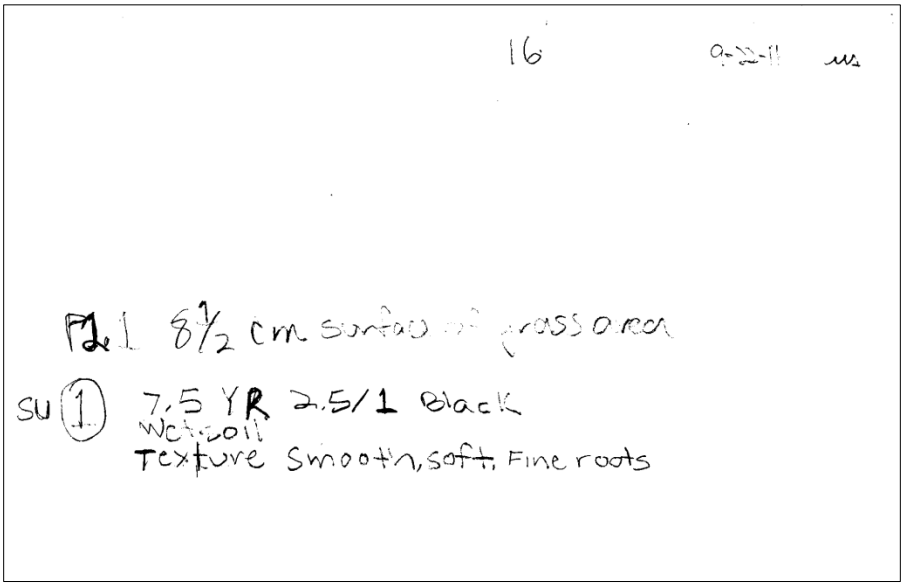


Fig 3.

For the coring we used a hand held auger. We entered the data in the site notebook as stratigraphic unit (SU) 2, the color of this core sample was 7.5 YR 5/3 Brown. Core location P2.2 was 88.5cm ground level to top of handle and 84 cm after. This was documented number 17, 9/22/2011 (Fig 4).

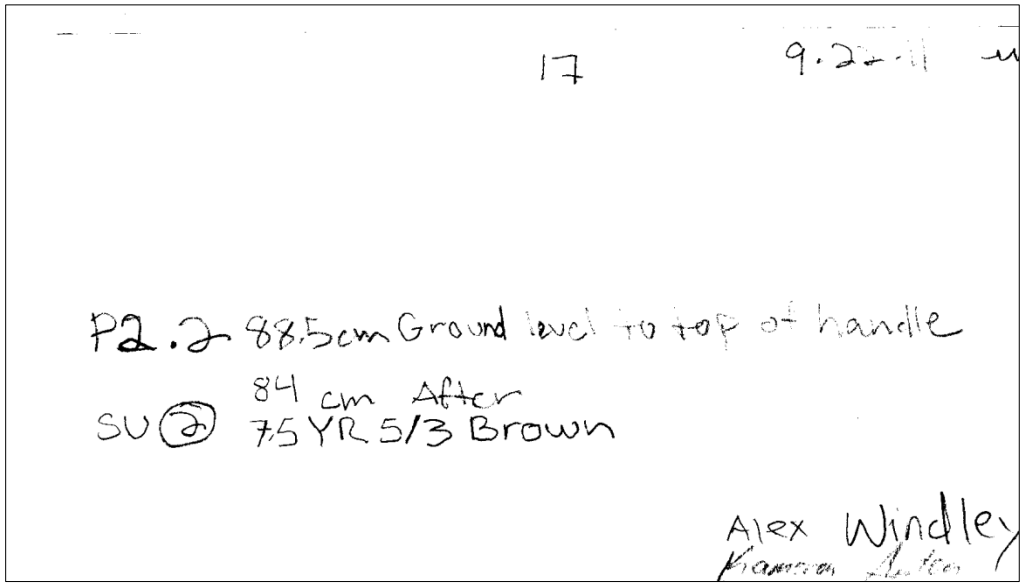


Fig 4.

We preserved the samples by carefully transferring the strata from the paper to bags without touching the sample; we labeled the bags with the site information. (Fig 5) This concluded our first day of field work.

