

## Detailed geochemical characteristics of the nuclei of ferromanganese nodules in the Minamitorishima EEZ

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Ferromanganese nodules are polymetallic concretion mainly composed of Fe-Mn (oxyhydr)oxides with significant concentrations of critical metals such as Ni, Cu and Co [1, 2]. The nodules can be found on deep-sea floor worldwide, and their dense distribution has recently been discovered in the Japanese exclusive economic zone (EEZ) around Minamitorishima Island [3, 4].

It is well known that ferromanganese nodules generally have nuclei, which indicates that growth of a nodule starts on nucleus surface. Therefore, characterizing the nuclei of the nodules can provide important information on the conditions for the initiation of the nodule formation. Previous study using X-ray computed tomography (X-ray CT) revealed that the nuclei of the nodules in the Minamitorishima EEZ can be classified into four types (nucleus I to IV) [5]. However, detailed chemical characteristics of the nucleus types identified by X-ray CT have not yet been fully understood.

Here, we performed major and trace element analyses of the nuclei using X-ray fluorescence mapping and inductively-coupled plasma mass spectrometer to reveal their chemical characteristics. In the presentation, we will show the results of the chemical characterization of the nuclei, and then will discuss the origin of the nuclei of ferromanganese nodules in the Minamitorishima EEZ.

[1] Petersen et al. (2016) *Marine Policy*, **70**, 175–187, [2] Hein et al. (2013) *Ore Geology Reviews*, **51**, 1–14, [3] Machida et al. (2016) *Geochemical Journal*, **50**, 539–555, [4] JAMSTEC press release, August 26, 2016, [5] Shimomura et al. (2018) *Goldschmidt 2018*.