Differentiating Anthropogenic and Geologic Sources of Arsenic Near Anaconda, MT

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Groundwater quality has been impacted by arsenic (As) in some areas near Anaconda, Montana. Previous work has shown that elevated As concentrations exist in soil and shallow groundwater as a result of historic smelting activities. However, elevated As concentrations in groundwater (~30 μg/L) have also been observed at depths of 525 feet below land surface, presumably far beneath the zone expected to be contaminated by smelter emissions. The primary goal of this work was to geochemically characterize soil, sediment, rock, and groundwater to determine if natural sources of arsenic (As) exist in the area.

Valley-fill sediment and rock cores were collected, along with soil samples in four areas that had elevated groundwater As concentrations. All of the soil samples had elevated As concentrations (up 164 mg/kg). All the sediment and rock samples had measureable As (>1 mg/kg) and could contribute to the As concentrations found in groundwater (>10 μg/L). However, As-bearing sulfides (up to 26,000 mg/kg) were encountered at depth in two locations.

Aqueous samples were collected from 80 wells. Dissolved sulfate isotopic data ($\delta^{34}S$ and $\delta^{18}O$) and Cl^- and NO_3^- data correlations show that samples from deep geothermal wells and areas with known sulfide mineralization, group separately from most of the other samples. Furthermore, samples with $\delta^{34}S$ values > 14‰ were indicative of areas with natural sources of As and samples with $\delta^{34}S$ values < 10‰ were indicative of wells with suspected smelter contamination (shallow monitoring wells). Most domestic wells also had $\delta^{34}S$ values < 10‰.