

Uranium mineralogy: diversity and significance

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Keywords: uranium mineralogy, microanalysis, Olympic Dam

ABSTRACT

There are 223 different minerals containing essential uranium, a function of multiple oxidation states and uranium's ability to combine with a broad range of other elements. Although a majority of these are extremely rare, uranium may still occur within many different minerals in any given ore deposit or weathering environment. Uranium can also readily occur within the crystal structures of a wide range of other minerals at parts-per-million to wt.% levels. These include common accessory minerals like ilmenite, rutile, or zircon, phosphates such as apatite or monazite, as well as iron-oxides such as hematite.

Different uranium-bearing minerals will behave dissimilarly during processing, or in the environment, and also display markedly different abilities to reincorporate daughter radionuclides produced from ²³⁸U decay. Excellent constraints on uranium mineralogy are thus critical in mining, whether the uranium is going to be recovered for processing and sale or is instead present as an unwanted contaminant that needs, along with daughter radionuclides, to be separated from the target metals and safely disposed of.

Using examples from the Olympic Dam iron oxide-copper-gold-uranium deposit, South Australia, this contribution addresses complex uranium mineralogy, and the methodologies used to study uranium mineralogy at the micron- to nanoscales.