19. THIRTY YEARS OF SUCCESSFUL EXPLORATION AT WESTMIN'S Zn-Cu-Au-Ag MYRA FALLS OPERATIONS, VANCOUVER ISLAND, BRITISH COLUMBIA: A CONTINUED APPLICATION OF EVOLVING GEOLOGICAL MODELS

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Introduction

The Myra Falls deposits comprise a complexly metal-zoned polymetallic volcanogenic massive sulfide district located 90 km from Campbell River, central Vancouver Island, British Columbia, Canada. The massive sulfide deposits are hosted by subaqueously deposited rocks of the Devonian age Myra Formation of the Sicker Group volcanic assemblage. The deposits consist of many individual massive sulfide lenses grouped into several major zones within two main felsic volcanic stratigraphic intervals: the upper Lynx–Myra–Price Horizon, and the lower H-W Horizon. The largest of these major zones, the H-W and Battle, occur within the H-W Horizon. To January of 1996, property-wide production has been 17.0 Mt grading 2.1 g/t Au, 56.0 g/t Ag, 1.9 % Cu, and 5.1 % Zn. As of January 1, 1997, geological reserves for the H-W are 6.7 Mt grading 2.2 g/t Au, 35.5 g/t Ag, 1.7 % Cu, and 4.2 % Zn, and geological reserves for the Battle deposit are 4.2 Mt grading 1.1 g/t Au, 31.5 g/t Ag, 2.1 % Cu, and 13.0 % Zn.

Property History

The first claims in the area of what is now Westmin's Myra Falls Operations were staked in 1917. Early prospecting resulted in the discovery of three massive sulfide showings which eventually became the Lynx, Myra, and Price mines. Sporadic exploration was carried out until 1961, when Western Mines Ltd. (now Westmin Resources Ltd.) acquired the claims. Subsequent ore definition outlined 1.9 Mt of ore (approximately five years of mine life) in the Lynx deposit, and mining began in 1966.

Exploration Methods

The degree of minesite exploration at Myra Falls Operations (MFO) has been cyclical and has ultimately been controlled by fluctuating exploration budgets. However, it has been proved that when exploration has been sustained over a 3-5 year period with annual budgets of more than $2 million, exploration success has been almost guaranteed and has resulted in the major ore discoveries of the Myra mine in 1969, the H-W mine in 1979, and the Battle mine in 1990. In the 30 years that exploration has been carried out at MFO, a total expenditure of $39 million has led to the discovery of 30 Mt of ore. Although healthy budgets facilitate exploration programs, by no means do they alone ensure success. At Myra Falls, the single factor that has been constant over the years, and that has contributed the most to the success of exploration, has been geology, specifically the development of a strong geological database through the use of stratigraphic diamond drilling, on-site research, and the rethinking of old ideas through application of new ideas that have been developed as a result of research on ancient and modern massive sulfide deposits.

Stratigraphic drilling at MFO has been essential in the interpretation of the geology and in the compilation of a reliable stratigraphic column. The combination of flat-lying strata and the steep, high-relief topography on the property greatly hinder the ability to carry out thorough geological mapping. Because the ore deposits at Myra Falls are stratabound, the identification of the relative stratigraphic positions and the unique characteristics of prospective geological horizons is of paramount importance for exploration. Establishment of this stratigraphic sequence has enabled a better interpretation of the magnitude and relative timing of the complicated fault offsets across the property, which in turn has assisted in the selection of prospective targets and in the placement of exploration drillholes to optimize the geological information to be obtained.

On-site research has proven to be important in the history of MFO. For example, preliminary lithogeochemical studies in the 1970s outlined Zn and Hg anomalies in rhyolites that traditionally had been regarded as being below the massive sulfide deposits. Although this was the case for the Lynx–Myra–Price orebodies, deeper drilling to the base of these rhyolites led to the discovery of the much larger orebodies of the prolific H-W Horizon. The Ph.D. study by Stephen Juras in 1985 provided the definitive work on the volcanic stratigraphy

of the property, putting into context the relative positions of the various mineralized horizons. A more recent study by the Mineral Deposit Research Unit at the University of British Columbia provided new insights into the evolution of the H-W deposit, and generated new ideas which are being applied to other parts of the property. Currently, researchers from the Centre for Ore Deposit and Exploration Studies at the University of Tasmania are studying the structure, volcanology, and geochemistry of the Battle deposit.

Geological theories and interpretations at MFO have paralleled the changes in popular thinking in the industry. At the commencement of mining in 1966, it was thought that the sulfide ores were epigenetic and related to a steeply dipping shear zone. However, with the development of the Kuroko model for massive sulfide deposits in the 1970s, it became apparent that the ores at Myra Falls, specifically the Lynx orebodies, were volcanogenic in origin and were more closely related to rhyolitic volcanism than to structures. With the advent of seafloor research in the late 1970s and 1980s, it became evident that polymetallic sulfide deposits did not necessarily have to form on top of rhyolites as was generally the case for the Kuroko model and the Lynx orebodies. This observation suggested that one should drill through rhyolites and not treat them strictly as a "footwall" unit. Such thinking led to the discovery of the H-W deposit at the base of the H-W rhyolite. This discovery, which emphasized the need to rethink old ideas and re-evaluate certain areas, eventually led to the discoveries of the Battle deposit, the Ridge zone, and the Marshall zone, all of which are at the base of a rhyolitic sequence and on top of paleo-seafloor andesitic rocks. More recent seafloor research has revealed the importance of subsurface replacement as a mode of sulfide accumulation, and of paleotopographic features such as scarp-bounded basins as conduits that focus hydrothermal activity and the formation massive sulfide bodies. Recent work at Myra Falls has outlined a series of what appear to be primary structures that have affected the distribution and thicknesses of the orebodies and certain geological units. This work has enabled the size of the basins that host the orebodies at Myra Falls to be estimated, thus providing reasonable target size and drillhole spacing requirements for future exploration programs.

20. RED DOG ALASKA - *see section VII. - 5.*