The origin of Darreh-Zanjir lead-zinc Deposit, 'Central Iran'

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The Darreh-Zanjir Zn-Pb deposit is located 25 km south-west of Yazd province within Cenozoic magmatic belt of central Iran. It occurs in the Lower Cretaceous dolomitized limestones of Taft Formation and is underlained by Albian shales of Biabanak Formation. A major fault known as Darreh-Zanjir thrust fault is associated with minor faults and trending east, north-east seems to control the mineralization. This fault is also responsible for pushing Lower Cretaceous carbonate strata over the older Albian shales. Cretaceous dolomite formed by metasomatism of Lower Cretaceous orbitolinous limestone, hosts the Pb-Zn mineralization.

The carbonated-hosted epigenetic mineralization consists of primary galena and sphalerite and secondary carbonates such as cerussite and smithsonite. The principal type of mineralization is irregular, open space filling, forming vein and stockworks. Two stages of mineralization are indicated. The first being the dolomitization of limestone followed by invasion of metal-bearing hydrothermal solutions. Mineralization is confined to fault planes, fractures and their margins. Several factors including geologic setting, lithology, and hydrothermal solutions have played a role in the mineralization. Minor faults and fractures have also provided suitable conditions for secondary dolomitization and mineralization. Field observations, mineralogy and geochemical investigations show that Darreh-Zanjir Pb-Zn deposit is a Mississippi Valley Type deposit.

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Natural attenuation of metal contaminants in a large mine-impacted river: A long-term case study of temporal and spatial trends

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We conducted a 20-yr study to determine environmental trends in a mine-impacted watershed in Northwestern Montana, USA. About 100 million tons of waste from copper and precious metals mining were disposed of in the headwaters of the Clark Fork River (CFR) between 1880 and 1982. Large amounts of contaminated material were transported downstream and deposited on the floodplain, where it acts as a secondary source of contamination to the river. Our study focuses on spatial and temporal trends of As, Cu, Cd, Pb and Zn in fine-grained bed sediments along a 200-km river section below a set of tailings ponds that were constructed to cut off the source of contaminants upstream. Remediation in this section has been minimal, providing an excellent area to study natural attenuation of contamination. We collected monthly sediment samples from three locations for most months between 1991 and 2010. In addition, four sets of about 40 sediment samples were collected longitudinally in 1991, 1998, 2001 and 2009. The longitudinal concentration profiles showed decreasing contaminant concentrations, with temporal trends being less obvious than for monthly samples at the three sites. Initial concentrations for As, Cd, Cu, Pb and Zn at the most upstream monthly sampling site were 140, 8.3, 1400, 220, 1500 mg/kg, respectively, in 1991. Monthly samples for all elements and sites trended down over time following a first-order exponential decay model. However, half-lives of sediment concentrations differed considerably between elements, suggesting element-specific processes affecting their transport and retention in the system. Half-lives for Cd were 10 ± 0.5 yr for the three locations in the watershed. Half-lives for Cu, Pb and Zn were 22 ± 5 yr, and for As 35 ± 10 yr. Our monthly sampling also revealed high variability without obvious relationships to seasonal or annual variations of the hydrograph, showing that sediment sampling in long intervals (e.g. annually) is insufficient to accurately estimate trends. Our exponential 'decay' model predicts when acceptable contaminant levels will occur without human intervention. Thus, these results may assist with the selection of cleanup strategies, for example where natural mixing and transport processes may be preferable over engineering approaches to remediation.