

Metamorphic effects on carbon isotope and REE compositions in 3.8 Ga metasedimentary rocks in Isua Supracrustal Belt

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The 3.8Ga rocks are preserved in the Isua Spracrustal Belt (ISB), West Greenland. From detail field investigation, new graphite schists were found inside of Banded Iron Formations (BIFs) in the western part of ISB (reported at this session last year). Graphite schist contains up to 4.12 wt % C. CI Chondrite normalized REE patterns shows the sedimentary origin of graphitic schist, thus black shale.

Carbon isotope compositions of graphites were determined on 14 samples. Their compositions varies -13.1 per mil to -20.7 per mil. Notable feature of these carbon isotope compositions are systematic change in compositions correlated to geological occurrence. Lightest carbon isotope composition was found in the most western area in where the highest graphite contents were found. On the other hand, heaviest carbon isotope composition was found in the most eastern area.

Such characteristics were also found in REE patterns. Chondrite-normalized REE patterns are similar to Archean sedimentary rocks in the most western area. Chondrite-normalized REE patterns of the eastern rocks are depleted in Sm, Nd and very different from the Archean sedimentary rocks.

These carbon isotope and REE characteristics are explained by more intense metasomatism in the eastern area even in the same formation. Metamorphism and/or metasomatism may make carbon isotope compositions of graphite heavier, but no mechanism is know to make them lighter. Therefore, the lightest isotope compositions found in this study is most likely closed to the initial carbon isotope composition of graphite. Microbial process is the only considerable process to form graphite which isotope composition is lighter than -20.7 per mil.