Research Sheds Light on South Australian Uranium Deposits

A project involving University of Adelaide researchers used mineralogy and geochemistry of ore materials and sediments to gain understanding of the geological formation of the Beverley uranium deposit.

The research fills a gap in understanding uranium deposits in South Australia as it is the first extensive study on Beverley-type mineralization and offers tools for the exploration of sandstone-hosted uranium deposits.

Beverley Uranium mine is Australia’s first in situ leach uranium mine. The deposit is located beneath the Lake Frome plains, around 530km north-northeast of South Australian capital city, Adelaide. The deposit flanks the North Flinders Ranges lying around 13km away from the exposed crystalline basement of the Mount Painter inlier.

Mineralisation was deposited mainly in organic matter-poor Miocene lacustrine sands and partly in the underlying reductive strata of organic matter-rich clays and sites. The bulk of the mineralisation consists of coffinite and/or uraninite nodules, growing around Co-rich pyrite with an S isotope composition suggestive of early diagenetic lacustrine origin, that is the chemical, physical or biological change of a sediment after initial deposition within a lake.

South Australia already has one of the world’s largest known accumulation of metals at Olympic Dam (copper, uranium, gold, silver deposit) with significant uranium mineralisation in places such as Mount Painter and Mount Gee, according to the Department of Primary Industries and Resources South Australia (PIRSA).

The suitability of the Beverley deposit for efficient mining via in situ leaching, and hence its economic value, is determined by the nature of the hosting sand unit. This provides permeability and low reactivity required for high fluid flow and low chemical consumption.

The research team used a range of techniques including the determination of heavy mineral provenance, thereby identifying the critical role of the emergence of the Mt Painter basement block due to tectonic uplift in the late Miocene time, as a critical source of uranium.

They found Beverley mineralization is mostly composed of coffinite with minor uraninite and associated native copper, pyrite, marcasite, carnitite, sphalerite, barite and chalcopyrite. The presence of native lead necessitates highly reducing sulphur-poor microenvironments while using the groundwater composition and observed mineralogy, the conditions during mineralisation are estimated as pH 6.3 to 8.4.

However the upper part of the mineralisation at Beverley has a different mineralogy which records acidic oxidising conditions (carnotite, no coffinite, alunite, kaolinite, goethite and gypsum) with prevailing conditions of pH 3.9 and 4.5. U-Pb dating of coffinite and carnotite suggest that the U mineralization is Pliocene (6.7–3.4 Ma).
The researchers note that Beverley deposit has already proven its economic viability. Exploration around the mine led to the discovery of the Four Mile deposit which confirms the high potential of the Paralana High Plains district. The researchers found that uranium sources in the Mount Painter domain can be considered as unlimited uranium sources to the neighbouring basins.

They classify the Beverley deposit in the tabular type according to the Bruneton and Cuney (2010) synthesis. Mineralisation is primary controlled by sedimentologic features which define the flat-shaped mineralised bodies. The deposit is quite different from the Colorado Plateau-type mineralizations and more similar to Arlit district deposits in Niger.

The researchers conclude economic value of uranium deposits in the province can be decided by sedimentological features. Beverley is well suited for cost-effective in situ acid-leaching techniques mining because of its favourable hydrogeologic situation and because host sediments have the right porosity and mineralogy with low carbonate and clay contents. Sedimentologic features resulting from a complex history involving angular sands of glacial origin cleaned up and remobilized into oblong bodies along ancient lake shores, together with the proximity to an active fault that exposed U-rich basement rocks conspired to form exceptionally rich uranium deposits.


Coffinite textures revealed by SEM images. Coffinite nodule 157 [−132 m], cobaltian pyrite, and coffinite bacterioform particles. Smectite flakes are also intermixed (black). Photographs (a) and (c) were taken in BSE mode to enlighten the heavy elements (here U). (a) zoom in the outer rim of the coffinite nodule. (b) and (c) a zoom on the pyrite core and coffinite contact.