Experimental observations on oxides and noble metal nuggets

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PGE nanonuggets are usually considered a nuisance in experimental studies designed to measure partitioning and solubilities in silicate melts. Their ubiquitous presence in experiments and in natural rocks as well suggest that they may have a role in natural systems.

Our experiments were designed to maximise nanonugget formation by using Ag–Pd capsules and Fe-bearing hydrous peralkaline melts, doped with TiO_2 and Bi_2O_3. The runs were not oxygen buffered. Metal phases are observed in the experimental runs, particularly adhering to Fe(-Ti) oxides. Nanonugget colour as observed in a 100x objective and oil depends on composition and size. Knowing that most nanonuggets are Ag, we infer nanonugget diameter to be between ~50 to 1000 nm using optical observation.

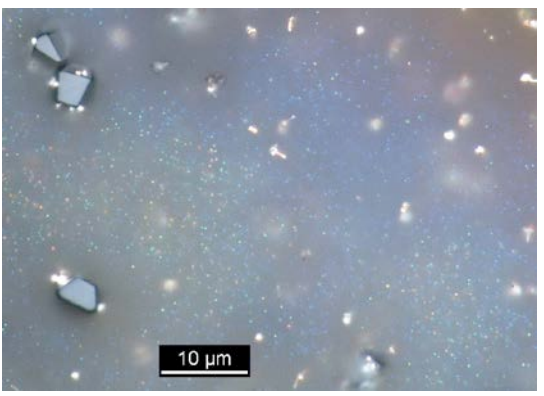

Figure 1: Photomicrograph of magnetite, nanonuggets and coarse noble metal phases consisting of Ag, Pd, Pt and Bi. Analyses by LA-ICP-MS show that Au and Ir also occur in the metal phases.

Nanometre-scale euhedral metal phases occur in some runs. Additional runs where metal saturation was enhanced by slow cooling exhibit no nanonuggets and coarse, μm-sized noble metal phases.

We suggest that nanonuggets are a means of PGE transport in silicate melts beyond traditional PGE solubilities and serve as feedstock for crystallisation of coarser PGM.