The formation of the continental crust: Constraints from Nb/Ta fractionation during subduction

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Formation of continental crust is one of the most important processes in planetary differentiation. It is, however, still widely debated how the continental crust formed and thus how its distinct geochemical characteristics came to be, in particular, its Nb and Ta characteristics, i.e. Nb-Ta depletion and subchondritic Nb/Ta. Niobium and Ta are dramatically fractionated from each other along the drillhole core of the Chinese Continental Scientific Drilling Project and in outcrops nearby. Eclogites have highly varied and overall suprachondritic Nb/Ta values in minerals ranging from rutile, titanite to amphibole [1]. By contrast, rutile in quartz vein has overall subchondritic Nb/Ta [2]. The significant Nb/Ta fractionation in rutile and other minerals can be plausibly interpreted by early dehydration of the subducted slab at shallow depths before rutile appears (above ~45 km) [2-4]. Dehydration in the presence of amphibole and absence of rutile, leads to suprachondritic Nb/Ta ratio in the residual phases with complementary subchondritic Nb/Ta in fluids. A large proportion of fluids may escape from the subducting slab and go into the mantle wedge directly; meanwhile considerable amount of fluids can be retained in cold regions by hydrous minerals within the slab, forming hydrated cold eclogites, which carry subchondritic Nb/Ta characteristics in the descending slab. As subduction continues to depths over ~45 km, rutile appears, and consequently controls Nb, Ta behavior and budget. In the presence of rutile, melting of hydrated cold eclogites with subchondritic Nb/Ta form magmas with negative Nb, Ta anomalies and subchondritic Nb/Ta.

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Using REE and isotope geochemsity to trace the origin of ore forming materials in Yixian fluorite deposits, China

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The Yixian fluorite deposit area, located in western Liaoning province is the most important hydrothermal vein fluorite producing area in eastern China[1]. For tracing the origin of oreforming materials, we analyzed the composition of REE and Sr-Nd isotopes of fluorites, the host Middle Proterozoic carbonate rocks and Mesozoic volcanics.

The δEu, δCe, $(Gd/Yb)_N$, $(La/Sm)_N$ and $(La/Yb)_N$ of volcanics are 1.24, 0.86, 2.31, 1.68 and 5.17, respectively, and those of fluorites are 1.21, 0.52, 2.26, 0.92, 3.08, respectively. The initial ratio of Sr in the host carbonate rocks, volcanics and fluorites range between 0.7089 and 0.7220, 0.7068 and 0.7070, 0.7084 and 0.7085, respectively. The initial ratio of Nd in the host carbonate rocks, volcanics and fluorites range between 0.5113 and 0.5118, 0.5116 and 0.5118, 0.5114 and 0.5116, respectively. Similarity existing in REE and Sr-Nd isotope composition among fluorites, host carbonate rocks and volcanics indicates that the source of oreforming material are the host Middle Proterozoic carbonate rocks and Meso-zoic volcanics.

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