CHARACTERIZING DUST EMISSIONS FROM THE DRY LAKEBED OF THE GREAT SALT LAKE RELATIVE TO OTHER REGIONAL DUST SOURCES

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INTRODUCTION

Dust storms frequently occur along the Wasatch Front causing negative effects on air quality, agriculture, snow pack and human health. Little is understood about sources for these dust storms. Dust along the Wasatch Front can come from a variety of sources. These include the Great Salt Lake (GSL) lakebed, Sevier Lake Bed, and Bonneville Salt Flats. Dust from GSL may prove to be an important component of dust. This is important as lake levels are reaching historic lows, which if continued will expose hundreds of square miles of lakebed. With new exposure of GSL lakebed, the frequency and intensity of dust storms may increase along the Wasatch Front. These dust storms may prove to be hazardous since high concentrations of salts and harmful metals are found on GSL lakebed. This study evaluates the relative importance of dust emissions from GSL lakebed relative to other regional dust sources and characterizes the adverse effects of dust deposition along the Wasatch Front.

SAMPLING AREA

To chemically link emission sources to depositional sources along the Wasatch Front. Four Dust collectors were placed along the Wasatch Front and eleven BSNE samplers were placed at emission sources (see Figure 1). Emission sites were selected based on a north-north-eastern wind pattern for Utah (Hahnenberger, 2012). The purpose of these sights is to better understand the impact of dust emissions from the Great Salt Lake relative to other regional dust sources.