Stratigraphic Unit	Depth	Munsell color, texture and other data recorded in site notebook
SU1	P2.1 8.5 cm	7.5 YR and 2.5/1 Black, smooth soft fine roots damp earth
SU2	P2.2 88.5 cm	7.5 YR and 5/3 Brown
SU3	P2.3 94cm	7.5YR and 3/3 dark brown. Damp soil Color determined in sunlight
SU4	P2.3 78cm	7.5 YR and 4/3 brown

Fig 5.

Additional field work was performed after using triangulation, a tripod and instrument to locate the coring location on 09/29/2011. Stratigraphic unit (SU) 3 color was 7.5 3/3 dark brown in P2.3 using 94 cm auger 1 extension at 84cm beginning and end at 78cm. (SU)4 color was 7.5 4/3 brown at the end of P2.3. The data was entered in to the site notebook to be compared to SU1 and SU2

(Fig 6)

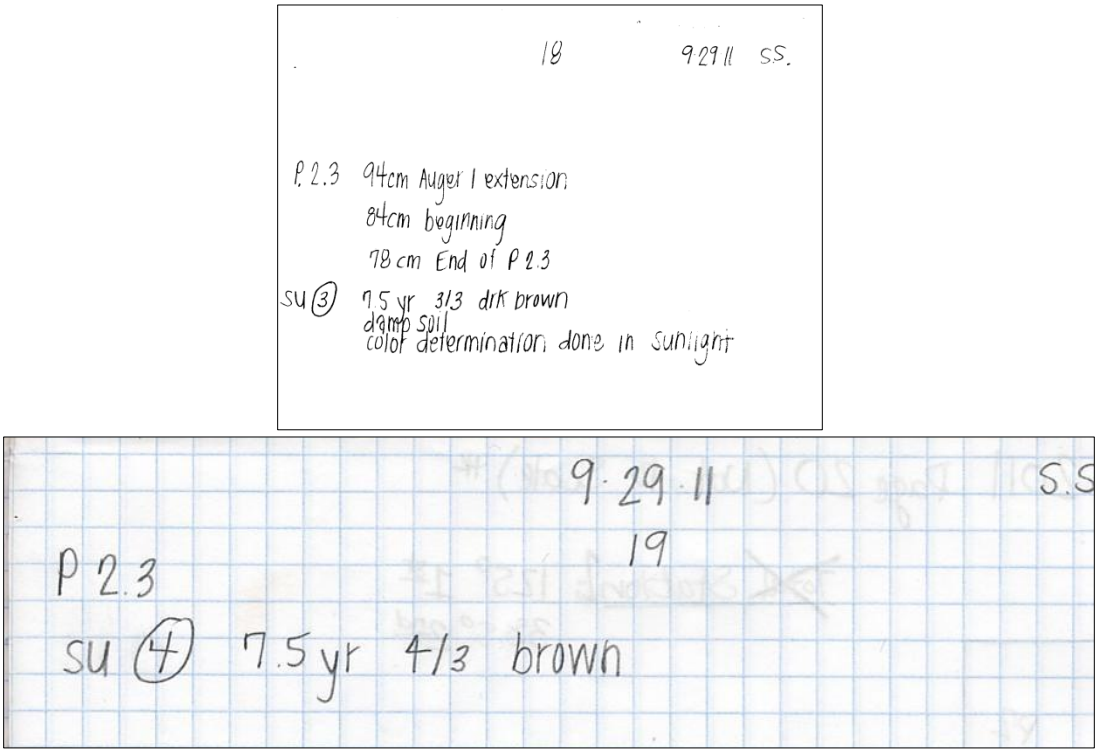


Fig 6.

Laboratory texture analysis was performed in class using a series of screens to separate the sample into 5 categories for core stratigraphic unit (SU) 1, core location P2. (Fig 7 and 8)

Beaker	Measurement	Measurement	Texture	Measurements Results per beaker	Texture results per screen in %
1	>	2mm	Granules	7.5ml	45.2 - 45.3
2	>	5.00mm	Very fine	6ml	66.37 - 65.9
3	>	1.25mm	Fine med sand	2.5ml	27.6 - 27.5
4	>	63mm	Very fine sand	0.5ml	5.5 - 5.5
5	<	63mm	Silt/clay	0.05-0.1ml	.5 - 1.1

Fig 7.

