# Environmental impact of toxic metal elution from manganese nodule under a deep-sea mining

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The interests of manganese nodules and hydrothermal deposits as mineral resources are rapidly increasing due to the development of deep-sea mining technique. Manganese nodule contains high level of valuable metals such as nickel, copper and zinc. Changes in physical and chemical properties during the mining stage may lead to the release of metals into the marine environments, especially seawater column at high concentrations. The purpose of this study is to evaluate the effect of toxic heavy metals leaching on the marine environment during manganese nodule mining.

The ratio of manganese nodule to filtered seawater was 1g/L. *In-situ* leaching experiment in the period of 10 days with three different sizes of manganese nodules (63-2000 μm, 20-63 μm, below 20 μm) was conducted. Seawater samples from East Pacific ocean were collected to estimate the degree of metal elution from manganese nodule. All samples in the present study were filtered with acid cleaned polycarbonate filter with pore size of 0.45μm and the concentration of metals were analyzed by seaFAST SP3 system (ESI, Elemental scientific) with Inductively Coupled Plasma Mass Spectrometry (NexION 2000, Perkin Elmer).

The result showed that the amounts of metal elution for less than 20μm of manganese nodule were higher than the relatively larger sizes. Co, Ni and Cu concentrations were gradually increased with increasing elution times. For the case of < 20μm at 10 days, Co, Ni and Cu concentrations increased 260, 15 and 22 times, respectively, compared to the background level. However, Zn concentrations were gradually decreased as the elution time increased for all sizes. Cr and Cd, which have a small content of manganese nodule but a large toxic effect, were also continuously eluted.

The heavy metals eluted into the water environment during mining are accumulated in the organisms through the food web and have a harmful effect. It is necessary to develop eco-friendly technology that minimizes environmental impact.