Legacy lead from past mining activity and gasoline additives: evidence from lead isotopes and trace element geochemical studies in the Arkansas River and White River basins, southern Ozark Region

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Lead isotope compositions (Nu Plasma MC-ICP-MS), and Pb and Zn concentrations (Thermo Scientific iCAP Q ICP-MS) in stream sediment leachates in the Arkansas and White river basins, and in ores from the Tri-State and Northern Arkansas Zn-Pb mining districts show that the effect of past mining activity and leaded gasoline on Pb concentrations in the river sediment can be documented.

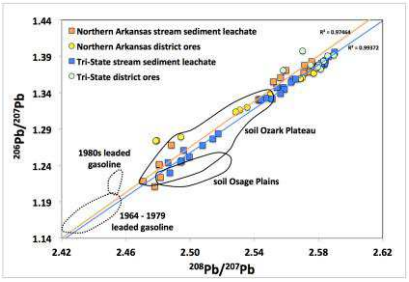

Figure 1: Lead isotope compositions of ores and stream sediment leachates in the southern Ozark region. Also shown are the Pb isotope compositions of leaded gasoline [1] and Ozark Plateau and Osage Plains soils [2].

Most analysed samples have toxic metal concentrations above the US EPA Sediment Quality Guidelines Threshold Effects Level. The Pb and Zn concentrations in downstream sediment leachates are directly related to the distance to mines. The Pb isotope values in downstream samples and MVT ores are similar, suggesting that most of the Pb adsorbed onto stream sediments was sourced by the ores. The heavy metal concentrations are significantly lower in the upstream sediments and show the influence of the leaded gasoline. The Pb isotope values of the upstream samples are similar to those defined by soils from the Osage Plains and Ozark Plateau, suggesting that Pb from historic mining does not dominate upstream sediments. However, a linear regression line through the leachate data indicates that mixing between two end-members represented by leaded gasoline and ores could generate the less radiogenic Pb isotope ratios noticed in the upstream leachates.

[1] Dunlap *et al.* (2008) *Geochim Cosmochim Acta* **72**, 5935-5948. [2] Reimann *et al.* (2011) *Appl Geochem* **26**, 1623-1631.