

Carbonate vein formation in banded iron formations and metabasalts associated with CO₂ metasomatism, Isua Supracrustal Belt, west Greenland

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Extensive carbonations in ca. 3.8 Ga volcanic and sedimentary rocks in Isua Supracrustal Belt (ISB), West Greenland, has been considered as a signature of CO₂ metasomatism in the ancient crust, which disturb primary occurrence of these rocks. Geological distribution, chemical reactions and associated fluid of the secondary carbonates still remain unknown, in particular for the northwestern part of the ISB, although evidences of the oldest ecosystem might be preserved in the area. Here, we investigated geological and mineralogical characteristics of the carbonated banded iron formations (BIFs) and metabasalts in the northwestern part of ISB to constrain fluid-rock interactions in the ancient crust.

Field observation indicates that carbonated rocks developed along folding axis parallel to the strike of BIFs, which formed vein and crosscut a BIF unit in the studied area. The result suggests that distribution of secondary carbonate vein was dominated by tectonic deformation of BIFs. Bulk rock compositions, mineral assemblages and chemical compositions of the minerals are systematically changing in terms of Fe, Mg, Ca, Al and trace elements from the central part towards the edge in the vein. Carbon isotope compositions of carbonate are also systematically distributed with the petrological variety in the vein, ranging from -8.4 to -2.0 ‰. Our results suggest that CO₂-rich metasomatic fluid migrated with secondary mineral precipitations, accompanied by compositional changes of fluid itself, through the channels formed by tectonic deformation of BIFs in the early Archaean crust.