A comparison of metamorphic history of the Hamedan and Boroujerd areas, Sanandaj-Sirjan metamorphic belt, Iran

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Metamorphic sequences of the Hamedan and Boroujerd areas (Sanandaj-Sirjan metamorphic belt, Iran) are composed of meta-pelites intercalated with minor meta-psammites and meta-basites. Metamorphic sequences of the two areas show the evidences of poly-metamorphic events (i.e. a low P-high T regional metamorphism followed by contact metamorphic events resulted from successive intrusions of mafic-intermediate and felsic plutonic bodies). Major metamorphic rocks of the areas are phyllites, pelitic schists/migmatites, amphibole schists. The major metamorphic zones of the areas are similar to each other (e.g. chlorite, biotite, garnet, andalusite, sillimanite and cordierite zones) but staroulite zone is not cropped out in the Boroujerd area. Also, outcrops of kyanite-bearing rocks/veins are absent in the Boroujerd area but widespread in the some parts of the Hamedan area. Garnet-bearing lithologies are not widespread in the Boroujerd area. The highest grade parts of the metamorphic sequences in the both of areas are characterized by the development of sillimanite-bearing rocks and veins. The intrusion of plutonic bodies has resulted in the development of the hornfelsic rocks and spotted schists near to plutons. Cordierite and fibrolite-bearing hornfelses are the commonest rocks in adjacent to plutonic bodies. Considering various geological evidences, we have concluded that these two areas have been suffered from similar metamorphic events, but in the Hamedan area, metamorphic rocks of the deeper levels of the upper crust have been cropped out.

Pyroxenites as source of mantle heterogeneity

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Introduction

OIB and MORB compositions point to heterogeneity of the Earth's mantle. This heterogeneity can be caused by preserved recycled ocean crust. We report Os isotopic compositions of 1-10 cm thick pyroxenites (pxt) parallel to high-temperature mantle fabrics in residual MORB-source mantle from a Jurassic Ophiolite in Greece, suggesting that they represent relics of primary mantle heterogeneities.

Results

Highly Siderophile Elements (HSE) and Os isotope ratios in whole rock pxts and wall-rock peridotites were measured. Compatible HSE (Os, Ir, Ru) patterns are similarly refractory in both cases, consistent with our petrographic observations that these pyroxenites are relics of replacive pyroxenites originally formed by melt-rock reaction between SiO_2-rich melts and peridotite. Some concordant pxts show small enrichments in incompatible HSE (Pt, Pd, Re), which is due to 0-5% sulfide present. $^{187}Os/^{188}Os$ ratios in pxts are between 0.1418-0.1980. These values are significantly more radiogenic than in the enclosing peridoties (0.1196-0.1291).

Interpretation

Textures, HSE and Os isotope differences between pyroxenites and host peridotites indicate that pxts are relicts of primary heterogeneities. The pyroxenites show how marked isotopic mantle heterogeneity can exist on the 1-10 cm scale, and that in the case of Os, it can be preserved even after high degrees of melting and extensive melt percolation at a mid-ocean ridge system. Moreover, the presence of pyroxenites with superchondritic Os isotope ratios in the mantle can explain why estimates for $^{187}Os/^{188}Os$ isotope ratios of depleted mantle rocks are generally subchondritic.