Contrasting behavior of Nb and Ta during magma differentiation and subduction dehydration processes: Implications for the continental crust

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We report major and trace element composition of eclogites as well as Nb and Ta concentrations of rutiles from eclogites and associated high pressure (HP) veins collected through a 2 km profile in the Bixiling Complex, Eastern China. Major and trace element characteristics confirm previous studies that the eclogites are an gabbroic cumulates differentiated from mantle-derived magma in a continental setting. More importantly, all but one eclogite away from veins display relatively constant Nb/Ta ratios ranging from 16.1 to 19.2 with an average of 16.9, similar to those from typical mantle-derived rocks (17.5). Nb/Ta values among individual grains of rutiles vary from 12.7 to 22.1; their averages are close to Nb/Ta in the bulk rock. This indicates that minor Nb and Ta fractionation occurred during magmatic differentiation processes. In contrast, Nb/Ta values of rutiles from eclogites close to veins display a very large spread among individual grains ranging from 17.8 to 41.6. Average Nb/Ta ratios in three eclogites between 20.3 and 36.5 are suprachondritic, much higher than those of rutiles from the associated HP veins and eclogites away from veins, indicating that Nb and Ta were mobile and fractionated during subduction dehydration processes. Based on the observation that Nb/Ta values of rutiles from both veins and adjacent host eclogites are much higher than that of the protolithic gabbro cumulate, we propose a metasomatic model for creating Nb and Ta depleted source region with lower Nb/Ta values. Fluids initially released by dehydration may not escape before precipitation of vein minerals from the slabs, which in addition may fractionate Nb and Ta resulting in low Nb-Ta concentrations and Nb/Ta values in the residual fluids after vein formation. Partial melting of the mantle wedge metasomatised by the escaped fluids may transfer the characteristic low Nb/Ta values to the continental crust.

Simultaneous analysis of anionic species of As, Se and Cr by HPLC-CRI-ICP-MS

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Elemental speciation plays an important role in the mobility, bioavailability and ecotoxicity of metals in the environment. There have been increasing demands for monitoring the individual metal species present in the environment, rather than just a total metal concentration. We will describe a method that is capable of determining the most commonly occuring anionic species of As, Se and Cr (e.g. As^{+3}, As^{+5}, Se^{+4}, Se^{+6}, Cr^{+6}) in liquid samples, using anion exchange chromatography coupled to an ICP-MS. Procedures for ensuring minimal interchange of species during sample collection, preparation and analysis will be presented. All isotopes of the three metals suffer polyatomic interfereces in ICP-MS analysis from sample matrices and the eluents used in chromatographic separation. A Varian ICP-MS equipped with a collision/reaction interface (CRI) is employed to minimize/eliminate such interferences, resulting in improved method detection limits for the metal species.