

Organic Alteration in Hydrothermal Sulfide Ore Deposits

ANDREW P. GIZE

Department of Earth Sciences, University of Manchester, Manchester M13 9PL, United Kingdom

Abstract

Many ore deposits are enriched in transition metals, especially iron, whereas organic carbon is a minor component. Based on currently available analyses, variations in bulk chemistry of organic matter in ore deposits correlates with differences in phase equilibria in the system Fe-S-H₂O. In the pyrrhotite and magnetite stability fields, extractable organic compositions are restricted to molecules with relatively few carbons. Organic matter in pyrite-rich deposits reflects biochemical precursors, pyrite also being the stable Fe-S phase in fossil fuels. Oxidation of relatively iron-poor deposits results in microbial oxidation of the organic matter. In iron-copper deposits, oxidation results in aromatization and the generation of organosulfurs. In H₂O-dominated systems, the fluid is a hydrogen source to the organic matter, whereas organic products in CO₂-dominated fluids are hydrogen depleted. The organic matter in ore deposits, therefore, is often considered to be an alteration product, reflecting the dominant iron phase, temperature, and the alteration fluid composition.