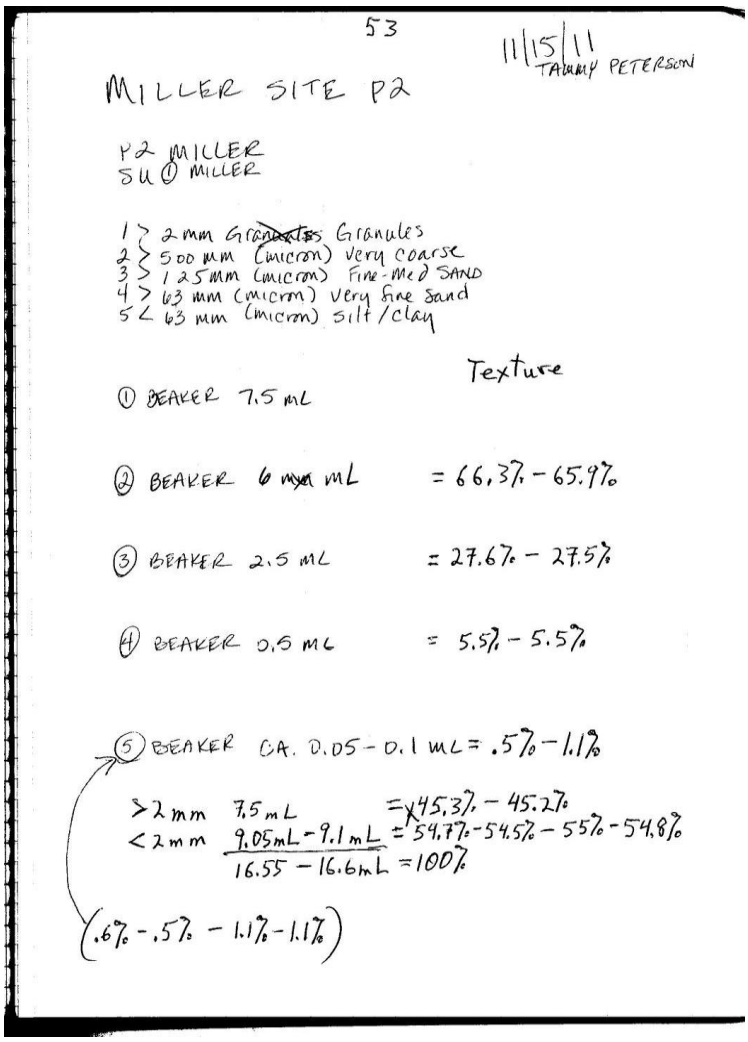


Fig 8.

From the results of beaker 5, we may make a slide to compare to a perviously gathered sample of polluted soil. Director Alan Giffiths made such comparisons with a microscope slide in his study. The information he noted about his slide is.

"*A microscope slide S2 was prepared from ash composed of 50% coal (from Price, Utah) and 50% wood (pine from Wasatch Mountains 16 miles east of Coalville) burned and collected in 2009 in a cabin furnace/chimney near Coalville, Utah. Positive comparisons between examples in S18 and S2 suggest microscopic burnt wood in S18 and hence in SU5 at the LC site P3 (compare Figures 10 and 11). Also, the grain in Figure 12 from S17 has similarities with a probable fired coal grain from the modern ash in S2 (see Figure 13 and 14). And the similarities in form and color between this S2 grain and the following microphotograph (Figure 15) of the grain above the burnt wood in S18 suggest the S18 grain to be a remnant of fired coal.*

"The form and color of the preceding hypothesized fired coal grains fit certain definitions in coal petrology. In this regard, the irregular forms of the opaque black particles in these examples might be explained as being chars formed in the firing process from the maceral (organic) component of coal while the translucent areas of the grain would be the mineral component of the coal. The form of these chars parallel descriptions of the heating of the vitrinite maceral. Vitrinite yields maximum tar between 500ºC and 600ºC and is associated with melting together to form larger particles in an agglomerated char (Suarez-Ruiz and Crelling 2008)". (Alan Giffiths) To view Dr Alan Griffins slides from this study and his conclusion see pages 9-13(appendix).

I would hypothesis that the sample from our sites SU 1, SU 2, SU 3, SU 4 do not have evidence of coal burning from before the 1950s because our samples lacked the dark grey color and evidence of opaque black particles found in Dr Alan Giffiths study . The campus was built after the 1950s but this may not be relevant because I am not sure what was on the location before the campus was built. The campus was completed in the fall of 2001 according to the

college web site (www.slc.edu). This was after the change from coal burning for cooking and heating to cooking and heating with natural gas and electricity.

Bibliography

2011, C. o. (2011). Miller Campus. *Site Notebook* , 15,16,17,18,19,20.

