

Road inputs dominate lake sediment chemistry in Pittsburgh

Questions

- 1) How has metal contamination changed in Pittsburgh over the last 150 years?
- 2) What are the relative contributions of industrial activities and roads to metal contamination?

Findings

Bottom sediments from a pond in Harmar Township were collected to reconstruct the potential consequences of Pittsburgh's industrial emissions on downwind areas. There are unexpected patterns in the relative contribution of contaminant sources to Harmar Pond over the last 150 years. Figure 1 shows spikes in some metal concentrations during Pittsburgh's peak iron and steel production eras. However, the most important contamination source to this pond over the last 70 years has metal chemistry similar to road runoff. This likely reflects drainage from nearby Interstate 76 which flows directly into the pond. There is a substantial and coherent shift in trace metal chemistry in the 1940s coincident with the opening of the Interstate 76 extension in Harmar.

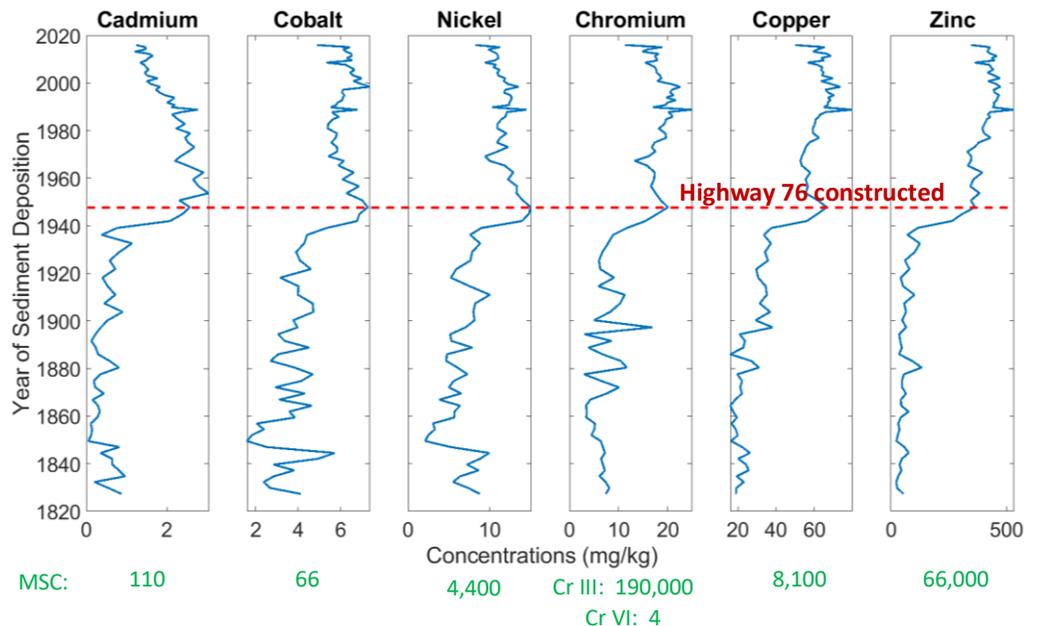


Figure 1: Metal concentrations increase post highway construction.

Concentrations of cadmium, Co, Ni, Cr, Cu, and Zn in Harmar sediments all increase after the construction of Interstate Highway 76, marked by the dashed red line. For reference the Medium-Specific Concentrations (MSC) of regulated substances in soil in residential areas are indicated with green text in units of mg/kg.

Memphis Hill,
 Dan Bain

April 2019

Rationale

Despite its reputation as “Hell with the lid off”, there is surprisingly little documentation of contamination history in Pittsburgh. This knowledge gap impedes our ability to target restoration and clean-up efforts, plan the next wave of green infrastructure investment, and assess disparities in environmental quality.

Approach

Historical and current trace metal contamination is reconstructed in a sediment core collected from a pond in Harmar Township, a lake located several miles northeast of Pittsburgh.

Road emissions dominate lake sediment chemistry in Pittsburgh

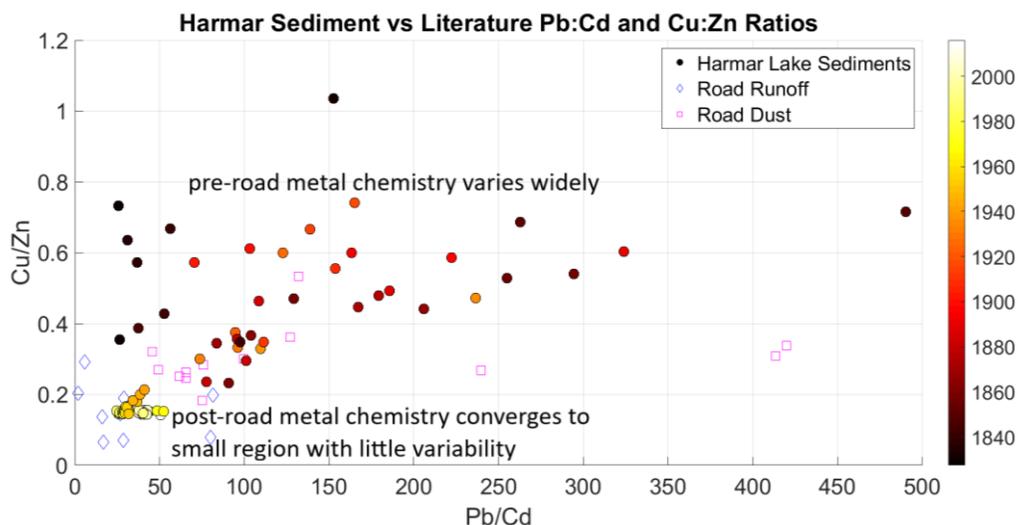


Figure 2: Converging sediment chemistry post highway construction.

Figure 2 compares the measured metal chemistry of Harmar sediments with the metal chemistry of potential sources. Here, sediments deposited after 1946 converge to a similar metal chemistry in the lower left-hand corner. The ratios of lead to cadmium (Pd/Cd) and copper to zinc (Cu/Zn) have remained very consistent since the construction of highway I-76. The observed Pb/Cd ratios of less than 100 and Cu/Zn around 0.2 match well with published data on road runoff. Metal chemistry in Harmar pond had higher variability in sediments deposited prior to I-76 construction, reflecting a wider variety of metal sources in the past.

Implications

- Metal contaminants accumulate in pond and lake sediments over time and record environmental conditions.
- Since its construction, Interstate I-76 has dominated heavy metal chemistry contributions in Harmar Pond.
- Road inputs dominate metal contamination in soils and sediments in near road areas, and likely are more important in these areas than industrial emissions.

The reconstruction of metal deposition history from sediment core analysis reveals legacy contamination of natural environments, particularly from roads.
