OXIDE MINERALOGY OF BAWDWIN ORES

PhD DISSERTATION

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ABSTRACT

The Bawdwin ore body is the best known and certainly the best documented mineral deposit in Myanmar. In size and richness, it once ranked as an ore body of world importance.

The Bawdwin mine is located some 600 rail miles (960 km) north of Yangon. The Mandalay-Lashio section of Myanma Railways connects the Namtu-Bawdwin narrow gauge (2 ft) line of 50 miles (80 km) at Namyau 547.5 miles (876 km) from Yangon. Namtu is connected by a metal road from the towns of Thibaw and Lashio, of Shan State (North).

The Bawdwin area is situated on the structural platform as part of the Sino-Burman Ranges. The Tawnpeng Batholith covering as extensive area lies 3 miles to the west. An east-west lineament passes through the area 10 miles (16 km) north of Bawdwin. Bawdwin was a centre of volcanic activity, manifesting the volcanic and volcanoclastic rocks. The regional stratigraphy comprises the turbidites of the Chaung Magyi Group (Precambrian), the clastic and volcanoclastic rocks of the Pangyun Formation (Cambrian) and a succession of clastic sediments of the Naung Kangyi Group, and the Nam Hsim sandstone, and extensive carbonate rocks of the Shan Dolomite Group. The regional structural fabric consists of composite easterly and northwesterly faults.

The Bawdwin mine geology comprises a northwest trending arch. The hydrothermal altered Central Bawdwin tuff and the Loimi quartz porphyry are host to mineralization. The major northwest trending faults have controlled the alteration and mineralization resulting in three major ore bodies: from north to south the Shan Lode, the Chinaman and the Meingtha Lodes, which has been renamed the Nos 2, 1, 3 Lodes respectively. The post-ore Yunnan and Hsenwi faults displaced the main ore bodies. Alteration of Bawdwin is pervasive; the common types of alteration are sericitization, silicification, kaolinization and chloritization.

The primary ores of the Bawdwin are sulphides, arsenides, sulpharsenides and sulphantimonides. The galena and sphalerite are the most important ores with silver being closely associated with the galena. Chalcopyrite though of minor importance in the main lead-zinc lodes, it is an important constituent of the Copper-nickel-cobalt ores of the deeper part of the Meingtha Lode. The minor ore minerals are Boulangerite, Bournonite, Pyrargyrite, Tetrahedrite-Tennantite, Lollingite, Gersdorffite, Bismuthinite and cobaltite.

The Bawdwin oxide ores are the primary focus of the present research. With the fast depleting primary sulphide ores and to sustain the production level, it became crucial to develop and mine the oxide ores at the Gossan quarry by open pit mining methods where reserves have been estimated at 1.2 million tons averaging 6.3% Pb, 2.6% Zn, 3.7 oz of silver per ton. The dominant oxides of lead and zinc ores are anglesite, cerussite, mimetite, pyromorphite, massicot. The copper oxides include chalcocite and covellite.

The supergene profile established at Bawdwin consists of the top most gossan zone, with remnants of the leached sulphides and concentration of the red, brown and yellow hydrated iron oxides. Below this is the leached zone where ore minerals are decomposed and the resulting solutions more downward. The secondary minerals are formed in the oxidized zone and these minerals form as encrustations, fillings in cavities and as vuggy, spongy masses. The oxidized zone is underlain by a transition or mixed zone of primary minerals and the supergene products down to the water table which lies at a depth of about 100 feet (30m) from the surface. Below the water table lies the primary sulphide zone where the primary sulphides ores only slightly attacked by the supergene process.

The iron sulphide mineral pyrite is the main generator of the oxidizing solutions composed of sulphuric acid and ferric sulphate. The mine waters are slightly acidic (a pH of 5.5 to 6.9) and have high sulphate content and carried a large amount of zinc.

The degree of oxidation depends to a large extent on the presence of pyrite in the ore, and from field and laboratory investigations there appears to be a paucity of this mineral indicated by the main sulphide minerals that remained unattacked in the leaching zone. This is also the main reason the incomplete oxidation and the absence of an enrichment zone at Bawdwin.

The 'difficult to float' oxide lead minerals, anglesite, pyromorphite and mimetite cause the major problem for processing of the oxide ores which have to be sulphidized prior to flotation. Study of the mill products reveals a high lead sulphide to lead oxide ratio at the present depth of the open pit which now approaches the primary sulphide zone.

A re-evaluation of the remaining oxide ore reserves, re-designing of the open pit and renovation the Bawdwin Concentration Plant (BCP) remains a challenge for the future of this century old Bawdwin mine.

CONTENTS