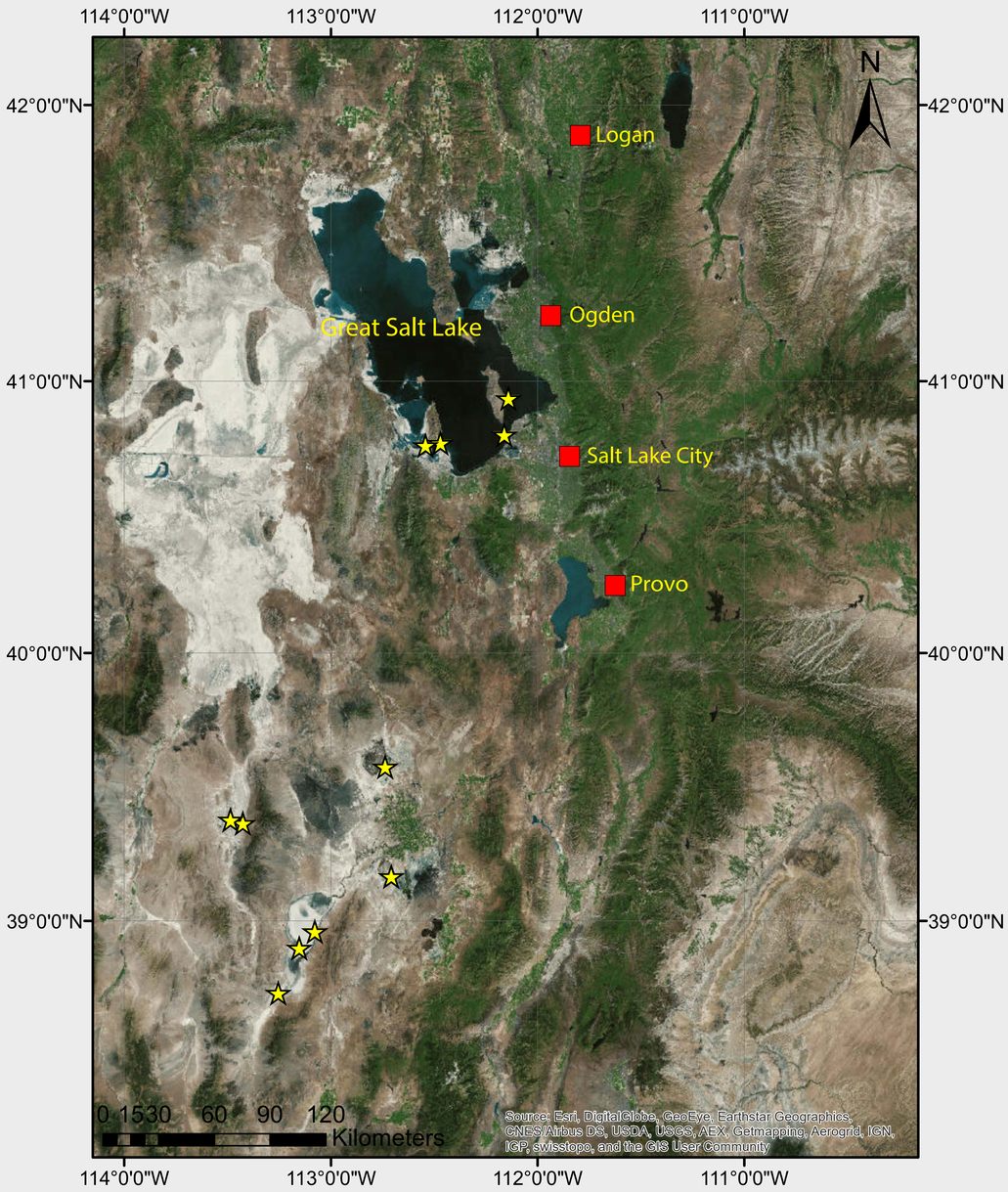

Figure 1 Shows the location of BSNE samplers(stars) and dust bucket collectors(boxes) in Utah, USA. BSNE samplers will sample dust emission sources. Dust bucket collectors will sample dust deposition along the Wasatch Front. Chemical signatures will be determined for each dust emission sight. These chemical signatures will be used to determine dust sources along the Wasatch Front.

METHODS

Samples were taken from emission and depositional sites using stainless steel BSNE samplers and dust bucket collectors, respectively. BSNE samplers were lined with Teflon to prevent contamination. Dust bucket collectors were lined with clean LDPE bags. Both samples after collection were dried in a clean laminar flow hood. These samples were then sequentially leached using ammonium, acetic acid, nitric acid and aqua regia. These leachates were then chemically analyzed using ICP-MS. A partition of the remaining dust was then prepared on a microscope slide and viewed at 600x. Using image J software, the area of 1000 grains per sample was measured to create a grain size distribution.

Figure 2. A) Shows BSNE sampler collecting dust south of Antelope Island Utah. This type of sampler was used for collecting dust from emission sources in playas in south-western Utah. Samples were taken during Spring 2016 B) Shows passive dust collector on USU campus in Logan, Utah. Four Samplers similar to this were placed along Wasatch front to sample dust deposition during Fall 2015 and Spring 2016.

PRELIMINARY RESULTS

. To chemically identify dust sources for the Wasatch Front, data from dust collector samples were normalized with average elemental concentrations. (Wedepohl 1995). Figures 3-6 show plots for each sequential leach. These plots show that there is a general correlation between all depositional sites. However, within the general correlation the Provo and Salt Lake City samples show similarities, as well the Ogden and Logan samples show similarities. The similarities suggest that those locations have identical dust sources. The average particle size for these samples are 1.99, 1.16, 1.26, and 1.30 microns for Logan, Ogden, Salt Lake City, and Provo, respectively.

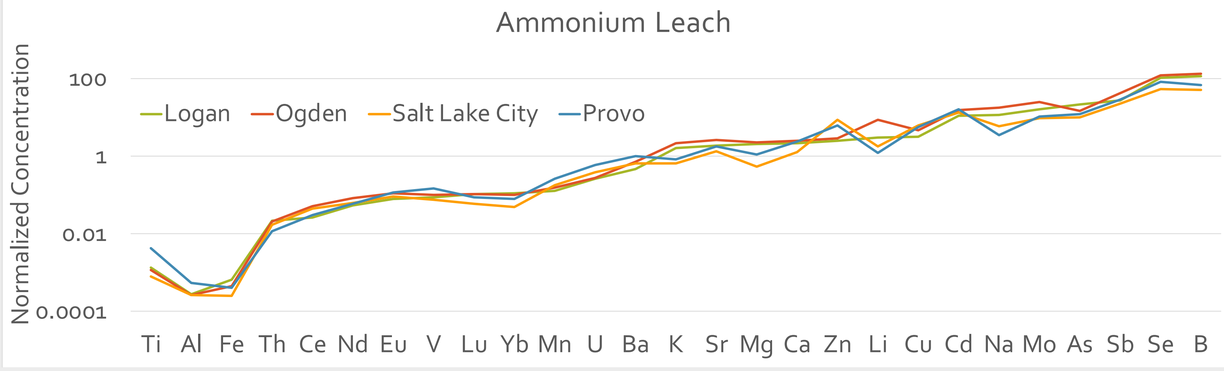

Figure 3 Shows line plot of normalized concentrations for the ammonium leach. Plot shows a good correlation for Provo and Salt Lake City, as well as Ogden and Logan. These correlations suggest similar dust sources. There is also higher concentrations of K, Li, and Na moving northward. This may have resulted from increased influence of dust emission from the Great Salt Lake

