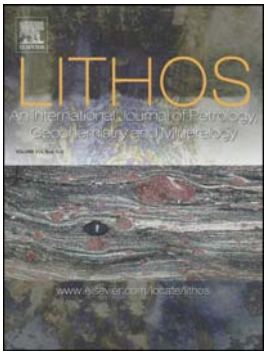

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Apatite at Olympic Dam, South Australia: a petrogenetic tool

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Abstract

The >10,000 million tonne Olympic Dam Cu-Au-U-Ag deposit, (eastern Gawler Craton, South Australia) is one of the largest orebodies in the World. The deposit is hosted within the Olympic Dam Breccia Complex, placed at the centre of, and resulting from multiple brecciation and Fe-metasomatism of the Roxby Downs Granite (RDG). The latter is part of a larger batholith emplaced at ~1.6 Ga. Apatite petrography and chemistry was studied in non-mineralised RDG and coeval granitoids and dolerites, as well as in mineralised RDG from deep (>2 km) and distal (2.7 km to NE) locations. In both latter cases, although the mineralisation corresponds to the same, early chalcopyrite-pyrite-magnetite±hematite stage identified in the outer and deeper zones of the deposit itself, the character of granite alteration differs: sericite-chlorite alteration with all feldspar replaced in the deep location; and red-stained K-feldspar on top of prevailing albitization in the distal location. Close-to end-member fluorapatite is a key accessory mineral in all igneous rocks and a common product of early hydrothermal alteration within mineralised granite. Variations in habit, morphology and textures correlate with chemical trends expressed as evolving Cl/F ratios, and concentrations of REE+Y (hereafter REY), Sr, Mn, S, Si and Na. Magmatic apatite is unzoned in the dolerite but features core to REY-enriched rim zonation in the granitoids. Increases in Cl- and Sr-contents correlate with rock basicity. Calculation of Cl in the vapour phase relative to melt at the

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