Highly siderophile element (HSE) compositions of Gakkel abyssal peridotites: Effects of serpentinization and constraints on accretion processes in early Earth

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Both fresh and typically serpentinized abyssal peridotites from the ultra-slow spreading Gakkel Ridge, Arctic Ocean, have been selected for HSE analysis (Os, Ir, Ru, Pt, Pd and Re). All but two harzburgites are fertile lherzolites with very low degree of partial melting. Previous Os isotopic studies indicate that the harzburgites have been subjected to low-degree partial melting in the early Proterozoic [1]. Comparison of HSE data between the altered rims and their corresponding fresh cores and between the fresh peridotites and serpentinites suggests that both Pd and Re are potentially affected by seawater alteration, whereas other HSE are not. The fractionation of PPGE (Pt, Pd) and Re from IPGE (Os, Ir, Ru) in Gakkel abyssal peridotites indicates that this is possible even at low degrees of partial melting (5-12%). Both Pd/Ir and Pt/Os show positive correlations with $^{187}Os/^{188}Os$ ratios, which cannot be explained by percolation of silicate/sulfide melts. We interpret these correlations to reflect the binary mixing of depleted and fertile components. The depleted component with low ratios of Pd/Ir (also Pt/Os) and $^{187}Os/^{188}Os$ represented by the harzburgites might be recycled ancient oceanic lithosphere or delaminated sub-continental lithospheric mantle (SCLM). The fertile component could have PUM-like HSE pattern and $^{187}Os/^{188}Os$ ratios in its history. The relationships of HSE/Ir ratios with both $^{187}Os/^{188}Os$ ratios and bulk Al_2O_3 contents in the fresh spinel lherzolites are used to estimate the HSE pattern of the PUM. We confirm the previously inferred non-chondritic HSE budget in the PUM [2], i.e., chondritic Os/Ir and Pt/Os ratios but supra-chondritic ratios of both Ru/Ir and Pd/Ir, which can neither be explained by secondary percolation of silicate/sulfide melts nor by addition of outer-core metals. It is also in conflict with the compositions of all known chondritic meteorite classes.

References

[1] Liu *et al*., *submitted*.

[2] Becker *et al*. (2007), *Geochimica et Cosmochimica Acta*, **70**, 4528-4550.

Important roles of sulfur cycling in karstic catchment erosion, Southwest China

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In southwestern China, there is a large area (about 600,000 km^2) of diverse karstic landscape, with well-known eco-environmental problems of land-degradation and rocky kastification. Sulfur isotopic compositions of sulfate from rain, river, ground water and soil leachate in karstic areas were determined to understand the linkage between sulfur cycling and catchment erosion.

The sulfur isotopic compositions of sulfate in the studied area show that a relative large part of sulfate ion comes from oxidation of sulfide mineral and organic sulfur. Combined with carbon isotope studies and water chemical composition, the sulfur isotope study suggests that carbonate rocks in the catchment were weathered by both sulfuric and carbonic acids. Meanwhile, the carbon isotopic compositions of dissolved inorganic carbon in the surface and ground water of the karstic catchment show a large contribution of carbon that was derived from of oxidation soil organic matter. In conclusion, the karstic catchment in southweatern China has a high weatering rate and repid loss of nutients due to copuled sulfur and carbon biogeochemical cycling.

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