

**Biosignatures recorded in
geochemical correlations
between organic matter and Fe-
bearing minerals in 3.2Ga
banded iron formations,
Barberton Green stone Belt,
South Africa**

RYO NAKAJIMA^{1*}, YOKO OHTOMO¹, TSUBASA
OTAKE¹, TAKESHI KAKEGAWA², TSUTOMU SATO¹

¹Faculty of engineering, Hokkaido University, Kita
13, Nishi 8, Kita-ku, Sapporo, Hokkaido, 060-
8628, Japan

(*correspondence: gypsophilaryo@eis.hokudai.ac.jp)

²Department of Earth Science, Tohoku University,
Aza-aoba 6-3, Aramaki, Aoba-ku, Sendai,
Miyagi, Japan

Iron oxidation process in banded iron formations (BIFs) has been controversial, particularly in those formed before 2.45Ga. Previous studies suggest that microbial activity, either anoxygenic iron-oxidizing bacteria or free oxygen produced by cyanobacteria are the main mechanisms involved. Because of differences in primary productivity, geochemical characteristics of organic matter in relation to the Fe mineralogy may provide an insight to the oxidation mechanism. In this study, we focused on ~3.2Ga BIFs in the Moodies Group, Barberton Green stone Belt, South Africa since the BIFs, which were deposited in a shallow ocean, may contain higher amounts of organic carbon.

Sedimentary rock samples collected in Sheba mine were classified into the magnetite group (magnetite-rich sandstone, 13–50 wt% -Fe₂O₃) and siderite groups (magnetite-poor silty clastics, 10–30 wt% -Fe₂O₃), based on the dominant iron mineral. Microscopic features of the clastics in samples from the siderite group show that they were deposited in a relatively shallow environment compared to those of the magnetite group. However, for both groups, negative and positive correlations were observed between iron and C_{organic matter} contents, between iron and C_{carbonate} contents, respectively. This suggests that primary organic matter may have been consumed by a reaction with iron (hydr)oxides and transformed to siderite, although some samples in the siderite group bear excess carbonates, which was probably affected by later mineralization events. The δ¹³C values of the organic matter in both groups are almost identical (~-27‰). The correlations and depositional environments, based on the microscopic observations, may imply that two different biological activities, cyanobacteria and iron-oxidizing bacteria were responsible for iron oxidation in the BIFs that were deposited in a shallow ocean.