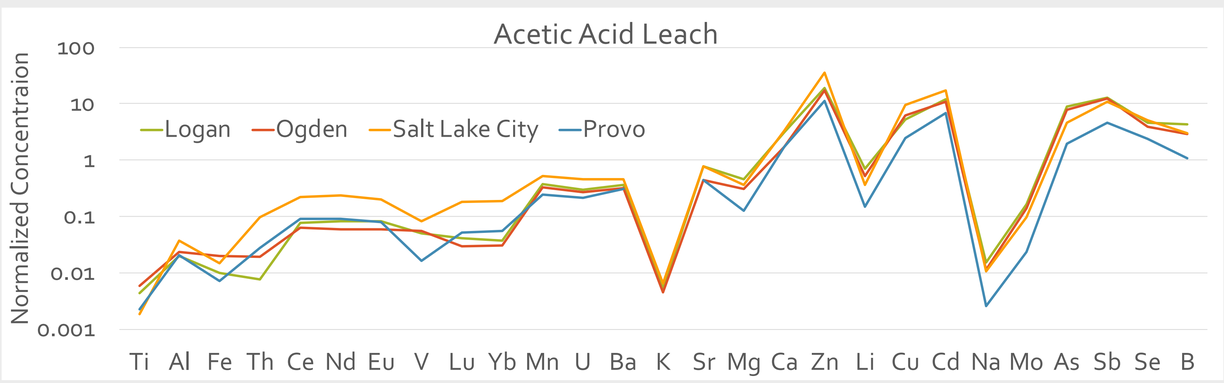

Figure 4 Shows line plot of normalized concentrations for the acetic acid leach. Plot shows a moderately well correlation for Ogden and Logan. Salt Lake City dust is increased overall in concentrations specifically Th, Ce, Nd, Eu, V,Lu, and Yb. These elevated concentrations may possibly correlate with urbanization.

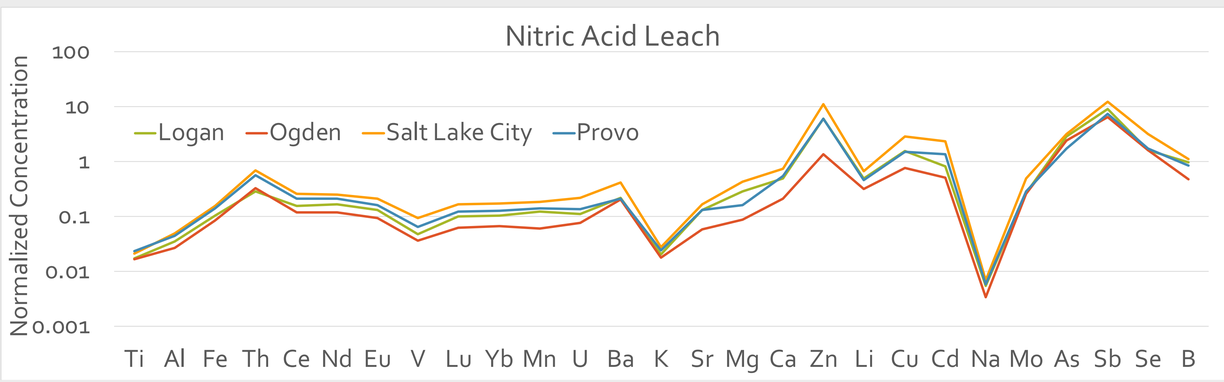

Figure 5 Shows line plot of normalized concentrations for the nitric acid leach. This plot shows a general correlation between dust sources for the region.

