

Mineralogical and geochemical characteristics of ferromanganese nodules in the Minamitorishima EEZ

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Ferromanganese nodules are spherical material mainly composed of manganese, iron, and other transition metal (oxyhydro)oxides, which are widely distributed on the deep seafloor around the world [1]. It has been widely accepted that ferromanganese nodules can be classified into three types: hydrogenetic, diagenetic and hydrothermal types [1]. Among them, hydrogenetic nodules are composed of Fe–Mn (oxyhydr)oxides that precipitated from seawater and thus, this type of nodules can be expected to provide proxy paleoceanographic records [2, 3, 4, 5].

In this study, we investigated mineralogy and geochemistry of ferromanganese nodules sampled from the Minamitorishima EEZ for the purpose of elucidating formation environment of the nodules. Both the ferromanganese mineral phase and bulk chemical compositions clearly show that these nodules are hydrogenetic in origin. Based on X-ray CT and micro X-ray mapping analyses, oxide layer of the nodules can be subdivided into five layers [6, 7]. Although ferromanganese mineral is common to all the oxide layers, we found that Mn/Fe and Ni content systematically changed from inner layer to outer layer. The result implies that bottom water of the Minamitorishima EEZ has gradually been oxygenated toward the present.

Keywords: ferromanganese nodules, ferromanganese mineral, bulk chemical compositions, formation environment, Minamitorishima EEZ