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Gold particles in upper mantle xenoliths

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Gold is the most incompatible of the noble metals and partitions into the generated melt during partial melting of mantle peridotites. However, some stron|gly depleted peridotites exhibit moderate to high whole-rock Au contents, which may be related to the late introduction of this metal in metasomatic Cu-Ni rich sulfides.

Gold rich minerals in mantle peridotites have been previously identified by [1] and [2]. [1] interpreted that a bleb of native Au enclosed within an olivine xenocryst was transported to relatively shallow depths by a rising mantle plume, although the incorporation mechanism remains unclear. [2] described micrometric to nanometric inclusions of Au-(Pb) minerals found within olivine from orogenic peridotites of the Lherz massif (France). They interpreted that gold particles were originally exsolved from their base-metal sulfide host upon subsolidus cooling at < 650º C. In addition, crystallization of gold from mantle-derived melts has also been observed in lamproitic lavas from south-east Spain [3] and in basanite glass from the Kilauea volcano in Hawaii [4].

In this communication we present the first occurrence of Au particles found in different textural positions in a single mantle-xenolith from the El Deseado Massif in Patagonia, Argentina. Textural evidence indicate that the Au particles occur: (1) enclosed within primary olivine, (2) embedded in in glass from cross-cutting metasomatic veins, and (3) in Cu-Ni rich sulfides contained in the metasomatic veins. We discuss two alternatives to explain the formation of these gold particles as the result of, i.e., Au liberation after resorption of Au-rich base metal sulfides, or direct crystallization from the metasomatic melt. Our observations provide further constraints regarding gold mobility and distribution in the upper mantle.

[1] Zhang *et al*. (2006) *Am Mineral***91**, 1178-1183. [2] Ferraris & Lorand (2015) *PCM* **42**, 143-50. [3] Toscani (1999) *Mineral Mag* **63**, 595-605. [4] Sisson *et al*. (2003) *Econ Geol.* **98**, 643-648.