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The giant Alum Shale polymetallic deposits of Jämtland, Sweden –a major potential low cost supplier of uranium for the future

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Jämtland County in Sweden contains approximately 11% of global uranium resources which are compliant with either the Toronto or Australian Stock Exchange codes.

A widespread unit through northern Europe, the Alum Shale host rock has been a historic source of alum, oil and uranium. Exploration for uranium in the 1970s located several tens of square kilometres with the development of relatively thick Alum Shale in Jämtland.

Geology and resources

The Alum Shale in Jämtland is a fine-grained, carbonaceous schist. The groundmass comprises quartz, feldspar, white micas and carbon.

The uranium, molybdenum and vanadium have been shown to be concentrated in the organic/mica matrix. Nickel and zinc are preferentially concentrated within the pyrite grains.

Total mineral resources in the district are approximately 5 billion tonnes, at a grade of approximately 160ppm U3O8. Aura Energy Ltd, one of the holders of permits in the district, has 2.35 BT @ 155 ppm U3O8. The average grades of other metals present in the resource are: molybdenum 207ppm, vanadium 1,519ppm, nickel 316ppm, and zinc 431ppm.

These polymetallic resources are exceptionally large, and Aura's uranium resource constitutes the second largest undeveloped resource anywhere in the world.

Low-cost bacterial leach technology

Black schists are typically considered to be challenging metallurgically. Hence the Alum Shale has been previously considered a potential high cost source of uranium.

The primary issue has been the high cost associated with acid reagent to extract the uranium. Recently the pyrite has been recognised as a possible source of acid within the ore itself. Bacterial leaching to catalyse the oxidation of pyrite was demonstrated to be the most effective process for generating this acid.

The Jämtland Alum Shales appear ideally suited to bioleaching because of the level of pyrite present, and the lower proportion of acid consuming minerals such as carbonates.

Aura Energy has established leach extractions of up to 85% of the uranium, and 66% of the nickel indicate the suitability of the Shale to this technology.

These extractions can be obtained at coarse crush sizes up to 25mm. This result demonstrated the potential to utilise a coarse-crushed low-cost bacterial heap leach operation for the Häggån material.

Bacterial heap leaching is widely applied in the copper industry, particularly in Chile.

Project economics

A scoping study completed by Aura Energy has suggested that a notional 30Mtpa operation would produce approximately 8 Mlbs of U3O8 per annum, plus other metals. Such a project has a Net Present Value of $1.85 billion, and a rate of return of 49$

Operating costs estimated by the Scoping Study, after co-product credits, are within the lower quartile of the WNA uranium producers cost curve.

Aura Energy has estimated operating costs at smaller throughputs between 3.5 and 7.5 Mtpa, and these remain below $25.00/lb$.

Primary author: Dr BEESON, Robert (Aura Energy Ltd)

Co-author: Dr GOODALL, Will (Aura Energy Ltd)

Presenter: Dr BEESON, Robert (Aura Energy Ltd)

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