Fore-arc mantle serpentinites as a reservoir of fluid-soluble elements released from subducting slabs

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Recent geophysical studies show the presence of a hydrated peridotite layer at the base of mantle wedges. In Mariana, such hydrated peridotites are exposed as serpentinite diapirs. In old subduction zones, these fore-arc serpentinites were commonly exhumed together with HP metamorphic rocks. We have examined these serpentinites in the Mariana fore-arc, northern Himalayas, western Alps and central Cuba. These serpentinites contain high Mg, Cr and Ir-type PGE (Ir, Os, Ru), as expected for refractory mantle peridotites. But, they contain high contents of fluid-soluble elements, such as Pb, As, Sb, Sr and LREE (Fig. 1). Himalayan samples show their profound enrichment, which is consistent with their release from subducting Indian continent. Marianan, Cuban and Alpine serpentinites, which formed during oceanic crust subduction, show a moderate enrichment. The interpretation is supported by isotope data of serpentinites (Sr, Nd, Pb, B, S, H). Himalayan samples show Archean crust-like values, whereas others have altered oceanic crust-like signatures (Fig. 2).

The enrichment pattern of these fluid-soluble elements in serpentinites is similar with that of volcanic front magmas (Fig. 1), which suggests serpentinites as a sink for these elements released from slabs. Mantle flow transports the serpentinites to deeper levels. Eventual dehydration of serpentinite discharges water and fluid-soluble elements, leading to partial melting, thus accounting for the observed enrichment of these elements and radiogenic signature of the volcanic front magmas.

Fig. 1. Composition of serpentinites and volcanic front magmas

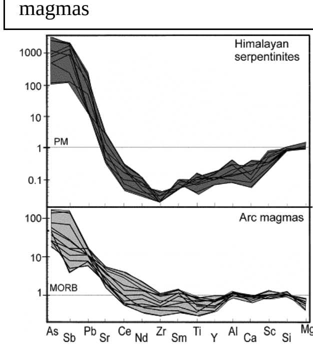
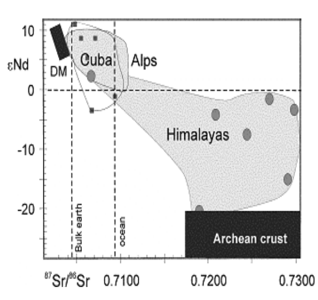


Fig. 2. Sr and Nd isotopic values of serpentinites. DM= depleted mantle



Distribution and dynamics of dissolved carbohydrates in Lake Biwa

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Carbohydrates constitute a large component of the dissolved organic matter in freshwater environments. Traditionally, it is known that dissolved carbohydrates (DCHO) is readily available for heterotrophic microorganisms, whereas a few studies reported the existence of relative resistant DCHO to biological degradation. To consider heterotrophic availability of DCHO, information about chemical structure and molecular components of DCHO are needed. In this study, the components of DCHO in lake water were examined by acid hydrolysis susceptibility and size speciation of tangential flow ultrafiltration before quantity of DCHO using the colorimetric and gas chromatographic determination.

The acid hydrolysis susceptibility is determined as the DCHO concentration difference after hydrolysis by 2M sulfuric acid after swelling with 6M sulfuric acid and hydrolysis by 0.09 M HCl. HCl-hydrolyzable fraction of DCHO was the major fraction among total DCHO in lake water. The HCl-hydrolyzable fraction consists of labile and refractory part to biological degradation. Neutral aldose composition of this fraction in the hypolimnion is invariable, and suggested formation of refractory dissolved organic matter. HCl-resistant fraction of DCHO increased in the surface water of lake during summer. This fraction consisted of biological labile compounds.

In distribution of molecular size by tangential flow ultrafiltration, large size of dissolved organic matter (50K Da - 0.2 μm) accounted for about 10% of total dissolved organic carbon, in contrast, this fraction had rich carbohydrates accounting for more than 40% of total DCHO. Neural aldose composition of large molecular size was similar with one of smaller molecular size.