CONSTRAINING THE SOURCES OF ORE METALS IN PICHER, OKLAHOMA USING PB ISOTOPES

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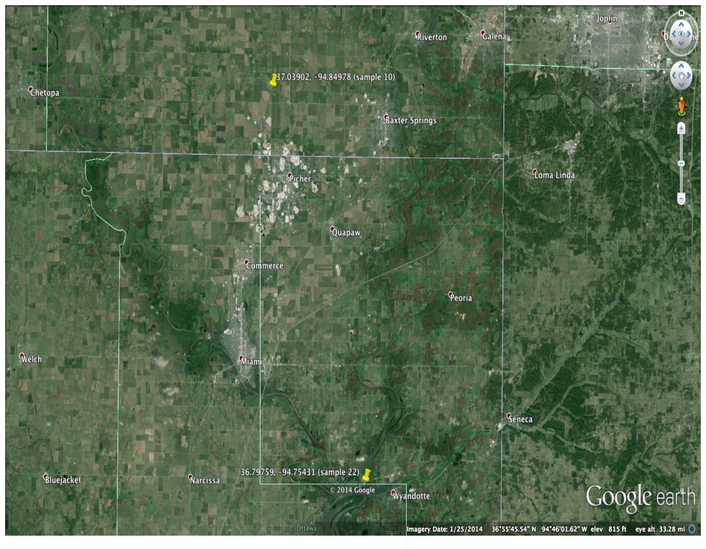
Project Summary

During both World Wars, about 75% of firearms, bombs and bullets used by the American troupes was made from Zinc and Lead mined from Picher, Oklahoma shown in Figure 1 and 2. From the 1920s, the Picher town, Ottawa County was a booming industrial town with extensive mining of heavy metals. At the time, Picher's population was about 20,000 people mainly working in the mining industry. Water contamination by heavy metals, frequent mine collapse and a tornado forced people to flee. Picher is currently a ghost town with a population of under 10 people. In this research project, samples were collected approximately 20 miles apart above Picher before contamination and below Picher, after the contaminated area.

Study Area

Figure 1. Detailed map of the study area, with the locations of the two core samples shown with yellow markers.



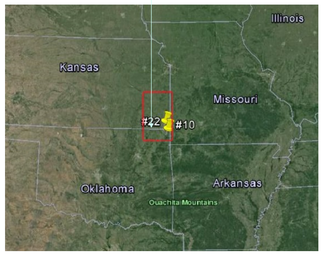


Figure 2. Generalized map of the study area, showing the location of the analyzed core samples (#10 and #22).

Purpose of the Study

Our main aim is to determine the lead isotopic compositions in two core samples. The ***hypothesis*** to be tested is that the collected core samples are similar to the lead isotopic compositions of the Mississippi Valley-type ores from the Tri-State (KS, OK, MO) district. A similar isotopic signature would suggest a common source of Pb contamination. In addition, we will determine the variation in lead concentration with depth in the samples. The analyses will be carried out on a Nu Plasma multi-collector inductively-coupled plasma mass spectrometer (MC-ICP-MS).

Methods and Results

1) Sediment core samples were collected approximately 20 miles apart and stored in a polycarbonate core barrel (Sample 10 and Sample 22)
2) The cylindrical core samples were removed from the barrel by slicing samples at 1.5-2.0cm depth from the bottom to top ensuring minimal contamination between samples
3) Eight sections were obtained from Sample 10 and eleven from Sample 22 (Table1)
4) From each section, extract the least contaminated part, preferably from the middle half filling a vial (Store the remaining samples in the cabinet)
5) Rinse the samples in the vials 3-4 times with Milli-Q water then 2-3 times with triple distilled water
6) Ultrasonicate for 15 minutes then discard the liquid part in the samples
7) Rinse the samples in the vials 3-4 times with Milli-Q water then 2-3 times with triple distilled water and let them dry.
8) Weigh about 2.000g of each sample and place in clean, acid-leached vials (Measurements shown in Table 1)
9) Add 15ml of HCl and 200µl of 30% H_2O_2 to each sample
10) Leach all samples in the Pubnoff Metabolic Shaking Incubator at 57derees for 2 hours
11) Pipette 9-11ml of the leachate from the vials into a centrifuge tube without disturbing the residue
12) In the laminar flow hood, pipette 3ml of each sample into smaller vials and allow them to dry

Core Sample 10	Sample Weight(g)	Core Sample 22	Sample Weight(g)
0.0 -2.0cm	2.003	0.0-1.5cm	2.004
2.0-3.5cm	2.003	1.5-3.0cm	2.000
3.5-5.0cm	2.004	3.0-4.5cm	2.002
5.0-6.5cm	2.004	4.5-6.0cm	2.002
6.5-8.0cm	2.005	6.0-7.5cm	2.001
8.0-10.0cm	2.004	7.5-9.0cm	2.001
10.0-12.0cm	2.006	9.0-10.5cm	2.001
12.0-14.0cm	2.004	10.5-12.0cm	2.003
		12.0-13.5cm	2.000
		13.5-15.0cm	2.003
		15.0-16.5cm	2.003

Table 1. Sample depths and weights from the two core samples

Future work

Samples will be analyzed on a Nu Plasma MC-ICP-MS

Figure 3. The Nu Plasma multi-collector inductively-coupled plasma mass spectrometer (MC-ICP-MS)

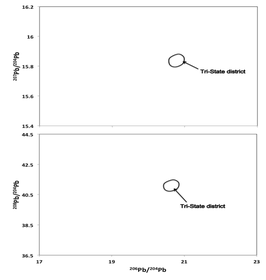


Figure 4. Lead isotopic compositions of the MVT ore Samples from the Tri-State district.

Discussion and Conclusion

This research study is aimed at comparatively evaluating the isotopic composition of lead adsorbed in sediment due to contamination. To prove our hypothesis, the Pb isotopic signature should plot within the field defined by the MVT ore samples from the tri-state district. However, due to time constrains, comprehensive data are not available at the moment. Our research laboratory is committed to carry out this project into completion to determine the varying composition of lead with depth around Picher,OK.

Acknowledgements

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