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Determining Uranium Mineral Compositions by Electron Probe Microanalysis

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Uraninite is one of the most abundant uranium ore minerals. It occurs in west central Namibia, in the world's largest mineable granite-hosted deposits. It is the primary ore mineral in late- to post-orogenic sheeted leucogranites (SLGs) that intruded in multiple generations into structurally prepared granulite-facies Neoproterozoic metasediments. Contemporary interpretations for the ore genesis favour models of oxidised, low-%, partial melt of weakly uraniferous source material intruding and reacting with reducing units of the metasedimentary sequence. The primary driver for uraninite crystallisation within the SLGs is redox buffering of dissolved U^{6+}-complexes by reductants in the reactive Damaran metasediments. Resultant insoluble U^{4+} has combined with available impurities and U^{6+} to bond with O^{2-} and crystallise impure uraninite. The uranium repositories in the source rocks likely included common accessory minerals such as zircon, monazite, biotite, and apatite that retain or release U, Th, lanthanides, and other incompatible elements into the silicate melt and magmatic fluids. Variable proportions of the uranium-bearing refractory minerals betafite and brannerite reflect diverse local conditions within deposits during and subsequent to ore genesis.