Magmatic platinum nanoparticles in metasomatic silicate glasses and sulfides from Patagonian mantle xenoliths

González-Jiménez, José María

Roqué-Rosell, Josep

Jiménez-Franco, Abigail

Tassara, Santiago

Nieto, Fernando

Gervilla, Fernando

Baurier, Sandra

Proenza, Joaquín A.

Saunders, Edward

Deditius, Artur P.

Schilling, Manuel

Corgne, Alexandre

Platinum-rich nanonuggets (s.l., nanoparticles) are commonly produced in experiments attempting to quantify the solubility or partitioning of noble metals in silicate and sulfide melts. However, it has been thought that these represent artifacts produced during quenching of the experimental runs. Here, we document nanoparticles (~ 20?80 nm) of Pt-rich alloys and arsenides dispersed in high-temperature metasomatic silicate glasses and in base-metal sulfides (BMS) entrained in them, found interstitially between minerals of mantle peridotite xenoliths from southern Patagonia. Pt-rich nanoparticles found in the interstitial silicate glasses are frequently attached to, or in the proximities of, oxides (ilmenite or Cr-spinel) suggesting a close link between the formation of the oxides and the Pt-rich nanoparticles. The interstitial glasses in the studied xenoliths correspond to quenched alkaline basaltic melts that infiltrated the subcontinental lithospheric mantle (SCLM) at > 1000 °C at an oxygen fugacity (fO2) near the fayalite?magnetite?quartz (FMQ) buffer. Experimental works indicate that at these conditions the crystallization of oxides such as ilmenite or Cr-spinel may lower

fO_2 to promote the precipitation of Pt-rich nanoparticles. The investigation of four Pt-rich nanoparticles hosted in two different pentlandite grains using a combination of focused ion beam and high-resolution transmission electron microscopy (FIB/HRTEM) show that these nanoparticles consists of polycrystalline aggregates < 10 nm that are randomly oriented relative to their sulfide host matrices. These observations suggest that these nanoparticles could be segregated either directly from the infiltrating alkaline basaltic melt prior to sulfur saturation in the silicate melt, or from droplets of immiscible sulfide melt once sulfur saturation was achieved. The formation of Pt-rich nanoparticles in high-temperature melts, either silicate or sulfide, provides new clues on the processes of fractionation, transport and concentration of Pt in the mantle.