Griffiths, A. (2009). *Field, Laboratory, Culture and Chronology, Salt Lake City Archaeology Reseach Project on Pollution.* Salt Lake City: Alan Griffiths.

Kelly, R. L., & Thomas, D. H. (2011). *Archaeology Down To Earth.* Belmont: Wadworth.

Salt lake Community College. (2011). www.slc.edu.com/index

Appendix

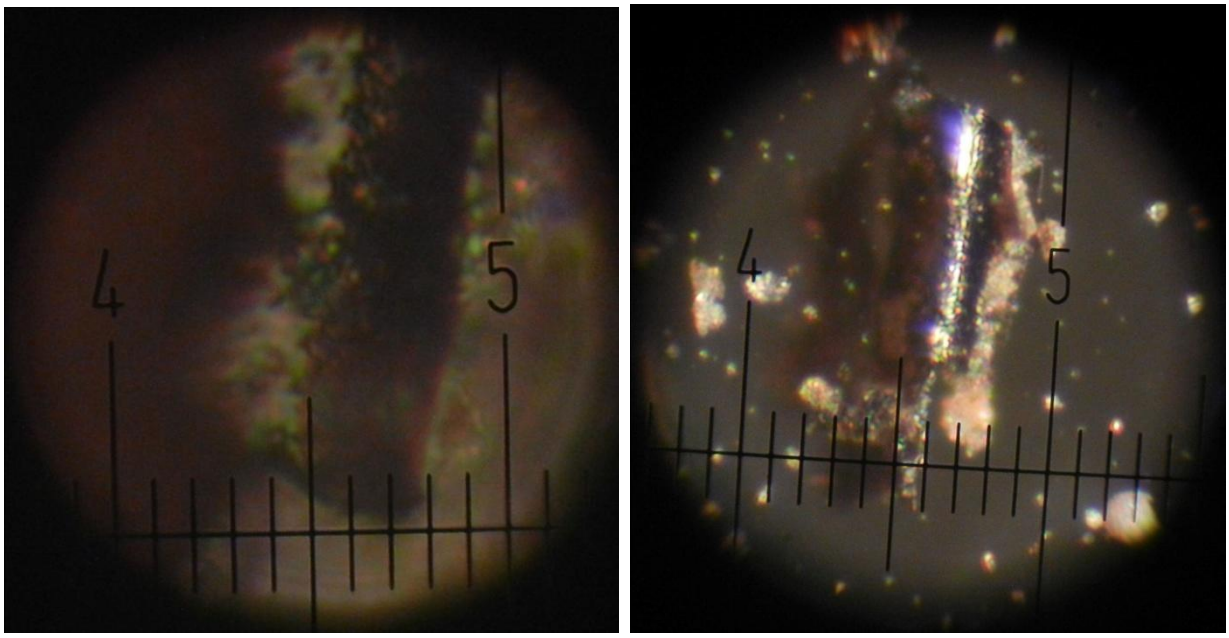


Figure 10. Microscope slide S18: 400X R3 (photo 1721): 25µm between 4 and 5 on reticule (scale), and

100X R3 (photo 1717): 100µm between 4 and 5 on reticule.

