Disseminated Gold in the Reefton Goldfields: Examples from OceanaGold's Globe-Progress Mine Showing the Benefits of Microanalysis using PIXE and EMPA

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The Reefton Goldfield is located within the Westland district on the west coast of the South Island of New Zealand. The orogenic gold deposits in this area are hosted in alternating turbidite sequences of graywacke and argillites that form the Greenland Group of the Buller terrane. These turbidites were deposited during the Cambrian through to the Ordovician and were folded and metamorphosed starting in the Silurian. The Globe-Progress mine, located about 5 km SSE of Reefton township, has dominated historical production within the goldfield by producing about 13 t of gold, predominantly from quartz veins, which were exhausted by about 1920.

In the 1980s new gold resources were identified as being dominated by two types of mineralization: that associated with quartz-vein remnants and that associated with disseminated sulfides hosted within the metasedimentary host rocks surrounding and adjacent to remnant quartz veins hosted within the Globe-Progress shear zone.

A study was undertaken to examine the nature and composition of the gold-bearing sulfide minerals within the shear zone: pyrite, arsenopyrite, and stibnite. Micro-analytical techniques (EMPA and PIXE) were carried out on sulfide minerals from 12 polished thin sections with the aim of improving our understanding of the relationship between Au, As, and Sb mineralization, and identifying the trace element compositions to constrain the source of the metals, the role of hydrothermal fluids and the importance of lithological contact relationships. Three-dimensional models of the distribution of Au, As, and Sb reveal that mineralization of these elements is heavily concentrated in the central portion of the shear zone with a smaller, secondary zone located to the west along the east-west–striking portion of the shear zone.

The relationships between the lithological, structural, and mineralogical characteristics of the deposit have been used to develop ideas on the stages and timing of mineralization events. Within this context, we observed geochemical differences between the pyrite porphyroblasts that formed during synmetamorphic, greenschist facies alteration, and pyrite that formed during a late metamorphic and the first hydrothermal alteration event which developed the hydrothermal quartz veins and enrichment in Au, As, and Sb. For instance, the pyrite porphyroblasts have low Sb, Pb, Sc, Zn, Co, Ga, V, and Au contents compared to the pyrites that formed during the hydrothermal event. Likewise, compositional differences are observed between like sulfides that formed during the first hydrothermal event and those that formed in the second post-metamorphic hydrothermal event. It has been suggested that during this event the massive stibnite veins were emplaced and cataclasites within the shear zone were created. The increased influx of Sb is reflected in the Sb contents of both pyrite and arsenopyrite in association with increased stibnite and sulfosalt abundance.