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Discovery Challenges with Deeper Ore Bodies

Brisbane, Australia

The World's mineral exploration teams require a significantly improved discovery performance to prevent the present inventory of identified economic mineral resources from being seriously depleted as the demand for mineral commodities rapidly escalates over the coming decades. Unfortunately, most of the supposedly easy discoveries of, for example, giant and extremely large copper, gold-copper, and gold ore bodies have likely been made, at least in mature exploration terranes; future discoveries of giant and extremely large deposits of these metals and other mineral commodities are undoubtedly going to be much less obvious, prior to discovery, than in the past.

To satisfy the future reserve-replacement and production challenges, the mineral exploration industry will need to target and discover giant and extremely large ore bodies that can be mined using very large-scale (mass), open pit and underground mining techniques. In mature exploration terranes, and possibly elsewhere in less explored areas, these deposits will increasingly be located in the deep-earth environment, where mass mining will be conducted at depths below surface to ~1500 m for open pit and ~2000 m for underground caving; this will probably extend to ~3000 m depth over time, as mass underground mining technologies advance. Inevitably, the depth to the top of some of these ore bodies will be beyond the economic capacity for open pit mining, even with exceptionally deep open pits, and extremely large block-cave underground mines, an order-of-magnitude larger in scale (as are presently being planned and developed) than any present cave mine, will be required to mine these ore bodies.

There is no obvious reason to expect that deep ore bodies of this type will not be discovered and successfully mined, provided the mining and exploration industry has an enlightened approach to the challenges. The discovery histories of three of the Cadia porphyry gold-copper deposits in Australia are used to demonstrate that the challenges of successfully exploring in the deep-earth environment can be surmounted. Such examples also provide insights that can be used to guide future discovery, as can the business approaches to discovery practised by successful mining companies in the past. Unfortunately, these and the creativity required for discovery are largely being subsumed presently in the mining industry by the increasing corporate desire to manage, rather than lead, discovery. Few mining company boards, CEOs and senior managers understand the ore-body discovery process. Compounding the issue for those who may understand the process, most simply do not have the capacity and skill that is required to encourage discovery where quarterly profits, market and operational issues, rather than creating wealth through discovery, dominate corporate strategy.

Some companies are beginning to take up and address the mass mining challenge, with major expansion and deepening by open pit proposed or planned for several, already very large and very deep copper mines. The underground mass mining challenge is being confronted by the planned or anticipated adoption of the panel caving style of block-cave mining at some, yet to be mined, deep copper-gold deposits and several existing, open pit copper ± gold mines where deeper open pit mining may not be economically viable. The challenge for exploration geologists will be to discover the ore bodies that will be mined in this way in the future.

Bio

Dan Wood is an exploration geologist who graduated with BSc (Hons) and MSc degrees from the University of Queensland, Australia. He retired from corporate mineral exploration in late-2008, after 24 years with BHP and almost 18 years with Newcrest Mining where, from the mid-1990s, he led its exploration team as Executive General Manager Exploration. Newcrest was judged by Metals Economics Group of Canada as the world's most successful gold explorer, 1992-2005.

Dan commenced his mining industry career in 1967 with BHP, working for a short time as a mine geologist in iron ore and associated steelworks raw materials before being transferred into exploration. He remained with BHP's exploration team until late-1990, transferring to Newcrest Mining when the company was formed by the merger of BHP Gold and Newmont Australia. The discoveries of Newcrest's exploration team laid the foundation for its transformation into a significant mineral resources company.

Recently, he was Director of the W H Bryan Mining and Geology Research Centre, University of Queensland, where he is an adjunct professor and member of the Centre's Advisory Board. He is also a non-executive Director of the Highlands Pacific Group, a Resource Industry Ambassador for the State of Queensland, Fellow of the SEG, member of the Geological Society of Australia, and joint-recipient of its Joe Harms Medal for discovering the Cadia gold-copper deposits.