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Investigation of the Mineralogical Factors Impacting on the Extraction Process for U and Be in the Baiyanghe Deposit

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1 Introduction

Baiyanghe deposit is a ultra-large type mine with Uranium and Beryllium, which is located in northwest of Xinjiang area. In order to utilize the U-Be resource, some experiments have been carried out to address the process mineralogy about Baiyanghe deposit. We used a combination of electron probe analysis (EPMA), polarization microscopy and X-Ray Diffraction (XRD) to identify minerals.

2 Mineralogical Characterisation

XRF analysis shows that the main elements in the ore are Si, Al and Fe. The BeO grade is about 0.2%, and the U content reaches 580ug/g. Beryllium is mainly hosted within the mineral bertrandite. A much smaller amount is absorbed in clay minerals(Liu, 2010). Uraniumis contained within pitchblende. The main gangue minerals are quartz, albite, K-feldspar, muscovite, chlorite, fluorite, hematite and limonite.Three main mineralogical characteristics were identified which can influence processing and recovery of the elements of interest.

(1) The bertrandite particles were small (no more than 20 microns), and appeared as short columnar grains or flakes, arranged in a disorderly manner.

(2) Bertrandite and fluorite are intimately intergrown. There are several types of fluorite in ore, differentiated by distinct colors. Xiu (2011) earlier found that high concentrations of Be were present in dark fluorite, whereas concentrations were low in white or light green fluorite. Xiu (2011) considered that this was due to isomorphism between BeF_2 and CaF_2. Distinct forms of bertrandite were observed in the ore associated with fluorite:(a) aggregates of fine, euhedral particles of bertrandite, with interstitial fluorite, and the two minerals enclosed within one another; (b) bertrandite particles occuring as wispy grains within fractures together with fluorite and quartz; and (c) bertrandite particles were enwrapped by fluorite and feldspar.

(3) Pitchblende particles grow in fissures, and are enclosed by bertrandite, fluorite and quartz. Previous studies suggest that the darker the ore is, the higher the uranium content (Li, 1991). Our XRD and EPMA results show that pitchblende particles are encapsulated by dark fluorite.

3 Factors Affecting the Extraction Process of Uranium and Beryllium

The common method for processing a bertrandite resource is in-situ leaching(McLemore, 2010). Such a method is not suited to the Baiyanghe deposit because of relatively low bertrandite content relative to high gangue mineral content. Beneficiation by flotation may thus be a viable alternative.We identified mineralogical characteristics which impact on this.

3.1 Liberation of bertrandite and fluorite

Bertrandite particles liberate from ore at a fine grind size because of their fine grain size and close association with fluorite. The fine grind impacts on economic beneficiation because of higher energy consumption; extreme sliming (bertrandite loss to muds); high reagent consumption; and low flotation efficiency.

3.2 The influence of fluorite on Be concentrate quality

Fluorite affected the quality of Be concentrates in two ways. Firstly, bertrandite and fluorite cannot be completely dissociated during grinding due to their finer grain size and close association. Secondly, bertrandite would collect by fatty acid in flotation, but this would also collect fluorite (Pei, 1997; Song, 2004), causing fluorite enrichment in the concentrate. Experiments show that the F/BeO ratio in the concentrate could be as high as 65.6% in a concentrate

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containing just 5.94% BeO. The limitation of the F/BeO ratio in smelter feed is no higher than 8%.

3.3 Leaching of uranium

Because pitchblende particles have grown in fissure, it was easy for H_2SO_4 to infiltration along microfractures. Experiments indicated that uranium leach rates of -3 mm ore was as much as 80% over a 96 hour period using5% H_2SO_4(V/V).

4 Conclusions

Particles of bertrandite are fine-grained (about 20μm); some particles are finely intergrown with fluorite. Pitchblende particles grow in fissures, and are enclosed by bertrandite, fluorite and quartz.

Bertrandite can be liberated if a fine grind size is used. This however consumes higher amounts of energy, causes extreme sliming, low flotation efficiency, and also results in a high CaF_2 content in the Be concentrate. In contrast U was easy to leach as it grows in fissures.

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