Diverse origins for PGE nanoparticles in mantle minerals

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It is well accepted that the platinum-group elements (PGE) generally reside in refractory sulphides and alloys in the upper mantle. In fact, the radiogenic isotopes of some of the PGEs are the basis for isotopic systems that are succesfully used to track the geochemical evolution of the upper convecting mantle (e.g., Re-Os and Pt-Os). However over the past three decades a growing body of analytical and experimental evidence indicates that PGE-carriers, particularly sulphides, may undergo significant alteration due to reaction with post-magmatic fluids. Highly reducing reactions during open-system metamorphism of mantle rocks may, for example, destabilise primary PGE-bearing sulphides like laurite (RuS_2), producing secondary rims and/or nanometer- to micrometer-sized inclusions of either (Os-Ir-poor) Ru and/or (Ru-poor) Os-Ir alloys via *in-situ* desulfurisation. These metallic "residues" occur as nm- to μm-sized particles at the reaction fronts, edges or margins of the larger precursor laurite grains, and are commonly interpeted as produced by exsolution due to cooling. However, most of such interpretations are based solely on observations in natural samples, since no information is currently available on the behaviour of IPGE nanoparticles at temperatures below the magmatic realm. In this communication, we will show examples that are allowing us to interpret the strong effect of temperature and mineral host alteration on the stability of noble-metal nanoparticle under metamorphic conditions. We make the first attempt to explain the formation and later preservation of nanoparticles of Ru-Os-Ir alloys in laurite by providing mineralogical evidence of Ostwald-type coarsening of metal nanoparticles occuring during prograde metamorphism. By constraining a general framework of IPGE nanoparticle sizevs. Thermal stability conditions, we aim to provide broad evidence of the relevant role of temperature and nanoparticle-host interaction phenomena, and shed new light on the kinetic controls of small-scale IPGE distribution during metamorphism.