PGE geochemistry, mineralogy and Os-isotope signature in the mantle-hosted ophiolitic chromitites from the Kahramanmaraş area, SE-Turkey

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Mantle-hosted ophiolitic chromitites from the Kahramanmaraş area (SE-Turkey), have been investigated as to their chromite composition, Platinum-group elements (PGE) concentration and mineralogy, as well as Os-isotope geochemistry. Chromitites vary from Al-rich to Cr-rich, however they indifferently display enrichment in Os-Ir-Ru over Rh-Pt-Pd, with concentrations of PGE lower than 510 ppb. Consistently, the most abundant Platinum-group minerals (PGM) are Ru-Os-Ir sulfides and alloys. They occur as small grains (less than 15 µm), mainly included in fresh chromite. Base metals sulphide (BMS), Na-rich amphibole and rare phlogopite were also identified forming inclusions in chromite. Their textural position and morphology indicate that these inclusions are magmatic in origin. Based on textural relations, paragenesis and composition, it was possible to establish that PGE alloys crystallized before than PGE and BM sulfides, at temperature comprised between 1300 and 1000 degrees and under increasing sulphur fugacity. The presence of abundant hydrated primary silicates suggests that the Kahramanmaraş chromitites formed in the presence of water and volatile- and sodium-rich fluids. This observation is also supported by the Re/Os ratio relatively high, that points a mixing of mantle-derived Os with Os from a source characterized by relatively high radiogenic signature, possibly fluids originated in a supra-subduction zone (SSZ). If a SSZ setting is accepted, the concomitant presence of Al-rich and Cr-rich chromitites suggests chromite precipitation from melts varying in composition from back-arc basalts (Al-rich chromite) to boninites (Cr-rich chromite), possibly at different mantle levels (i.e. deep for the Cr-rich chromitites and close to the Moho-Transition Zone for the Al-rich ones).

Potential problems in the annealing of zircon

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Annealing experiments are often employed to study the recrystallisation behaviour and the real structure of radiation-damaged zircon. This includes dry annealing in air and hydrothermal annealing; in the latter case the reconstitution is controlled by fluid-driven reaction fronts (Geisler *et al.*, 2003). It is well-known that the temperature-induced recovery of strongly radiation-damaged zircon involves an intermediate stage (at about 900–1100 °C) where nearly amorphous $ZrSiO_4$ decomposes into oxides (Nasdala *et al.*, 2002). This is explained by the preferred nucleation of tetragonal ZrO_2 over $ZrSiO_4$ (Garvie, 1965). Dry annealing of moderately radiation-damaged zircon, in contrast, does not involve this intermediate stage but rather results in a gradual reconstitution of zircon.

We have found that under certain conditions ZrO_2 may also be observed in the annealing of lowly metamict zircon, and at temperatures as high as 1600 °C. For instance, we found baddeleyite on the surface, or in the entire volume, of annealed zircon crystals that were treated at 1400 °C. We attribute the high-temperature formation of baddeleyite to be an artefact, for which we see two potential causes. First, if volatile alkali elements are present in the furnace atmosphere, they may react with silica to form Na-silicate glass. Second, if annealing is done using corundum crucibles, there may be a reaction of the silica component with corundum (for instance by formation of mullite). The latter idea seems to be confirmed by recent observations that during high-temperature treatment of gem-quality ruby, baddeleyite may form at the surface of included zircon crystals (Wanthanachaisaeng *et al.*, 2006). It is therefore important to consider doing annealing experiments in a controlled environment (no contaminants reaching the sample) and choosing suitable materials (e.g., Pt crucibles).

References

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