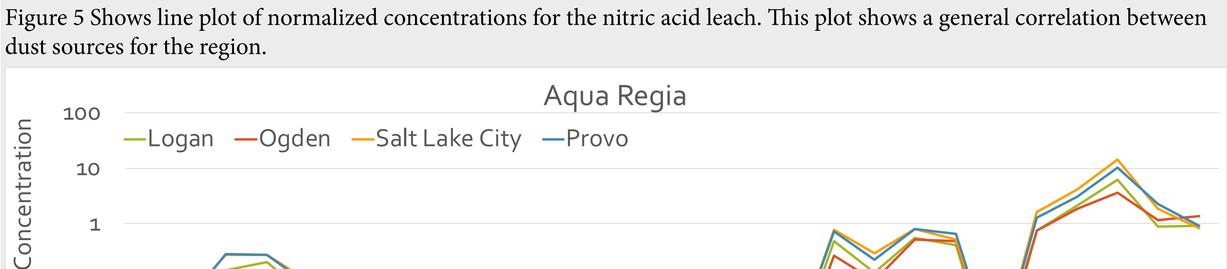

Figure 6 Shows line plot of normalized concentrations for the aqua regia leach. This plot shows a general correlation for the region. Plot shows a good correlation for Provo and Salt Lake City, as well as Ogden and Logan.

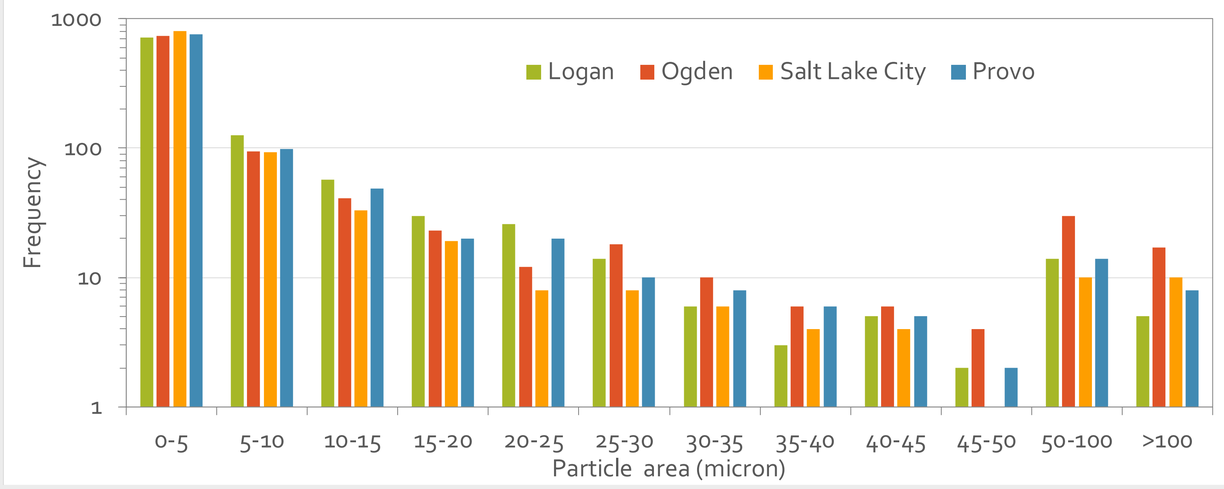

Figure 7 Show bar chard of particle area for dust deposition along the Wasatch Front, Utah. Area of 1000 particles were measured per sample. Area was measured using image J software from microscope slides. The overall average area of particles is 7.59 microns, and the median area is 1.39 microns. The individual sample medians for Logan, Ogden, Salt Lake City, and Pro-

FUTURE WORK

Samples will be evaluated using qemscan to determine mineralogy. Using mineralogy with sequential leaching should help better understand each depositional and emission site. Lab work for BSNE samples will be finished near the end of June. Upon the completion of lab work, “chemical fingerprints” will be examined for each site. These fingerprints will help to identify dust trajectories and determine dust sources for specific areas along the Wasatch Front.

REFERENCES

Hahnenberger, M., and Kathleen N., 2012, Meteorological characteristics of dust storm events in the eastern Great Basin of Utah, USA: Atmospheric environment, v. 60 p. 601-612.

Wedepohl K. H. (1995) The composition of continental crust: Geochimica et Cosmochimica Acta, v. 59, p.1217-1232.