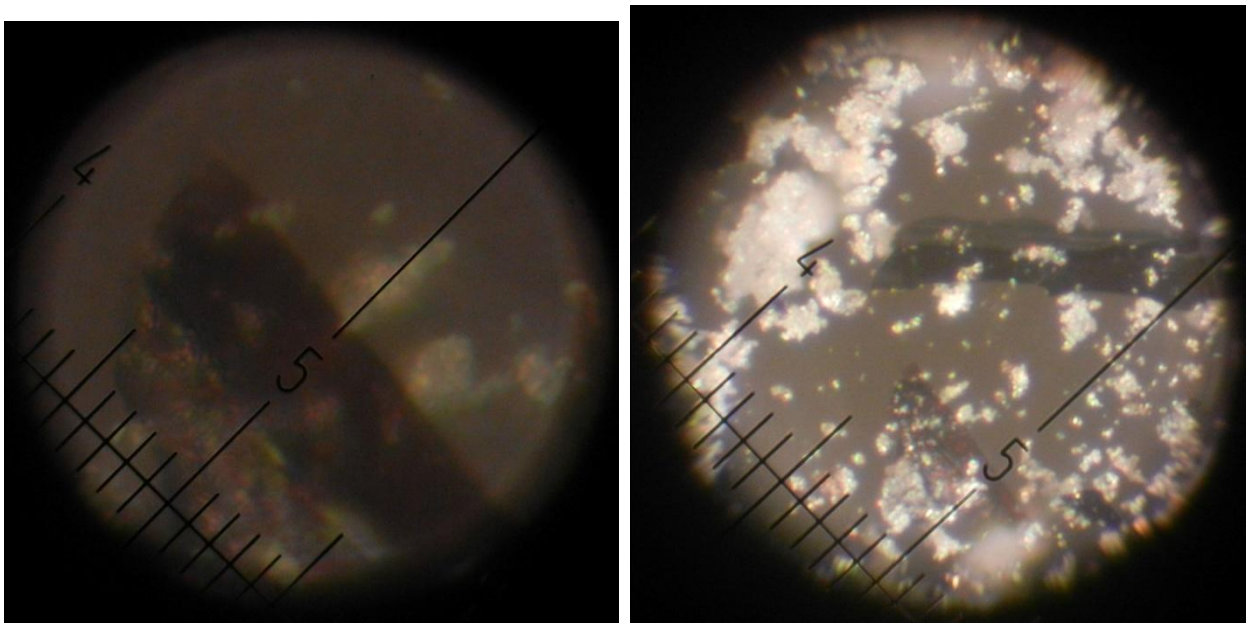


Figure 11. Microscope slide S2: 400X R3 (photo 349) and 100X R3 (photo 345)

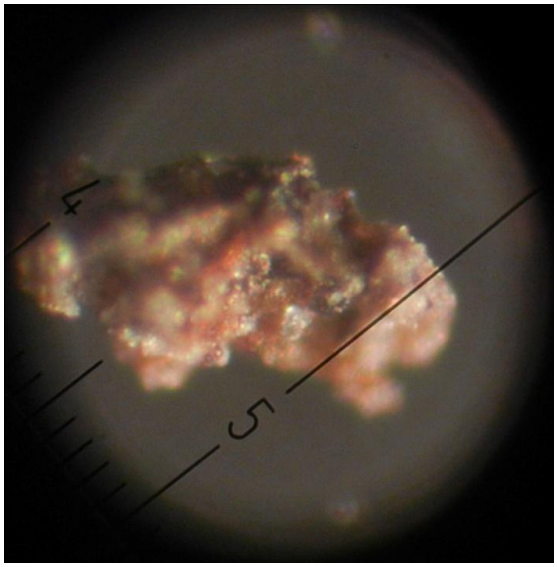
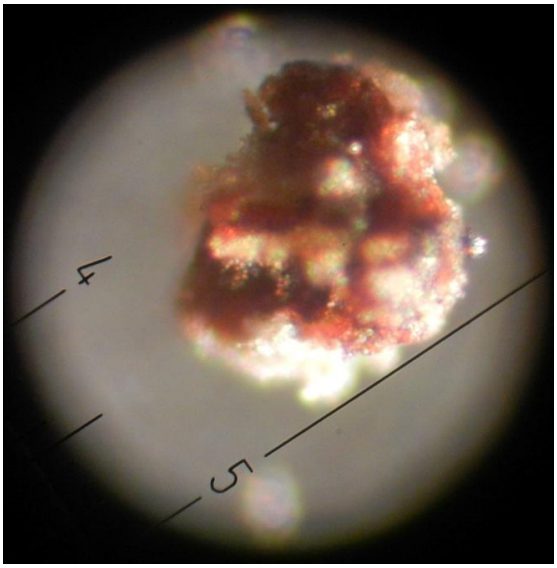



Figure 12. Microscope slide S17: 100X R3 (photo 291): 100µm between 4 and 5 on reticule (scale). Figure 13. Microscope slide S2: 100X R3 (photo 308).

