

## Mineralogical and geochemical characteristics of manganese mineral particles in the South Pacific Gyre sediment

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Manganese mineral deposits widely occur on the seafloor of abyssal plains as nodules consisting of manganese, iron and various trace metal elements. Accumulation of the vast mineral deposits play important roles in the global manganese cycle. However, no clear picture has yet emerged as to the nature of these minerals in entirely oxic deep-sea sediments. During the Integrated Ocean Drilling Program (IODP) Expedition 329, we drilled the entire sedimentary sequence at 6 sites in the ultra-oligotrophic region of the South Pacific Gyre (SPG), where dissolved O<sub>2</sub> and aerobic microbial communities are present from the seafloor to the sediment-basement interface [1]. We observed abundant micrometer-scale particles of ferromanganese minerals in oxic pelagic clay sediments of the SPG over 100 million years. Three-dimensional micro-texture and elemental composition analyses using electron microscopy, mass-spectrometry and synchrotron-based spectroscopy approaches revealed that most Mn-microparticles are poorly crystalline ferromanganese minerals that contain various trace metals and carbon species, indicating that Mn-microparticles are possibly derived from the oxidation and precipitation of dissolved manganese in deep-sea water.

[1] D' Hondt, S., Inagaki, F., Zarikian, C. A., Abrams, L. J., Dubois, N., Engelhardt, T., Evans, H., Ferdelman, T., Gribsholt, B., Harris, R. N., Hoppie, B. W., Hyun, J.-H., Kallmeyer, J., Kim, J., Lynch, J. E., McKinley, C. C., Mitsunobu, S., Morono, Y., Murray, R. W., Pockalny, R., Sauvage, J., Shimonono, T., Shiraishi, F., Smith, D. C., Smith-Duque, C., Spivack, A. J., Steinsbu, B. O., Suzuki, Y., Szipak, M., Toffin, L., Uramoto, G., Yamaguchi, T. Y., Zhang, G., Zhang, X.-H., and Ziebis, W. Presence of oxygen and aerobic communities from seafloor to basement in deep-sea sediment. *Nature Geosciences*, 8(4), 299-304, 2015.

Keywords: Mn mineral particle, pelagic clay, South Pacific Gyre