

## バクテリア性ストロマトライトとしてのマンガンノジュール成因論 Genesis of Mn-nodules as deep sea floor bacterial stromatolite

\*赤井 純治<sup>1</sup>

\*Junji Akai<sup>1</sup>

1. 新潟大学

1. Niigata University

Since the first finding in 1876 Mn nodules had been problematic in its genesis; Why the shape is nodular? Why not buried: sedimentation rates of the surrounding are much faster than the slow growth rate. Where do the metals of Mn, Fe, Co, Ni etc. come from? Reason of thin rhythmic banding? Biogenic or abiogenic? Akai et al. (2013) has answered these questions; that is, Mn nodule is stromatolite with fractal like signature. Co-rich Mn crusts were also found to have fundamentally the same characters (Akai et al., 2014).

In this report, the author summarize these results and compare other biogenetic precipitation of Mn oxides.

Samples of Mn nodules and Co-rich Mn crust in Pacific ocean were used for mineralogical examinations: Morphology, OM, XRD, TEM, SEM, EDS, HRTEM, X-ray CT, mathematical simulation by assuming fractal morphology.

The results (Figs.) showed the followings: morphology is fractal-like nature; the fourth order corresponds to top dome shapes of the columnar stromatolite structure, which will be mentioned later.

Bacterial signature(fossil) was widely found on the surface and inner structure. Manganese and Iron metabolic bacteria may be symbiotically cooperating to form Mn nodules. Mineralogy of the Mn oxide is characterized by 2.5 Åmanganate and/or 10 Åphyllo-manganate. Thin rhythmic banding is always found as growth layer, essentially similar dome-like stromatolite and sometimes it is interrupted by some event layer. There is a discussion for this thin layer as Milankovitch cycle (Han et al., 2003). Textural similarity to the present hot spring stromatolite (Akai et al., 1995, 1997) containing Mn-stromatolite is very strong. We have found stromatolite structure also at Onneto-Yunotaki Mn deposit (Kanai and Akai, 2008). Mn-nodule aggregate is apparently a kind of relic of Precambrian stromatolite bio-community.

キーワード：マンガンノジュール、ストロマトライト、生物起源、フラクタル様形態、バクテリア性バイオミネラリゼーション、コバルトリッチ・マンガンクラスト

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Typical OM/SEM/TEM images : SEM/TEM indicate bacteria (arrow) ; Mn-oxidizing & Fe-oxidizing bacteria



0.1mm

Mn oxide : Fe oxyhydroxide  
Bacterial biomineralization

