

Geological and geochemical study of lower-Fig Tree Group in Josefsdal, South Africa

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Understanding extent of Archean biosphere and conditions of surface environments is important subject to understand evolution of the Earth. Accumulating more geological and geochemical data on Archean sedimentary rocks is necessary to approach the above problem. Therefore, geological and geochemical studies are performed on Fig Tree Group (~3.2 Ga) and Onverwacht Group (~3.4 Ga) in the Barberton Greenstone Belt, South Africa in the present study. The objectives of this study were (1) to survey lower-Fig Tree Group and upper-Onverwacht Group, which were not described in previous literatures and (2) to constrain paragenesis of minerals, including sulfides, in the sediments, and (3) to investigate the carbonaceous matter (CM) in the black chert in the Fig Tree Group using the raman geothermometer of Beysac et al (2002) and to discuss microbial ecosystem through stable carbon isotopic compositions ($\delta^{13}\text{C}$).

Result of the outcrop survey revealed that our research areas correspond to stratigraphy to that of Hoffman (2005), who studied area in the Fig Tree Group in the BGB. Mineralogical investigations showed that Ni-rich sulfide minerals were abundant and some of them were chemically zoned in the black chert. These observations suggest that represent carbonaceous sediments in the lower-Fig Tree Group were silicified by later hydrothermal fluids which contain abundant Ni, most likely coming from ultramafic rocks. Using the raman geothermometer, the peak temperature about CM in the black chert in the Fig Tree Group is estimated to be approximately lower than 330 ± 50 °C, suggesting very low metamorphic grade (lower green schist).

Additionally, $\delta^{13}\text{C}$ values of the examined samples in the Fig Tree Group ranged from -28.9 ‰ to -23.2 ‰. Carbon isotope compositions of Onverwacht Group samples are ranged from -30.63 ‰ to -26.5 ‰ (PDB), which is within a range of organic matter produced by Calvin cycle using atmospheric CO_2 , such as cyanobacteria.

Keywords: Carbonaceous sedimentary rock, Hydrothermal process, Barberton Greenstone Belt, Fig Tree Group