[JJ] Evening Poster | B (Biogeosciences) | B-CG Complex & General

[B-CG09]Decoding the history of Earth: From Hadean to the present

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Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

The latest results of Earth's evolution and geological processes through 4.6 billion years from Hadean to Modern, based on various approaches including fieldworks, chemical analyses, experiments and computer simulation, will be presented. In this session, we aim to discuss and understand causal relationships and interplay among the evolution of Earth's deep interior, changes in the surface environments, and development and evolution of life. Wide-ranging topics are accepted.

[BCG09-P08]Geological and geochemical studies of 2.7 Ga banded iron formation and black shale in Kukatush, Swayze Greenstone Belt, Ontario, Canada.

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Large volumes of volcanogenic massive sulfide deposits and banded iron formations (BIFs) were formed at ca. 2.7 Ga, because of intense global volcanisms. These events most likely enhanced fluxes of metals and sulfur into 2.7 Ga oceans, possibly stimulating microbial activities. In the previous study, models of “rise of methanogens” and “sulfate-poor ocean” were proposed for 2.7 Ga environments. However, necessity exists to accumulate more data to examine the above models.
In the present study, we performed geological and geochemical studies on 2.7 Ga BIFs and associated black shales in Kukatush, Ontario, Canada to examine the contemporary marine ecosystem.
BIFs in this area are overlain by ultramafic rock and underlain by felsic tuff. Magnetite and siderite are major constituents with SiO2. In addition, two shale layers were found in the BIFs stratigraphy. The lower shale unit present between BIFs and felsic tuff, with a thickness of 4.5 meters. This layer was mainly composed of clay minerals, pyrite, and carbonate. The other shale unit is interlayered with BIFs units, with a thickness of 0.5 meters. The major minerals of this shale are clay minerals and pyrrhotite.
Isolation of organic matter was carried out for 33 shale and BIFs samples. However, for BIFs samples, we could not obtain the sufficient amount of organic matter for the geochemical analysis (below the detection limit: <0.1 wt%). In contrast, shale samples had sufficient amounts of organic matter (range 0.2~2.1 wt%). The δ^{13}C values of organic matter range from -31.2 to -30.2‰. Those values are much higher compared to δ^{13}C values of other 2.7 Ga sedimentary organic matter. The δ^{34}S values of pyrite are ranging from -1 to +15‰. This variation suggests that isotope fractionation of sulfate by sulfate-reducing bacteria, indicating sulfate-rich ocean water in the Kukatsush sedimentary basin. Methanogenic and methanotrophic activities are, in general, controlled by availability of sulfate in ocean water. The δ^{13}C values of organic matter, which does not have methanogen and methanotroph signatures, in examined samples also give supportive evidence of sulfate-rich sedimentary environments. Those results provide new constrain to the evolution of late Archean biosphere.