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Dolomite problem of Neoproterozoic cap carbonate and snowball earth hypothesis, Otavi Group, Namibia

Bunji Tojo[1], Shin-ichi Kawakami[2]

[1] Nagoya Univ., [2] Fac. Educ. Gifu Univ.

Carbonates that cover Neoproterozoic glacial deposits are called cap carbonate and regarded as important key in understanding the Neoproterozoic glacial event. Neoproterozoic glacial deposits distribute in global, and palomagnetic data suggest that widespread continental glaciers were formed within a few degrees of the equator. The low-latitude glaciations, close association of the cap carbonates and diamixtites, negative excursions of delta13C, and some occurrences of banded-iron formations within the diamixtites, all suggest that these deposits record global climatic events and provide evidence of Earth's most extreme ice ages, and snowball earth hypothesis is proposed based on these evidences.

Neoproterozoic succession contains more than two glacial intervals, as many as five successive ice ages have been proposed. The Bottom parts of Neoproterozoic cap carbonate are dolomite in general. The origin of dolomite is still difficult problem In general, it is accepted that dolomite is generated by diagenetic process of limestone. Surely, as for cap carbonate of Precambrian, the ratio of dolomite is high but though limestone is accumulating on it, the bottom part of cap carbonate is always dolomite. It is difficult to understand that the cause is only the far after diagenetic process. This problem is called dolomite problem of cap carbonate.

In the Neoproterozoic sequence of the Otavi Group, northwest Namibia, the glacial deposits and cap carbonates occur twice. The lower cap carbonates (Rasthof formation) has 220m thick at the sampling point and the parallel laminating part (rhythmite) occupies the basal 14.2 m. The transition from the rhythmite unit to overlying stromatolitic unit was rather sudden in the outcrop. We collected a 14.2 m thick, continuous series of samples from the entire rhythmite unit. The collected samples were embedded in plastic case with chert grains and epoxy resin to make polished slabs of 400 x 200 x 30 mm in size. The number of the polished slab was 36. They were analyzed with Scanning X-ray Analytical Microscope (SXAM). The data show cyclic fluctuations in Ca and Mn. These fluctuations reflects the cyclic change of the carbonate contents, clay rich layer, calcite rich layer, dolomite rich layer. The number of such cycles is about 20. Dolomite is controversial mineral in the diagenetic formation, so we can't conclude that the cycles reflect cyclicity of primary environmental change with only these data. However, we traced Rasthof formation in lateral. The columns of the rhythmite part of the Rasthof formation show well correlations of turvidites, thin clay layers, and the cycles. Further more we found slump deposits. The slump deposits contain blocks of clay rich layer and calcite rich layer with fine laminations in the dolomitic matrix.

These observations show to have become dolomite already when carbonate was few meters of the basement after deposition. There are few dolomitized process which explain this successfully, but if then snowball earth event was happen, these process are more coordinating according to the recent research of the sulfur isotope of cap carbonate.