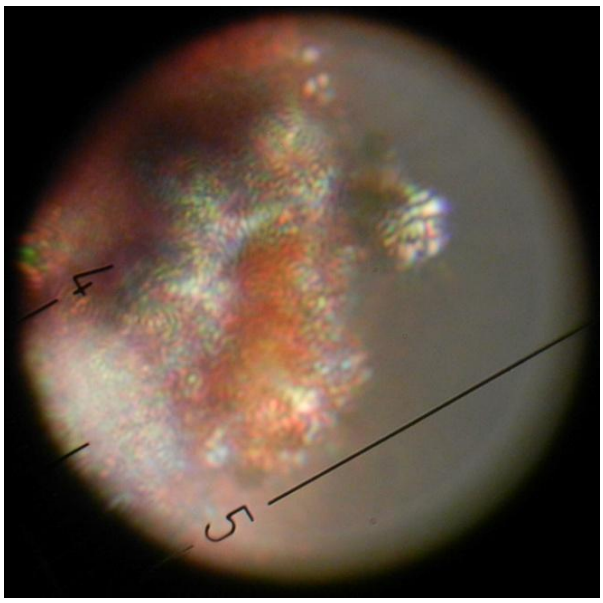
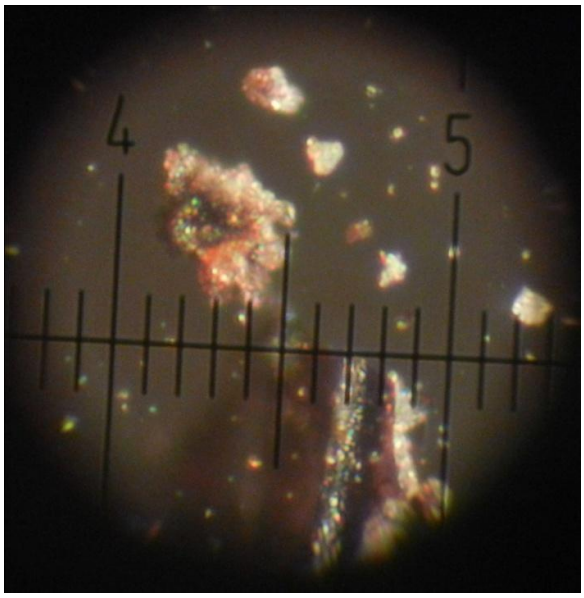



Figure 14. Microscope slide S2: 400X R3 (photo 325) Figure 15. Microscope slide S18: 100X R2 (photo 1732).

"Recently, a piece of coal was burned and the resulting smoke was caught on a microscope cover slip (see Figures 6 and 7). This evidence of smoke from burning coal was examined under the microscope. An example of one of the black particles from the coal smoke is shown in reflected light (Figure 16) and in light from the above stage Bausch lantern (Figure 17). This experimental evidence can be compared to microscope observations of prepared soil samples in order to hypothesize remnants of coal smoke produced by human technology'.(Alan Griffiths)

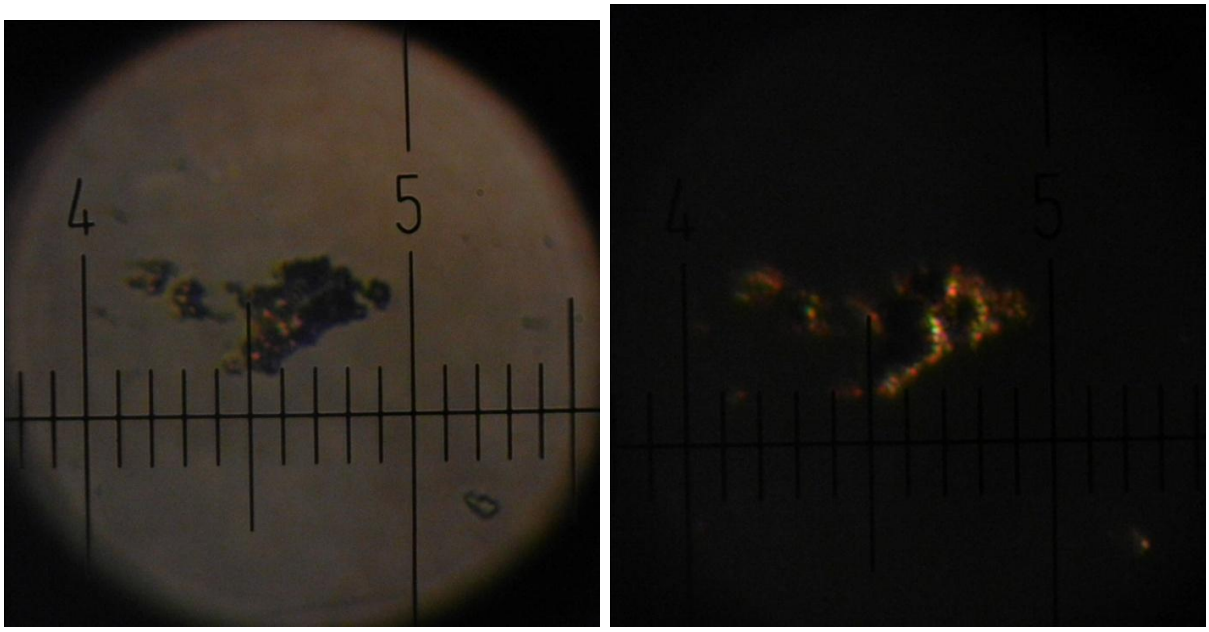


Figure 16. Microscope slide S33: 100X R (photo 1892).

