

Mineralogical study of clastic sedimentary rocks in the 3.2 Ga Moodies Group, South Africa

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It is important to investigate the timing of emergency of oxygenic phototrophs (i.e., cyanobacteria) on the early Earth. To approach this problem, Sakamoto (2012) studied chemical sedimentary rocks (Banded Iron Formation:BIF) deposited in shallow ocean environments in Moodies Group in the Barberton Greenstone Belt, South Africa (ca.3.2Ga). Sakamoto (2012) concluded that chromite in Moodies BIFs is a chemical precipitates from oxygenated 3.2 Ga ocean water. However, absence of knowledge of a clastic chromite creates ambiguity if Sakamoto's chromite was a real chemical precipitate. Therefore the objectives of this study is set: (1) to constrain paragenesis and find minerals formed under oxic environments in shallow water clastic sediments, (2) to determine the chemical compositions and occurrence of clastic chromite, and (3) to discuss microbial ecosystem through stable carbon isotopic compositions.

We collected of the Moodies Group from the under-ground mining site (Sheba mine). Chromite in the examined samples is rounded or angular and surrounded by fuchsite and Cr-bearing biotite, contrasting chemical precipitated euhedral chromite surrounded by magnetite. Mg# of clastic chromite is 0.012 to 0.043, which differs from Mg# of chemical precipitated chromite (Mg# = 0.000). Such contrast suggests that both detrital and chemical precipitated chromites are present in Moodies sedimentary rocks. Additionally, stable carbon isotopic compositions are within a range of organic matter produced by cyanobacteria. Overall results of this study indicated that presence of 3.2 Ga oxygenic shallow oceans in where cyanobacteria were active.