Discovery to Evaluation in a Mature Brownfields Terrane: A Case History of Exploration in the Northparkes District, NSW, Australia

Jonathon Hoye* and Jeneta Wellard

Northparkes Mines, P.O. Box 995, Parkes, NSW 2870, Australia

*E-mail, jonathon.hoye@northparkes.com

The Northparkes district is one of a number of clusters of economic porphyry Cu-Au mineralization developed within the Early Ordovician to Silurian Macquarie arc in central western NSW, approximately 300 km NNW of Sydney. Protracted exploration over a 40-year period has resulted in the definition of a number of bornite-dominant silica-saturated alkalic porphyry systems associated with pipe-like quartz monzonite porphyry complexes, of which four have been mined to date.

The discovery of the first porphyry deposits in the district occurred as the result of systematic exploration in the early 1970s by Geopeko Ltd., targeting potential VHMS systems within the Ordovician volcanic package. Traditional exploration methods including geological mapping, surface and bedrock geochemical sampling, and regional geophysical surveys led to the discovery of a number of subeconomic Zn-Au-Cu skarn systems by Geopeko. Owing to extensive, locally thick, lateritic to transported cover, no economic deposits were discovered until a program of kilometer-spaced auger core drilling along local roads intersected the margins of what became the E22 porphyry Cu deposit in 1976.

Deposits mined to date have been deeply eroded, exposing potassic alteration zones and ore-grade Cu-Au mineralization beneath the regional cover sequence, allowing bedrock detection, aiding in their discovery and delineation. Due to the relatively mature nature of the exploration setting, recent brownfields exploration has moved away from direct detection of ore systems and is focused on assessing the potential for the district to host concealed or blind deposits, in which the anomalous copper envelope has yet to be exposed by erosion.

Global and site-based advances in the understanding of porphyry systems have led to revision of geological models for mineralization. Recognition of near-miss alteration and geochemical vectors from these models and acquisition of broad-suite geochemical and high-resolution geophysical datasets, as well as application of fertility indicators, have led to the reassessment of a number of areas previously considered to be of low prospectivity. This exploration strategy has yielded success in recent years, with the discovery of the large low-grade GRP314 ore deposit, which fails to conform to the "typical" Northparkes deposit model.

Geological models and datasets acquired as part of the exploration process have also added value to both the interpretation and evaluation stages of project assessment. This is exemplified by the application of exploration phosphorus assay data to delineate and domain separate porphyry phases in areas of strong alteration, where separation based on traditional macroscopic texture or modal analysis is impractical due to intense overprinting by hydrothermal alteration.

Despite protracted exploration in a mature environment that is perceived to be well understood, ample scope remains for further discoveries by applying relatively inexpensive exploration methods to explore for and evaluate blind deposits in the Northparkes district.