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Re-Os behaviour during subduction of oceanic crust

C.W. DALE[1], A. GANNOUN[1], T.W. ARGLES[1], K.W. BURTON[1], I.J. PARKINSON[1] AND A.P. BOYLE[2]

[1] Dept of Earth Sciences, Open University, Milton Keynes, MK7 6AA, United Kingdom. (c.w.dale@open.ac.uk) Fax: 0044-1908-655151

[2] Dept of Earth Sciences, University of Liverpool, 4 Brownlow Street, Liverpool, L69 3GP, U.K.

Ocean island basalts (OIB) often possess high $^{187}Os/^{188}Os$ isotopic ratios that are thought to result from a component of recycled oceanic crust in the mantle source (e.g. HIMU). Oceanic crust has a high Re/Os ratio and, over time, develops a high $^{187}Os/^{188}Os$ ratio; the system is therefore an excellent tracer for subducted crustal material in the mantle. However, the available data from basalts suggest that up to 60% of Re may be lost during high pressure metamorphism, resulting in lower Re/Os ratios in the subducted slab [1]. In this case, large quantities of oceanic crust or very long residence times in the mantle source would be required to generate the observed OIB Os compositions.

This study offers a comprehensive account of the Re-Os budget of a portion of subducted oceanic crust. Data from metastable gabbros and corresponding eclogites from the Zermatt-Saas ophiolite, which have undergone very high-pressure (HP) metamorphism (2.0-2.2 GPa), yield a best-fit regression consistent with a U-Pb zircon age of 163.5 Ma [2]. This suggests that gabbroic bodies remain closed, with respect to the Re-Os system, during subduction. However, data presented for metabasalts from the same ophiolite, lie to the upper left of this best-fit line, and have a median Re value of 254 ppt, which is substantially lower than published data for MORB glasses (870 ppt) [3]. This evidence indicates that these HP eclogite facies metabasalts have experienced Re loss, in agreement with a previous study [1].

A suite of pillow basalts of progressive metamorphic grade (chlorite, biotite, garnet and kyanite), from an ophiolite in northern Norway, has been analysed for Re and Os, in order to ascertain the metamorphic grade at which Re loss may occur. An isotope evolution diagram indicates that at all grades the $^{187}Re/^{188}Os$ ratio is insufficient to explain the measured $^{187}Os/^{188}Os$. Therefore, the Re-Os system has been disturbed, and, as in the case of the eclogite facies basalts, these rocks have undergone substantial Re loss. The Re loss must first occur at chlorite or a lower grade, or possibly even as a result of seafloor hydrothermal alteration.

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Origin of the ultrapotassic volcanics within the Late Cretaceous to Early Tertiary Ulukışla Basin, Central Anatolia, Turkey

M. ALPASLAN[1], R. FREI[2], M.A. KURT[1], A. TEMEL[3] AND D. BOZTUG[4]

[1] Mersin University, Department of Geology, 33343, Mersin-Turkey
[2] Geological Institute University of Copenhagen, Øster Voldgade 10 DK-1350 Copenhagen, Denmark
[3] Hacettepe University, Department of Geology, Ankara, Turkey
[4] Cumhuriyet University, Department of Geology, 58140, Sivas, Turkey

Ulukışla basin is one of the post-collisional basins in the Central Anatolia that developed after collision between Tauride and Anatolide platelets. It includes the sedimentary units which reaches up to 5000 m. thickness, intercalating volcanics and mafic dykes. During the beginning of the basin development, alkaline volcanics occurs as lava flows which intercalate with sedimentary units. Ultrapotassic volcanics postdates the alkaline volcanics which occur as lava flows and dykes. Ultrapotassic volcanic rocks in the Ulukışla basin have geochemical characteristics belonging to Group III ultrapotassic rocks of the Foley et al. (1987) classification. These rocks have unusually high contents of large-ion-lithophile elements (LILE) (e.g. Ba up to 5900 ppm, K2O up to 8 wt% in massive lava and 10 wt% in dykes). Incompatible trace element patterns exhibit a large Nb-Ta trough and large enrichments on LILE such as Ba, Th and U, and LREE, which indicate a subduction zone signature. Negative Nb and Ti anomalies and LREE enrichments relative to HREE on chondrite normalized trace and rare earth element patterns indicate that subduction related material is present in the mantle source region.

Their high initial $^{87}Sr/^{86}Sr$ (0.70798-0.70917) and low εNd values suggest that they originated from enriched subcontinental lithospheric mantle sources with low Sm/Nd ratios. The elevated $^{207}Pb/^{206}Pb$ and low $^{143}Nd/^{144}Nd$ ratios and geochemical features such as low Nb/La and elevated Ce/Sr reflect a sedimentary signature. The relatively elevated $^{207}Pb/^{206}Pb$ ratios (15.743-15.797) and steep trend on the $^{207}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram imply involvement of an old radiogenic component in the source region.