

Organic matter around Miocene Kuroko ore deposits: Implications to Archean submarine hydrothermal microbial community

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Kuroko ore deposits were products of black smoker activities at 15 Ma paleo-Japan Sea. Kuroko is often covered by organic-rich sedimentary rocks, but details of these organic matter have not been unclear. Here I report analytical results of stable isotopes, Raman spectroscopy and bitumen compositions of organic matter around Miocene Kuroko deposits.

In general, all geochemical characteristics of organic matter were uniform in the same horizon of Kuroko deposits. On the other hand, H/C ratios and Raman spectroscopic data suggest that organic matter were extensively graphitized by thermal degradation only around Kuroko. More ¹²C- and ¹⁴N-enriched features are found in Kuroko-associated kerogen and bitumen. Such stable isotope data suggest the presence of chemoautotrophs, which utilized hydrothermal CH₄ and NH₃. However, geochemical and geological characteristics of the examined samples suggest that hydrothermal CH₄ and NH₃ were produced by thermal degradation of sedimentary organic matter, which are mainly derived from photoautotrophs. This further suggests that chemoautotrophs at Kuroko were not independent and had strong connection to surface photoautotrophs.

Organic matter enriched in ¹²C and ¹⁴N are ubiquitous around many middle-Archean Kuroko ore deposits. Such stable isotope compositions also imply the presence of submarine hydrothermal microbial communities. However, ¹²C- and ¹⁴N-depleted organic matter, which most likely represent photoautotrophs, are also common around Archean Kuroko deposits. Such contrast stable isotope characteristics suggest that deep submarine chemoautotrophs already had linkages to surface photoautotrophs since Archean age.

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