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# Alkaline leaching of brannerite.

## Part 2: Leaching of a high-carbonate refractory uranium ore

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### Abstract

There are several metasomatic uranium deposits in the area around Mount Isa in Queensland, containing a total of 56,400 tonnes of uranium. Many of these ores are refractory in nature, meaning that relatively high leach temperatures ( $>75^{\circ}\text{C}$ ) and reagent dosages ( $>50\text{ g/L H}_2\text{SO}_4$ ) are needed to effectively extract the uranium from them. Also, these ores are hosted in alkaline rock which means that acid leaching is unlikely to be economical.

While refractory uranium ores are not typically leached in alkaline media, previous work has shown that uranium can be extracted from brannerite in alkaline media, albeit slowly. The same leaching conditions previously shown to be effective for the extraction of uranium from brannerite were repeated with a sample of refractory uranium ore from a deposit near Mount Isa in north western Queensland. Mineralogical analysis with a Tescan Integrated Mineralogical Analyser (TIMA) showed that the uranium was present as brannerite (51%) and coffinite (49%).

The ore was leached in sodium carbonate media for 24 hours. Leach temperatures of 50, 70 and  $90^{\circ}\text{C}$ , and sparging with oxygen, air and nitrogen were tested. The effect of adding ferricyanide chemical oxidant was also tested. Similar initial uranium extraction rates were observed for the Mount Isa uranium ore compared with Sierra Albarrana brannerite leached under the same conditions in earlier work. The final extractions were lower however, due to the fine-grained nature of the uranium mineralisation in the ore.

TIMA analysis on a residue produced under the most intense set of leaching conditions ( $90^{\circ}\text{C}$ ,  $\text{O}_2$  sparged) showed that the extent of coffinite dissolution was greater than that of brannerite dissolution during leaching. Likewise, the TIMA analyses showed that the extent of apparent uranium liberation decreased during leaching, due to poorly liberated particles remaining undissolved. These results indicate that alkaline leaching could be a viable method for the processing of these long overlooked ores provided that the uranium is sufficiently liberated.

*Keywords: Uranium; Brannerite; Leaching; Alkaline; Carbonate; Kinetics.*

## 1 Introduction

The first uranium deposits near Mount Isa in northern Queensland were discovered in 1954 (Brooks, 1958). Of the uranium deposits in Queensland, only the Mary Kathleen deposit has ever been mined.

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