Economic Geology
Vol 94, 1999, pp. 1051-1066

Sedimentary Exhalative Nickel-Molybdenum Ores in South China

D. A. LOTT, R. M. COVENEY, JR., J. B. MUROWCHICK,
Department of Geosciences, University of Missouri, 5110 Rockhill Rd., Kansas City, Missouri 64110

AND R. I. GRAUCH
U.S. Geological Survey, Mail Stop 973, Denver, Colorado 80225

Abstract

Unique bedded Ni-Mo ores hosted by black shales were discovered in localized paleobasins along the Yangzte platform of southern China in 1971. Textural evidence and radiometric dates imply ore formation during sedimentation of black shales that grade into readily combustible beds, termed stone coals, which contain 10 to 15 percent organic carbon. Studies of 427 fluid inclusions indicate extreme variation in hydrothermal brine salinities that were contained by Proterozoic dolostones underlying the ore zone in Hunan and Guizhou. Variations of fluid inclusion salinities, which range from 0.1 to 21.6 wt percent NaCl equiv, are attributed to differences in the compositions of brines in strata underlying the ore bed, complicated by the presence of seawater and dilute fluids that represent condensates of vapors generated by boiling of mineralizing fluids or Cambrian meteoric water. The complex processes of ore deposition led to scattered homogenization temperatures ranging from 100° to 187°C within the Hunan ore zone and from 65° to 183°C within the Guizhou ore zone. While living organisms probably did not directly accumulate metals in situ in sufficient amounts to explain the unusually high grades of the deposits, sulfur isotope ratios indicate that bacteria, now preserved as abundant microfossils, provided sufficient sulfide for the ores by reduction of seawater sulfate. Such microbiota may have depended on vent fluids and transported organic matter for key nutrients and are consistent with a sedex origin for the ores. Vent fluids interacted with organic remains, including rounded fragments of microbial mats that were likely transported to the site of ore deposition by the action of waves and bottom currents prior to replacement by ore minerals.