

Noble metal nanoclusters and nanoparticles precede mineral formation in magmatic sulphide melts

Abstract

In low temperature aqueous solutions, it has long been recognized by in situ experiments that many minerals are preceded by crystalline nanometre-sized particles and non-crystalline nanophases. For magmatic systems, nanometre-sized precursors have not yet been demonstrated to exist, although the suggestion has been around for some time. Here we demonstrate by high temperature quench experiments that platinum and arsenic selforganize to nanoparticles, well before the melt has reached a Pt–As concentration at which discrete Pt arsenide minerals become stable phases. If all highly siderophile elements associate to nanophases in undersaturated melts, the distribution of the noble metals between silicate, sulphide and metal melts will be controlled by the surface properties of nano-associations, more so than by the chemical properties of the elements.