

Abiogenic graphite in the 3.8 Ga Isua Supracrustal Belt

KAKEGAWA, Takeshi^{1*}

¹Graduate School of Science, Tohoku Univ

Graphite is known to occur in the >3.7 billion years old Isua Supracrustal Belt (ISB) of western Greenland. The unequivocal documentation of biogenicity for graphite is complicated by the possibility of secondary graphite precipitation from metamorphic or igneous fluids and the difficulties in distinguishing biogenic from secondary graphite. Here I report the discovery of siderite-rich veins enriched in reduced carbon in the western ISB. In the studied area, metamorphosed basaltic rocks are dominant. Three layers of banded iron formations, enriched in magnetite, quartz, grunerite, and Fe-rich garnet, are found in the studied area. It is found that the carbonate-rich vein occurs in some banded iron formations, and such veining extends approximately 100 m from north to south. The carbonate carbon concentrations of this vein range from 2.5 to 4.5 wt %C. The concentrations of graphite range from 0.1 to 5.0 wt %C. The mineralogy associated with abundant graphite is quite similar to the secondary carbonate veins found in eastern ISB (van Zuilen et al., 2002).

Results of the present geological survey constrain that the carbonate vein was formed by interaction between pre-existing BIFs and carbonic fluids during metamorphism. Siderite was formed during the early stage of metasomatism and became a subject for further metamorphism, producing magnetite and graphite. Because BIFs do not contain recognizable amounts of graphite, graphite in the carbonate veins were certainly formed during the vein formation, thus the product by metamorphism. This finding is a second report of abiogenic graphite in the ISB. Such abiogenic graphite most likely widespread in ISB, because carbonation of BIFs are commonly found throughout the belt.

On the other hand, ¹³C-depleted graphite from sedimentary rocks are present in ISB, in particular 2 km north from the surveyed area of this study. Graphite in those sedimentary rocks are interpreted as biogenic in origin. Detailed geological, mineralogical and isotope analyses allow us to distinguish graphite generated during sedimentation from that produced during metamorphism.

Keywords: abiogenic, Isua, Archean