New Mapping and Interpretations of the Mount Lyell Mining District, Tasmania: A Large Hybrid Cu-Au System with an Exhalative Pb-Zn Top

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Abstract

New detailed mapping of the Mount Lyell mines area has resulted in a better understanding of the large Cambrian volcanic-hosted alteration-mineralization system. The mapping integrates the exhalative top and silica-rich upper part of the system at Lyell Comstock, the large displaced mass of silica-rich schists with high-grade bornite ores at North Lyell, and the deeper levels of the system exemplified by the low-grade Prince Lyell deposit. The 6km-long alteration system has a core zone of pyrite-rich sericite-chlorite-silica schists, which contains most of the copper orebodies, flanked by marginal zones of pyrite-poor sericite and chlorite schists. The alteration has been focused along the Great Lyell fault, a major reverse-type growth fault, which forms the contact between the volcanic rocks and the younger (Late Cambrian) siliciclastic conglomerate sequence of the Owen Group.

Small lead-zinc-rich massive sulfide lenses, together with lenses of fossil-rich limestone, characterize the exhalative zone, which is hosted within submarine volcaniclastic breccias and sandstones in the basal part of the late Middle Cambrian Tyndall Group at Comstock. The upper part of the alteration zone immediately below this is characterized by numerous cherty silica masses or heads contained within sericite-pyrite-silica schists, culminating in the very large Comstock chert body that appears to have formed a siliceous cap to the system. Ore lenses of disseminated chalcopyrite-pyrite, with some bornite, were located below the silica cap.

At North Lyell, a large displaced mass of schists from the upper part of the system has numerous silica heads and a large cap-like silica body, the North Lyell chert, similar to the Comstock chert, which has been generally misinterpreted as silicified Owen conglomerate. Bornite-chalcopyrite ores were located immediately beneath this chert body, and several chalcopyrite-pyrite lenses are present at slightly deeper levels. The schist mass was apparently emplaced into the Owen basin by collapse from the scarp of the Great Lyell fault, after the alteration zone was uplifted and unroofed by erosion. The sulfide- and chert-rich mass was exposed, oxidized, and partially eroded during its slow, nappe-like emplacement, and gossan-like hematite-barite bodies and hematite- chert breccias were developed along the contact in places and interfinger with the contemporaneous Middle and Upper Owen sediments.

There appears to be a zonation in the copper ores from disseminated chalcopyrite-pyrite in the deeper levels, as at Prince Lyell, to chalcopyrite with minor bornite in the silica heads zone (exemplified by Comstock and Western Tharsis), to bornite-rich ores with lesser chalcopyrite in the upper levels against the silica cap, as at North Lyell. Pyrophyllite is associated with the bornite mineralization, which appears to represent a high-sulfidation phase, possibly associated with increased or renewed magmatic activity, rather late in the development of this large, hybrid, magmatic-seawater system. Much of the upper part of the system, probably including some rich orebodies, was apparently eroded off during deposition of the Owen Group.