

Distribution of stable Pb isotope ratios in the Ulleung basin, Korea

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The spatial distributions of dissolved lead (Pb) concentrations and stable Pb isotope ratios in the Ulleung Basin, East/Japan Sea, were investigated to identify the Pb source, the behavior of Pb in seawater, and the relationship between Pb isotopes and water masses. The Pb concentrations showed a surface maximum and rapidly decreased with increasing water depth. In the slope area, Pb concentrations increased near the seafloor due to diffusive flux from the sediments. The Pb concentrations in the surface layer were higher than in the Northwest Pacific Ocean and western Philippine Sea due to the proximity and downwind location of the sampling site from a Pb source area. The bottom Pb concentrations were lower in the study area than in the open ocean, indicating a higher scavenging rate due to the presence of well-developed bottom boundary layers from the continental slope to the basin.

The Pb isotope ratios obtained from the continental slope and basin area were relatively constant among water masses. The Pb isotope ratios in the surface layer were similar to those of coal from northern China, which may indicate Pb supply from coal combustion in China. Meanwhile, Pb in the bottom water had a similar isotopic signature to Russian ore deposits and coal, indicating that bottom Pb is associated with thermohaline circulation in the East/Japan Sea. The Pb isotope ratios of the intermediate layer were constant across the depths of East Sea Central Water (ESCW) and were similar to aerosols measured previously (in 2003–2004) around Ulleung Island, which may indicate the timing of ESCW formation.