

Distribution of phosphate oxygen isotope in boring core samples for evaluation of phosphorus cycling in groundwater

*Takuya Ishida¹, Yusuke Tomozawa², Xin Liu³, Jun Qian³, Mitsuyo Saito⁴, Shin-ichi Onodera², Noboru Okuda¹, Syuhei Ban³

1. Research Institute for Humanity and Nature, 2. Hiroshima Univ., 3. The Univ. of Shiga Pref., 4. Okayama Univ.

Phosphorus (P) input through groundwater discharge plays a significant role in nutrient cycling and primary productivity in the coastal area (Slomp & Cappellen., 2004). Therefore, its biogeochemical cycling in underground environment is important in proper land management and understanding of natural systems. Recently, phosphate oxygen isotope ratio ($\delta^{18}\text{O}_{\text{PO}_4}$) has been used as a promising tool to elucidate the P cycling. Previous studies showed the possibility to evaluate P sources, metabolism by organism in some ecosystems (Paytan & McLaughlin 2011). However, it is not clear whether $\delta^{18}\text{O}_{\text{PO}_4}$ is useful for evaluating the P cycling of in underground environment, because few researches have applied the $\delta^{18}\text{O}_{\text{PO}_4}$ analysis for underground P cycling.

In the present study, we investigated the $\delta^{18}\text{O}_{\text{PO}_4}$ values of boring core samples and groundwater to clarify P cycling in underground.

A boring core (28 m depth) and groundwater (5 m and 28 m depth) were collected at The University of Shiga Prefecture, which is located on coastal area of Lake Biwa, central Japan. Boring core was divided by 1 m and ground to powder using a multi-bead shocker (Yasui Kikai) with tungsten carbide beads. The powdered boring core samples were immersed in 1 M HCl for 16 h to extract the inorganic P. Groundwater samples were filtered through 0.45- μm membrane filters (Advantec). The SRP concentration of each samples was measured using the molybdenum-blue method on a microplate spectrophotometer (Multiskan GO; Thermo Fisher Scientific). For the $\delta^{18}\text{O}_{\text{PO}_4}$ analysis, the extract and groundwater samples were converted to Ag_3PO_4 according to McLaughlin et al. (2004) or Tamburini et al. (2010). The $\delta^{18}\text{O}_{\text{PO}_4}$ values reported relative to the Vienna Standard Mean Ocean Water (VSMOW) of the Ag_3PO_4 samples were measured using a TC/EA-IRMS (thermal conversion elemental analyzer connected to a Delta plus XP via ConFlo III, Thermo Fisher Scientific) at the Research Institute for Humanity and Nature (RIHN).

The soluble reactive P (SRP) concentrations in 5 m and 28 m depth of groundwater were 0.74 and 6.78 $\mu\text{mol L}^{-1}$, respectively. Deeper groundwater has much higher SRP concentration than river and lake water ($< 0.7 \mu\text{mol L}^{-1}$) near The University of Shiga Prefecture. The $\delta^{18}\text{O}_{\text{PO}_4}$ values in 5 m and 28 m depth of groundwater were 15.1 and 17.1‰, respectively. In our poster, we will show the result of distribution of $\delta^{18}\text{O}_{\text{PO}_4}$ in boring core samples and discuss the P cycling in groundwater.

Reference

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