Microbial community associated with 2.7 Ga submarine hydrothermal activities: geochemical and STEM studies on kerogen from Canadian greenstone belts

YUKI KUNITAKE[1*], TAKESHI KAKEGAWA[1], YUMIKO WATANABE[2]

[1,2]Department of earth science, Graduate school of science, Tohoku University Aramaki 6-3 Aoba-ku, Sendai, Miyagi 980-8578, Japan (* yuki.kunitake.q2@dc.tohoku.ac.jp)

Submarine hydrothermal activities were intense on ca. 2.7 Ga ocean floor. In order to examine relationship between hydrothermal activities and microbial ecosystem in 2.7 Ga oceans, geochemical studied are performed on sandstones and shales from Schreiber area and Kidd Creek Mine in Ontario of Canada. The H/C atomic ratios of extracted kerogen range from 0.01 to 0.14, consisting with sharp G peak detected by Raman spectroscopic analyses.

Kerogen in sandstone shows $\delta^{13}C$ values around -28 per mil. Such values are most likely reflecting $\delta^{13}C$ values of surface photoautotrophs. Our geological survey indicates that examined black shales represent metalliferous sediments around hydrothermal vents. $\delta^{13}C$ values of kerogen in black shale are less than -35 per mil. These values represent mixture of surface photoautotrophs and benthic submarine microbial communities, such as methanogens and methanotrophs.

TEM-EDX analyses on kerogen in shale detected Mo and Co. These metals are not present as sulphides but associated with carbon in kerogen. It is interpreted that Mo and Co were initially discharged into 2.7 Ga oceans by submarine hydrothermal activities, and then metabolized by benthic microbial community. Therefore, Mo- and Co-kerogen compounds found in the present study most likely represent chemical fossil of coenzyme in submarine hydrothermal microbial community. Late Archean submarine hydrothermal activities were creating reducing environments, supplying bio-essential elements and activating vent microbial community, while photoautotrophs were also active independently.