

Stratigraphic setting of Neogene Manganese deposits in Northeast Japan

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Banded manganese deposits occur in the Neogene of the northeast Japan (Fig. 1). These manganese deposits had been mined until 1970's and had been studied vigorously from the 1950's to the 1960's, especially from the viewpoint of mineralogy and mining geology (for example, Yoshimura, 1952; 1969). Based on the mineral and major element compositions with the geological background, it has been regarded that these manganese deposits were submarine hydrothermal origin. Miura et al. (1992) concluded also as hydrothermal deposit from the rare-earth element composition for the Neogene manganese deposits from the Oshima peninsula, Hokkaido.

The stratigraphic study of the manganese deposits has not progressed after the 1960s (e.g. Moritani and Uemura, 1964; Moritani, 1968). In recent years, Sakai et al. (in prep.) conducted a biostratigraphic study of radiolarians for the Kitaichi manganese mine in Fukaura area, Aomori Prefecture, and indicated that the manganese deposit and the underlying tuffaceous sandstone showed ages of 13.0 Ma to 11.7 Ma, and the overlying tuffaceous sandstone has an age of 5.3 Ma to 4.2 Ma. A hiatus ranging from 9 m.y. to 6 m.y. after manganese deposition was also proposed.

We applied zircon U-Pb dating and diatom biostratigraphic analysis for the two manganese deposits in Fukaura area. The results are consistent with Sakai et al. (in prep.). The age of the manganese deposit and the underlying tuffaceous sandstone were 12.5 Ma without age gap between them. The overlying tuffaceous sandstone was dated at 5.0 Ma. This suggests that the immediate growth of manganese deposit after the sedimentation of footwall tuffaceous sand at 12.5 Ma. After 7.5 m.y. of the hiatus, the manganese deposit was buried by the deposition of tuffaceous sand at 5.0 Ma.

The age of the manganese deposit formation, 12.5 Ma, corresponds to the base of the Onnagawa Stage in the stratotype section in the northeast Japan and is simultaneous with the beginning of the long term (several m.y.) blooming of diatoms in the surrounding basins (Kobayashi, 2000).

Based on the distribution of middle Miocene benthic foraminiferal assemblages throughout the northeast Japan, Kitazato (1983) concluded shallow parts on northward hill having limited sediment supply as the place of the manganese deposit formation. In that same period with the manganese deposits formation, it is known that anaerobic, laminated, fine-grained sediments occurred in the eastern basin of the hill (e.g. Tada, 1992). These sedimentary settings with upwelling of anoxic (manganese-rich) middle to deep water will be fitted to the classical bath-tab ring model (e.g. Force et al., 1983) for the origin of the manganese deposits.

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