Petrogenesis of mantle peridotites from the Kizildag ophiolite (SE Turkey): Implications from mineral composition

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Kizildag (Hatay, SE Turkey) ophiolitic complex is one of the best maintained Tethyan lithospheric remnants of Turkey ophiolites. Mantle tectonites from the Kizildag ophiolite contains spinel with Cr# 0.47-0.61 which indicates that they are residue of ~23-30% of partial melting of primitive upper mantle, and are similar to the supra subduction zone peridotites. Pyroxenes have lower content of Al ($Al_2O_3^{Cpx}$=1.61-2.77 wt%) and Ti (TiO_2^{Cpx}<0.25), and also indicate the respectively high degree of depletion. Clinopyroxene from the twelve peridotite samples of Kizildag ophiolite complex analyzed by LA-ICP MS for their trace and REE contents. Clinopyroxenes from mantle tectonites show LREE enrichment (Sm_N/Lu_N=0.04-0.78) and nearly horizontal HREE (Er_N/Lu_N=0.49-1.32) patterns. There is a negative correlation between Sm/Yb vs. Yb contents of clinopyroxenes, which consistent with the hydrous partial melting and fluid-melt enrichment trend. There is also a negative correlation between Yb content in clinopyrexene and Cr# of spinel. The depleted composition of incompatible elements and LREE enriched pattern known as an evidence for mantle-melt interaction. There is a good correlation between Cr# of spinel and HREE concentration of clinopyroxenes. However, chondrite-normalized Ce concentrations $(Ce)_N$ of clinopyroxene in mantle tectonites of Kizildag ophiolite is higher (0.10-0.13ppm) than the abyssal peridotites. The mineral chemistry results indicate that the mantle tectonites shows higher degree of partial melting than abyssal peridotites. Subducting oceanic lithosphere produces LREE-enriched melt and/or fluids and this is resulted with the higher melting. These evidences indicate an arc magmatism i.e. a suprasubduction zone setting fort he genesis of Kizildag ophiolite.

Human impact on global element cycles

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Material flow caused by human actions has become a major component of the Earth's biogeochemical cycles. In order to constrain the effect of human activity on global elemental cycles, Klee and Graedel [1] quantified the magnitude of anthropogenic activities on 77 of the naturally occuring elements. Their study compiled estimates of natural (weathering of continental crust, net primary production, element mobilized through sea spray) and anthropogenic (mining, biomass burning, and fossil fuel combustion) element fluxes and determined the role of humans on global elemental cycles. While Klee and Graedel [1] assessed the role of a number of important natural and anthropogenic processes, their assessment was not comprehensive. For instance, global dust fluxes [2] and losses to and gains from the extraterrestrial environment were not considered.

Here we revisit the Klee and Graedel [1] study and add important sources (chemical flux contributions from volcanoes and aeolian dust, input of extraterrestial matter) that affect global elemental cycles. In addition, we updated chemical inventories and fluxes for a range of processes.

Our calculation shows a substantial change from the original Klee and Graedel [1] study. Geochemical cycle of 22 elements are dominated by human actions. Biogeochemical cycle of gold, platinum, palladium, rhenium and iridium are dominated by anthropogenic activities, followed by chromium, antimony, copper, mercury, rhodium, lead, bismuth, tin, tellurium, cesium, arsenic, tungsten, iron, silver, nickel, indium and uranium.

[1] Klee & Graedel (2004) *Annu. Rev. Environ. Resour.* **29**, p. 69–107. [2] Cakmur *et al.* (2006) *J. Geophys. Res.* **111**, D06207, doi: 10.1029/2005JD005791.