Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

BAO01-08 Room:502 Time:April 28 11:25-11:40

Cu-Zn ores in 2.7 Ga komatiite-basalt assemblages in Abitibi Greenstone Belt, Canada, and their associations to microbs

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Archean greenstone belts are hosting many massive sulfide ores. In particular, komatiite-basalt sequences are hosting Ni-Cu ores, which are mostly considered as a magmatic in origin. Some Ni-Cu ores are associated with serpentinization near seafloor. Such serpentinization may have been important for early life as hydrogen donors with alkaline fluids. Cu-Zn-Pb ores are also reported from the same komatiite-basalt sequences, although the origin of these ores are still uncertain. One representative 2.7 Ga komatiite-basalt sequence appears in the Munro area of the Abitibi Greenstone Belt. In order to understand the origin of Cu-Zn-Pb ores, mineralogical and geochemical studies are performed on ores at Munro area. Sulfide ores are essentially developed in black shale zones, and some ores are disseminated in altered volcanic rocks. Chalcopyrite, sphalerite, pyrrhotite are major minerals associated with minor galena, electrum, pentlandite, etc. Sulfur isotope compositions of those sulfides are ranging are not magmatic values. Some ores are rich in Se and As. Host volcanic rocks are extensively hydrated (followed by metamorphism) forming tremolite, chlorite and talc. Those features are similar to the modern submarine hydrothermal deposits, rather than magmatic ore deposits. Therefore, Cu-Zn-Pb ores in komatiite-basalt sequences were formed by black smoker type submarine hydrothermal activities. Carbon isotope analyses of organic matter in ore-associated sediments suggest that methanogens were active when komatiite became serpentinite, followed by submarine hydrothermal activities.

Keywords: Komatiite, ore, submarine, Abitibi, microbe