Unlocking the Giant Ladolam Gold Deposit: Discovery Through to Recovery

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Ladolam is the world's largest low sulfidation alkalic epithermal Au deposit with resources exceeding 59 Moz Au (www.newcrest.com.au). Over the past 30 years, exploration has identified multiple adjacent and partly overlapping ore zones in an area of approximately 3 km^2 in the Luise Caldera on the east coast of Lihir Island. The mineralization is open along strike and to the east, bounded by the Pacific Ocean.

Lihir Island is part of the Tabar-Feni Group, a 250-km-long, NW-trending, alkalic volcanic island chain in a zone of oblique convergence between the Australian and South Pacific plates. Based on 1970s observations by the Geological Survey of Papua New Guinea and the Australian Bureau of Mineral Resources, Niugini Mining Ltd and Kennecott Exploration Ltd targeted Lihir for "hot spring-style" epithermal mineralization. Intensely altered "red rock cliffs" were noted on the BMR 1:100,000-scale map sheet; pyritic and silicic outcrops on the prominent coastal bluff ranged from 0.53 to 4.36 g/t Au.

Surface sampling resulted in delineation of Coastal, Lienetz, and Kapit mineralized areas. In Coastal zone, a >1 g/t Au in soil and rock chip anomaly measured 450 × 250 m, with trenches cutting 219 m at 4.58 g/t Au. The first drill hole (September 1983) in the Coastal zone cut 29 m at 7.69 g/t Au in oxide ore and 21 m at 7.09 g/t Au in sulfide ore. Gold was associated with quartz-alunite-kaolinite–altered breccias; at depth, higher-grade (+5 g/t) pyritic adularia-rich mineralization occurred (the "boiling zone"). Disseminated gold mineralization was subsequently discovered in Lienetz. By the end of 1984, a large gold resource had been confirmed; preliminary reserves at Lihir were calculated at 137 Mt at 2.66 g/t Au at a 1 g/t cutoff.

Earliest feasibility studies recognized the complexity of mining in an active geothermal area. Discovery of higher-grade, near-surface mineralization at Minifie helped to unlock Ladolam. Test work showed that Minifie ore would not require significant cooling before mining. Further exploration led to the Kapit discovery, but, like Coastal and Lienetz, Kapit was found to occur in an active geothermal system. In 1992, Kennecott Mining completed a new feasibility study. In 1995, Lihir Gold Ltd (LGL) was established to own and operate the Lihir gold mine on behalf of a joint venture between Kennecott Mining and Rio Tinto, and construction started; first gold was poured in 1997.

When mining commenced at Minifie, the temperature of the groundwater and rocks was commonly in excess of 60°C. Successful mining of geothermally active parts of Ladolam encouraged LGL to complete drilling of the hotter Kapit zone. The project was acquired by Newcrest Mining Ltd in 2010; Newcrest drilling has focused on delineating mineralization in the Kapit North East area, thereby delineating the north-south extent of pyritic gold mineralization across 3 km. Over 500 km of drilling now defines a mineral resource of 790 Mt at 2.3 g/t Au (www.newcrest.com.au).