Geochemical records of microbial activities in 2.7 Ga volcanogenic massive sulfides at Potter Mine, Abitibi Greenstone Belt, Canada

TOMOTARO ODAKA[1-1], TAKESHI KAKEGAWA[1-2]

[1]Graduate School of science, Tohoku University
[1-1](tomotaro.odaka.p8@dc.tohoku.ac.jp)
[1-2](kakegawa@m.tohoku.ac.jp)

Volcanogenic massive sulfide (VMS) deposits occur in the Kidd-Munro assemblage of Abitibi Greenstone Belt in Canada [1]. Those VMSs are often associated with black shale. It is unclear as to which microorganisms were responsible for enrichment of organic matter in those black shale. VMS associated with black shale is found at Potter Mine, Munro Township, Ontario, Canada. Chalcopyrite, sphalerite and pyrrhotite are major constituents of ores. Ores appear as stratabound forms, or disseminated forms in hyaloclastite or carbonaceous sediments. Examination of drilled core samples indicates sulfide ores appear at 11 different stratigraphic positions, and 5 positions are associated with black shale. Talc and Mg-chlorite are abundant in altered footwall hyaloclastite. Calcite and Fe-dolomite are also found in VMS and altered volcanic rocks. Such mineral characteristics indicate VMS at Potter mine was formed by H_2S-CO_2-rich hydrothermal fluids. Black shale contains more Fe-rich chlorite, suggesting large amounts of Fe were introduced during sedimentation by hydrothermal fluids. Sulfur isotope compositions of sulfides are ranging from -0.49 to 4.63 per mil (CDT).

Raman spectroscopic analyses indicate less metamorphosed and low graphitization characteristics of organic matter. Carbon isotope compositions of organic matter are ranging from -45.88 to -38.79 per mil (PDB), suggesting CH_4-oxidizing bacteria were active besides other microorganisms when hydrothermal fluids were discharging. Carbon isotope composition of carbonate mineral is -15.96 per mil (PDB), indicating that sedimentary organic matter was source for carbonate carbon. Such hydrothermal decompositions of sedimentary organic matter also produced CH_4. CH_4 discharging in local seawater most likely activated CH_4-oxidizing bacteria at Potter site.

[1] Péloquin et al. (2005), *Ontario geological survey open file report* **6157**.