Figure17. Microscope slide S33: 100X R3 (photo 1895).

Stratigraphic History

"The P3 core at the Lincoln Corner (LC) site exhibits a dark gray layer in SU5 (see Figure 18), which contains a large number of probable fired wood grains seen microscopically (see Figures 10 and 15). In this regard, the fired wood as well as fired coal in the contemporary ash of S2 (see Figure 11, 13 and 14.) Parallel grains in S18 in form and color (see Figure 10 and 15). These parallels would support an interpretation that SU5 (=S18) contains ash from coal and wood burning appliances. Also, ash from those types of appliances was thrown into gardens to promote the growth of plants as indicated in an ethnographic interview by the author with a person who grew up in Emery County, Utah during the 1920s and 1930s. Such a cultural event in SU5 would have been followed by later soil deposits that include

SU2, which does not contain the ash characteristic. These data are construed to support a relative chronology at the LC site P3 in which SU5 represents a time earlier than SU2 as charted in Figure 19". (Alan Griffiths)

Stratigraphic Unit	Depth	Munsell color, texture and other data recorded in site notebook
SU1	P3.1 ca. 8 cm	very dark brown 7.5YR2.5/2-3 damp earth
SU2	P3.1 ca. 7 cm	dark gray 7.5YR4/1 (mottled with some white & a little light brown) somewhat rocky: largest 4 by 2.5 cm
SU3	P3.2 ca. 7 cm?	very dark gray 7.5YR3/1 (mottled with spots of reddish yellow 7.5YR8-7/6) damp earth
SU4	P3.2 ca. 4 cm	light to strong brown 7.5YR6/4-6 (black 7.5YR2.5/1 underlying this face) damp soil
SU5	P3.2 ca. 5 cm	very dark gray 7.5YR3/1 (mixed with much pink 7.5YR8/4) damp soil a sandstone-like chunk, 5 by 6 cm, pink-reddish yellow 7.5YR8/4-6
SU6	P3.3 ca. 8 cm	dark gray 7.5YR4/1 & dark brown 7.5YR3/2 (variegated colors) very loose soil many chalk-like grains: sand to granules to small pebbles in size reddish earthenware-like fragment with black core in its crumbled reddish deposit thick light brown organic fragment, wood-like bottom of core too hard to continue with bucket auger

Figure 18. LC site P3 stratigraphic units (SUs).

Time Phase	Location	Stratigraphic Unit	Munsell Soil Color	Microscope Slide
Phase 1	LC site P3	SU2	dark gray 7.5YR4/1	S17
Phase 2	LC site P3	SU5	very dark gray 7.5YR3/1	S18

Figure 19. Relative chronology at LC site P3.

"Based on an interpretation that opaque black particles in S18 are remnants of coal furnace or stove combustion, phase 2 would have ended by a time not long after World War II (see Figure 20). Such an absolute date is extrapolated from a history of Utah where in Salt Lake City' beginning in the 1930s and continuing at an accelerated rate after World War II, most residences installed natural gas furnaces, which virtually eliminated residential heating as a major source of air pollution' (Alexander 1995, 295). And fired coal grains in phase 1 such as in SU 2 (= S17) would be interpreted as occurring in a secondary context".

Before the 1950s	After the 1950s
Phase 2	Phase 1
SU5	SU2

Figure 20. An absolute chronology of LC site P3.

Sources Cited

Alexander, Thomas G. Utah, the Right Place, the Official Centennial History. 1st ed. Salt Lake City: Gibbs Smith Publisher, 1995.

Suarez-Ruiz, Isabel and John C. Crelling, eds. Applied Coal Petrology, the Role of Petrology in Coal Utilization. Amsterdam and Boston: Elsevier, 2008.

Legend: 1 millimeter (mm) = 1000 microns (µm) (Alan Griffiths)