Isotope and geochemical characteristics of native gold from the Olympic Dam deposit

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Olympic Dam is the unique iron oxide Cu-U-Au-Ag-REE deposit located on the Gawler Craton in South Australia. Copper sulphide and uranium mineralization occurs in the Olympic Dam breccia complex (ODBC), which consists of tectonic-magmatic-hydrothermal hematite-rich granite breccias hosted by Mesoproterozoic granite. Formation of this deposit is believed to be related to several episodes of tectonic activity that took place episodically from ~ 1600 to ~500 Ma [1].

Anomalously rich, bonanza-style, native gold mineralization occurs on the edges of the sulphide-barren, hematite qaurtz breccias in the deposit. To link this specific gold mineralization to one of the stages of deposit formation we have conducted isotopic research: (i) direct U-Th-He dating of native gold; (ii) measurements of Nd isotopic composition in native gold; (iii) study of the isotopic composition of Pb in native gold. The important assumption in this study is that native gold acts as a refractory, inert and soft matrix for submicron inclusions of REE-rich minerals, which prevents isotope exchange with outer fluids.

Before isotopic study 1-2 mm sized nuggets of native gold were washed in acids to remove all inclusions that have a contact to surface. Sm-Nd and U-Pb isotopic system were studied by classical TIMS method. For Sm-Nd research the samples were dissolved by aqua regia and additionally treated by HF, $HClO_4$. For U-Pb study dissolution was in aqua regia only. U-Th-He dating was conducted by the methodology described in [2].

Preliminary results were compared to the existing isotopic data on the Olympic Dam deposit and indicate that the formation of gold is related to several ore forming events..

[1] Apukhtina et al., (2017) Econ Geol, accepted [2] Yakubovich et al., (2014) *Petrology*, v.**22**, n.5, 460-468