

Arsenic contaminations and its effect on marine phytoplankton during seafloor mining

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In terms of deep seafloor mining, environmental impact assessment is required because it could lead to marine environmental problems. Heavy metals (e.g., Zn, Pb, Cu, Cd, and Hg) and arsenic might be released from waste ore minerals during transfer of those from seafloor to vessel. Here, we discuss about the possibility of arsenic contaminations and its effect on the primary production of marine phytoplankton during seafloor mining.

Chimney sample containing a high amount of arsenic (2.3 wt.%) was powdered manually and reacted with ultrapure water or artificial seawater (Daigo SP) in a Teflon centrifuge tube. The concentration of arsenic dissolving in the solution was quantified by ICP-MS. Arsenic was released from the chimney into the solution after the shaking with ultrapure water; the concentration of arsenic dissolving in the ultrapure water and artificial seawater were 43 ppm and 13 ppm, respectively. Arsenic was the most abundant element in the solution, and major arsenic species dissolving in the solution was arsenite, but not arsenate.

A seawater was incubated on board to evaluate the toxicity of arsenic on the natural phytoplankton assemblages. Seawater was collected near Kume island (Okinawa) during the KR16-03 (Feb. 2016, R/V Kairei) cruises, and the solutions reacted with the chimney and containing arsenic reagent (50 ppm) were added to the seawater (1 %). After incubation for 24 h, cell densities of phytoplankton drastically decreased, especially when the solution reacted with the chimney was added. These results suggest that arsenic could be released from ore minerals to ocean during deep seafloor mining, and that the primary production of marine phytoplankton would be inhibited by arsenic released from ore minerals.