

Variable Mobilization of Copper From Grain Coatings in Red-bed Sandstones as a Control on the Endowment of Sediment-hosted Copper Basins

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Sediment-hosted ore deposits contain >23 % of the world's discovered copper and other metals such as cobalt and vanadium. Red-bed sandstones have been identified as potential metal sources for sediment-hosted Cu(-Co-V) ores because they are volumetrically abundant in the basins hosting such deposits and the iron oxide coatings on grain surfaces can adsorb metals. Dissolution of these coatings could lead to the formation of ore fluids. Here, we report acid leaching experiments using aqua regia to determine the total leachable metal content of 56 red-bed sandstones from 13 basins, including samples from basins with and without known economic ore deposits. Results indicate that oxide grain coatings are a likely host of many adsorbed metals. Preliminary analysis using supervised machine learning suggests that acid leaching data can discriminate basins of different endowments. Simple mass-balance considerations suggest that red-bed sandstones are present in sufficient volume to supply the known metals in well-endowed basins. Well-endowed basins may be distinct because they host local packages of red-beds with much higher labile metal content. Additional brine leaching experiments on a subset of samples reveal that metal mobility is strongly influenced by brine major element chemistry, with implications for secular and climatic controls on the mobilization of metals in red-bed basins.