Sediment property in the exploration area for cobalt-rich crusts

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Surface sediment cores were obtained from 5 seamounts (JA02, JA03, JA04, JA06, and JA17 Seamounts) as a part of the environment baseline survey in the exploration area for cobalt-rich crusts, and physical property and chemical composition of the sediments were investigated. In some of the sediment cores, DO, pH, and ORP of pore waters were measured using a microsensor. The flat-top sediments from all seamounts (1,300-1,500 m water depth) were calcareous ooze (CaCO3 content >90%), which is consistent with carbonate-dominant production and shallower depth than CCD. The flat-top sediments had similar density of 2.6-2.7 g/cm3 and water content of about 50%. In contrast, the flat-top sediments at JA02 and JA04 Seamounts showed larger median grain size (100-350 μm) than the other JA03, JA06, and JA17 Seamounts (10-60 μm). Chemical compositions of the flat-top sediments were characterized by low TOC (<0.15%), TN (<0.03%) and biogenic opal (<0.9%). The TOC, TN, and biogenic opal decreased with depth, corresponding to decrease of DO in the pore waters. Surface sediments in the base of seamounts (4,000-5,000 m water depth) were collected from JA03 and JA06 Seamounts. The base sediments consisted of pelagic clay except for one sediment core composed of siliceous ooze from JA06 Seamount. The physical properties of siliceous ooze were significantly deferent from pelagic clay, showing lower density, higher water content, and larger median size. TOC and TN in the base sediments were also low with the maximum values of 0.4% and 0.08%, respectively, reflecting oligotrophic condition in the area. and. C/N ratios decreased with depth, suggesting the preservations of inorganic ammonium and nitrogen-rich organic matter within clay minerals. Several large manganese nodules (2-5 cm in diameter) were observed on the surface of base sediments from JA03 Seamount, whereas small manganese nodules (~1 cm in diameter) were existed on the surface of one sediment core from JA06 Seamount. While the DO in pore waters was relatively constant in the base sediments from JA03 Seamount, the rapid decline of DO within 2 cm surface layer was observed in the base sediments from JA06 Seamount. Mn concentration of the base sediments from JA03 Seamount was 0.3-0.4% with no vertical variation. In contrast, Mn was concentrated up to 4.6% in the surface layer of the base sediments from JA06 Seamount and showed decrease trend with depth. Co, Ni, Cu, Zn, Cd concentrations also showed similar depth distribution patterns. The chemical compositions of manganese nodules from the base of JA03 Seamount indicated hydrogenetic origin, which is consistent with the observed oxic sedimentary environment. On the other hand, the base sediments from JA06 Seamount would represent suboxic conditions, favorable to the growth of diagenetic manganese nodules.

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