IHE-Adart: An innovative Dutch Arsenic removal technology

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The main objective of the study was to develop new and affordable arsenic removal process based on use of low-cost, regenerable adsorbents.

The technology is based on arsenic adsorption on Iron Oxide Coated Sand (IOCS), and *in situ* regeneration of exhausted adsorbent. IOCS is a by-product of iron removal groundwater treatment plants. Developed regeneration procedure is based on re-coating of adsorbent with a new active nano-layer of iron (hydro)oxides. Batch adsorption studies demonstrated that IOCS has high potential to effectively remove both arsenate and arsenite from model water. Arsenite that comes in contact with IOCS is presumably catalytically oxidized to arsenate and subsequently adsorbed onto the IOCS surface. Arsenic adsorption capacity of IOCS from several treatment plants was found to be comparable to that of commercial arsenic adsorbents. Results from laboratory filter experiments showed that filtration through IOCS filter bed can highly effectively and consistently remove high concentration of arsenite spiked to the model water (Fig.1). *In situ* regeneration cycles conducted periodically resulted in substantial restoration of IOCS adsorption capacity. No significant shift in arsenic removal profile along the filter bed was observed after almost 150 days of continuous operation and 15 regeneration cycles conduced.

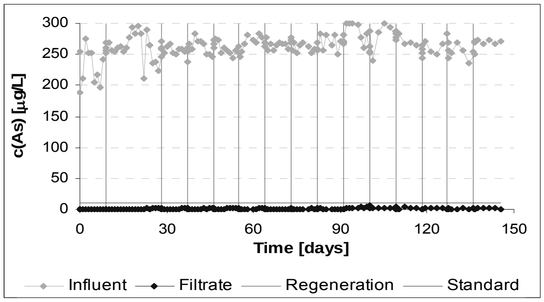

Figure 1. Arsenic in feed water and filtrate of laboratory pilot filter with 2.5 m of IOCS.

The source of copper, gold and molybdenum in giant porphyry-type ore deposits from western North America

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Calcalkaline magmas producing porphyry-type ore deposits are thought to be generated by contemporaneous subduction zone processes. We show here that this is not required.

Lead isotope ratios measured in individual fluid inclusions from 37 Ma old high-temperature hydrothermal ore veins at Bingham Canyon, USA, are uniform and conspicuously non-radiogenic, for both the Cu-Au and the distinctly later Mo stage. These data lie at the non-radiogenic end of a linear array described by *in situ* Pb isotope data from felspars of shallow intrusions bracketing the ore-forming event. It indicates mixing between components from depleted mantle and non-radiogenic, ancient Pb.

Lead isotope forward modeling of the non-radiogenic Pb component reveals a history dating back to the Archean. Three events characterize this evolution. (1) Archean extraction of crustal components, that then evolved with elevated μ- and κ-values in isolation for >1 Ga. (2) During the assembly of Laurentia at ca. 1.8 Ga, this material was subducted and released a Pb-rich but U- and Th-poor fluid component that metasomatized the overlying depleted mantle. This metasomatized mantle then evolved in isolation until incipient extensional tectonics triggered its partial melting in the late Eocene to form the Bingham magmas and associated giant Cu-Mo-Au deposit.

Such distinctly non-radiogenic, lead-rich, ancient source domains are extensive beneath western North America and have been identified at Butte, Henderson, Questa, and at ore deposits in SE Arizona. We propose that Cenozoic melting of lithospheric mantle metasomatized by subduction fluids during the early Proterozoic has provided the metal endowment and subduction flavor for the formation of giant magmatic-hydrothermal ore deposits in western North America, which together constitute the world's major molybdenum province.