Impact of Fe minerals on the stability of microbially immobilized Zn

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In situ bio-precipitation (ISBP) induced by sulphidogenesis leads to removal of heavy metals from groundwater. However, the long term stability of the formed metal precipitates is an issue. Fe being the second most abundant metal on earth influences various natural and engineered processes. Here, we investigated the impact of three Fe minerals *viz*. ferrihydrite, goethite and glauconite on the stability of microbially immobilized Zn under changing redox conditions. The column set up consisted of microbially precipitated Zn in the presence and absence of Fe minerals. The groundwater passing through the column were flushed with N_2, N_2/O_2 and N_2/CO_2 (in parallel) to simulate changing redox conditions. The results revealed that presence of Fe minerals during Zn immobilization indeed enhanced the stability of Zn under changing redox conditions. When groundwater flushed with N_2/O_2 was introduced, then approximately 28% precipitated Zn leached out in no Fe condition as compared to only up to 2% leaching in presence of Fe minerals (Fig. 1).

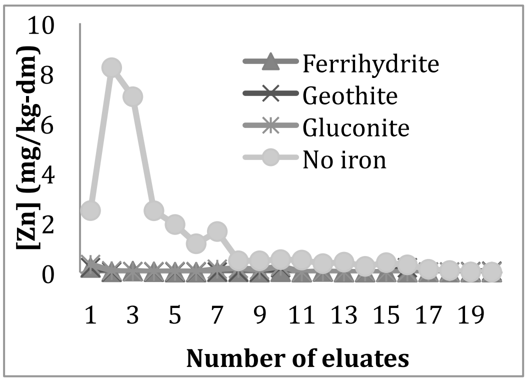

Figure 1: Zn leached in presence and absence of Fe minerals in various column elauates in N_2/O_2 condition.

Similar results were obtained in other tested conditions. Impacte of the presence of excess Fe in the incoming groundwater was also studied. SEM-EDX investigations were conducted to further investigate the mechanism of Zn and Fe co-precipitation.

Volatility of metals during subduction-related 'distillation' and the geochemistry of epithermal ores

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Shallow epithermal ores formed since ~75Ma in the western USA exhibit a continent-scale, geographic geochemical zonation from west to east exhibiting this pattern: Hg-rich->Se-rich->Te-rich. This geochemical zonation parallels the increasing depth to the subducted Farallon slab during the Laramide Orogeny in the region, which suggests that depth to the slab may have played a role in mantle 'preparation' prior to partial-melting processes that led to magmatism, volcanism and ore formation in the crust. Epithermal ores and associated volcanic rocks in western USA formed as a consequence of several large-scale geotectonic processes: 1) Cretaceous-Tertiary Laramide subduction and associate porphyry and epithermal deposits; 2) Post-subduction Eocene rifting and/or 'anorognesis' triggered epithermal ore formation in Pacific Northwest (Republic, Wenatchee), porphyry ores at Bingham, Utah, and magmatism associated with Carlin-type Au ores of Nevada; 3) Oligocene onset of Basin and Range rifting (and continued subduction?) triggered formation of Cripple Creek (CO) epithermal Au-Ag ores, caldera-related ores in the Central Colorado volcanic field (CO) and Great Basin (NV, UT) and their associated epithermal Au-Ag ores, Climax-type Mo deposits; 4) Miocene emergence of Yellowstone hotpsot triggered localized bonanza epithermal Au-Ag ores in the northern Great Basin; and 5) rift- or strike-slip-related magmatism and epithermal ores. Given the disparate nature of these major geotectonic events, it is significant that the observed geochemical zonation of epithermal ores appears to transcend those events, indicating a larger-scale control on metals distribution.