Experimental Insights Into the Mobility and Extraction of Metals in Sedimentary Basin-Hosted Copper Systems

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Understanding the extraction and transport of metals in sedimentary basins is important because basin-hosted copper deposits host more than 23% of the world's discovered copper (Brown, 2007) as well as other metals such as vanadium and cobalt.

Red bed sandstones have been identified as potential metal sources for sedimentary basin-hosted copper deposits because they are a characteristic facies in the mineral system and their iron oxide coatings can adsorb metals. The dissolution of these coatings could lead to the formation of an ore fluid (Parnell et al., 2021). However, previous experiments to understand the extraction and mobility of copper and other trace elements have not considered flow effects, elevated temperatures, or brine chemistry variations.

Hence, we report new experiments to quantify the release of metals from red bed sandstones while in contact with aqua regia and a variety of natural brines. Experiments with aqua regia are used to determine the total leachable metal content of the rocks, whereas brine experiments represent conditions more relevant to metal mobilisation in sedimentary basins. Leaching under aqua regia revealed a significant variability of trace element concentration from the red bed sandstones, with ore-bearing basins displaying higher trace metal concentrations. We found the highest concentrations of copper in samples from the Neuquén Basin (Argentina) and Katangan Basin (Zambia). Preliminary results from the brine-leaching experiments show that sandstones have a highly variable ability to exchange protons and therefore buffer pH.

References:

Brown, A.C., 2007. World-class sediment-hosted stratiform copper deposits: Characteristics, genetic concepts and metallotects. Australian Journal of Earth Sciences 44:3, 317-328.

Parnell, J., Wang, X., Raab, A., Feldmann, J., Brolly, C., Michie, R., Amstrong, J., 2021. Metal Flux from Dissolution of Iron Oxide Grain Coatings in Sandstones. Geofluids, 5513490.