Rhenium-Osmium and Platinum Group Elements in oceanic crust – Oman and DSDP/ODP 504B

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Our knowledge of the inventories of Re, Os and other PGE in oceanic crust is currently limited by the availability of well-characterized sections of oceanic crust. This is especially true for the lower oceanic crust that has not been drilled *in situ* to the Moho. Existing data for the only analyzed middle-lower crustal section (ODP 735B, Blusztajn *et al.* 2000) are suggestive of low PGE concentrations and MORB-like $^{187}Re/^{188}Os$ values that drive rapid development of a radiogenic isotope signature. However, interpretation of the data is complicated by the ill-constrained abundance of PGE-rich troctolite, a trace lithology in the upper 2000 meters of this section through the middle oceanic crust.

We report new data for the bottom 4680 meters of an ocean crust section from the Oman ophiolite that includes the crust-mantle transition zone. The data indicate higher PGE concentrations and lower $^{187}Re/^{188}Os$ than in all previously reported ocean crust sections. Analyses of grain-size fractions from one Oman gabbro, isolated by electric pulse disaggregation, reveal the presence of at least two important host phases of Os; one with low $^{187}Os/^{188}Os$ and high Os, S and Pb concentrations, and a second with elevated $^{187}Os/^{188}Os$ and low Os, S and Pb concentrations.

We calculate Re-Os-PGE inventories of a model 6.5 km crustal cross section that consists of 1825 m DSDP 504B-like upper oceanic crust and 4680 m Oman-like middle and lower ocean crust. The weighted chemical and isotope characteristics of our model oceanic crust section, corrected for Re decay since emplacement, are 500 pg Re/g, 44 pg Os/g, 128 pg Ir/g, 1760 pg Pd/g, 2828 pg Pt/g, $^{187}Re/^{188}Os$: 80, and $^{187}Os/^{188}Os$: 0.144. Such crust will develop $^{187}Os/^{188}Os$ values of 1.5, 2.9 and 4.3 after 1.0, 2.0, and 3.0 billion years, respectively, with Os concentrations of 51, 59 and 67 pg/g. Unless fundamentally altered during subduction, subducted oceanic crust will evolve to form a PGE-depleted, Re-rich mantle reservoir with radiogenic $^{187}Os/^{188}Os$. Mixtures of ~30% of such subducted ocean crust with ~70% mantle-peridotite can evolve HIMU-type $^{187}Os/^{188}Os$ signatures within 0.5 Gyr.

Single-grain or/and *in situ* U-Pb and Hf-isotope study to unravel long-lived calc-alkaline magma complex

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The advances in the conventional and *in situ* techniques of U-Pb zircon dating and Hf-isotope tracing enables detailed studies addressing the chemical/physical evolution of magma within an absolute time-frame. High-precision ID-TIMS U-Pb geochronology can date zircons with 2 sigma uncertainties of <0.1%, which are eventually sufficient to distinguish replenishment processes of magma chambers. The main task remains to find the zircons, which are linked to the specific processes, as composite plutons reveal usually complicated zircon populations resulting from inheritance, growth, mixing (xenocrysts, antecrysts and autocrysts). Here we present precise ID-TIMS and *in situ* LA-ICPMS U-Pb and Hf-isotope data for Cretaceous and Permian-Carboniferous calc-alkaline rocks with the aim to unravel processes of magma evolution and interaction in middle/upper crustal chambers. They are compared with the observations on zircons from possible volcanic products of the same magmatic complexes.

ID-TIMS U-Pb dating of single zircons from felsic and mixed/mingled dioritic to gabbroic horizons of single plutons in the Central Srednogorie zone and the Western Balkan in Bulgaria (SE Europe) define crystallization ages of around 86, 84.5 and 82 Ma and around 303 and 307 Ma, respectively. Age dispersion of up to 1.5 Ma from 281.5 to 283 Ma in granitic zircons from the Alps (chemically abraded and double spiked), as well as in the remobilized granitoid melts in both Bulgarian outcrops could be due to the incorporation of antecrystic zircon from the same magma system. This interpretation is supported by the distinct zircon grains and zones in the hybrid gabbros that are U- and REE-rich and have the youngest age. *In situ* and single-grain Hf isotope analyses of these zircons evidence juvenile mantle dominated melts with epsilon Hf of + 7 to + 10, whereas in the granitoid zircons the epsilon Hf of -1 to +6 suggest different degrees of hybridization with crustal materials. LA-ICPMS *in situ* dating cannot overcome the 1% uncertainties and is not suitable for dating of magma-replenishment. The volcanic products in the studied areas are intermediate in composition and either miss newly saturated zircons, or they are from the first, most voluminous magma portion.