

## **Elution characteristics of metal from sulfide minerals and environmental impact of deep sea mining**

H. JEONG<sup>12\*</sup>, J. LEE<sup>12</sup>, K. RA<sup>12</sup>, J.Y. CHOI<sup>12</sup>, K.-T. KIM<sup>1</sup>,  
E.-S. KIM<sup>1</sup>, K. HYEONG<sup>1</sup>

<sup>1</sup>Korea Institute of Ocean Science & Technology (KIOST),  
Busan 49111, Republic of Korea

(\*Correspondence: hrjeong@kiost.ac.kr)

<sup>2</sup>Department of Ocean Science(Oceanography), KIOST  
School, Korea University of Science & Technology  
(UST), Busan 49111, Republic of Korea

Submarine mineral resources such as manganese nodules and hydrothermal deposits (Cu, Zn rich sulfide minerals) in the deep sea contain a large amount of useful metals. Although deep sea mining technologies have been developed, there is a lack of information on significant environmental impacts. In this study, we aimed to assess the impact of metal elution in seawater from sulfide minerals. For elution experiments, two different sizes (20-63  $\mu\text{m}$ , <20  $\mu\text{m}$ ) of sulfide minerals were prepared and seawater were sampled and filtered with 0.45  $\mu\text{m}$  pore size capsule filter. The relative ratio of sulfide mineral and seawater were 0.01, 0.1, 1 g/L to estimate the amount of leaching of heavy metals such as Cr, Cu, Zn, As and Cd. The eluted seawater samples were collected at different sampling times and were measured by using the seaFAST SP3 system (ESI, Elemental Scientific) with Inductively Coupled Plasma Mass Spectrometry (NexION 2000, Perkin Elmer Inc.). The vertical distribution of these metals at the Indian Ocean were also investigated to evaluate the severity of metals released from sulfide minerals into seawater.

Cr and As were lower than the background concentration, indicating that these metals in the seawater are adsorbed and removed by the particles. However, the concentration of Cu, Zn and Cd rapidly increased, indicating that a considerable amount of these metals were eluted from sulfide minerals. Metal concentrations tend to gradually decrease (Cr and As) or increase (Cu, Zn, Cd) with increasing elution experiment time of 12 hrs. There were no differences in heavy metal concentrations at two different sizes. When the amount of sulfide minerals was large (1g/L), the eluted amount of metal was also high. In an experiment at 12 hrs elution (1g/L), Cu, Zn and Cd concentration in eluted samples were 375, 4681, 931 times higher than in the bottom seawater concentration. Considering the amount of elution for metals and their toxicities, there is concern that deep sea mining for hydrothermal deposits could have adverse effects on the marine environments and ecosystems.