VERA SOUTH: DISCOVERY HISTORY

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INTRODUCTION

The Pajingo Project consists of several economic gold-silver orebodies. They include the mined out Scott and Cindy Lodes, the Vera–Nancy deposits which are presently being mined, and the recently discovered Vera South deposit. The project is located 150 km south-southwest of Townsville and 80 km by road south of Charters Towers in north Queensland (Figure 1).

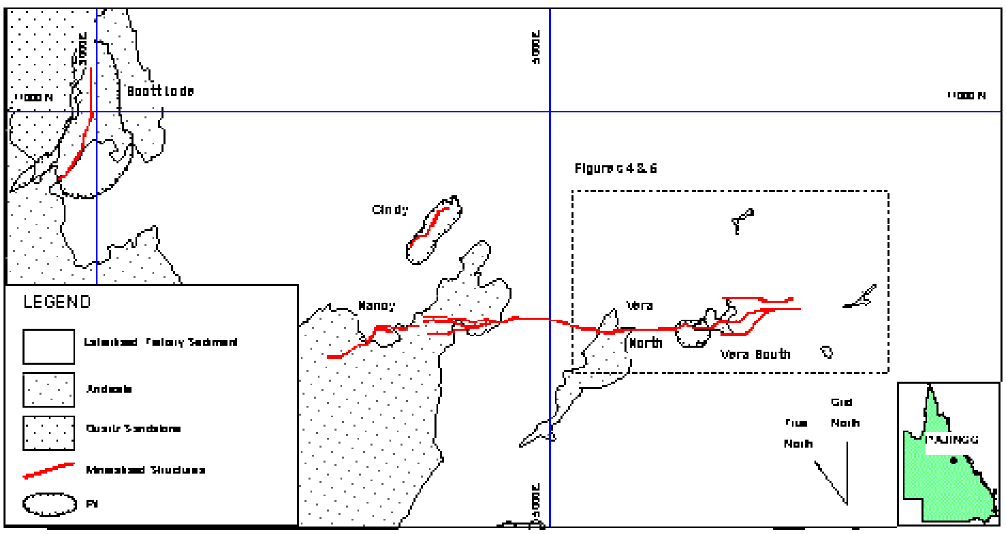

Figure 1. Location and geological plan of Pajingo orebodies and location of Figures 4 and 5.

The Project operates as a 50:50 joint venture between Normandy Pajingo Pty Ltd (wholly owned subsidiary of Normandy Mining Ltd) and Battle Mountain (Australia) Inc. (wholly owned subsidiary of Battle Mountain Gold Company).

Normandy is the operations manager and assumed management of exploration in March 1998. The Joint Venture is presently proceeding with development of the Vera South resource as part of a A$48 million expansion project which will result in doubling the annual gold production to more than 200,000 ounces per annum.

The purpose of this paper is to outline the geology of Vera South, and the use of geophysics in its discovery beneath younger Tertiary and Quaternary cover. A comparison is also made with the Vera-Nancy deposits immediately along strike, as a guide to future exploration in the field.

HISTORY

The Pajingo Epithermal System (PES) was discovered by Battle Mountain in 1983 and is presently interpreted to cover an area of 150 km^2 (Richards et al, 1997). The Scott Lode was discovered in 1984, and mined from mid 1987 until the end of 1993.

Battle Mountain actively explored the region until 1991 for additional shallow open pittable resources without success. ACM Gold Operations Pty Ltd (later absorbed into Normandy Operations Pty Ltd) farmed in to earn a 50% interest in the Pajingo Project in early 1991. Normandy managed exploration until 1995 with the main focus being large tonnage low grade gold mineralisation similar to Mt Leyshon. Battle Mountain recommenced exploring for open pittable resources in 1994 under a Mill Feed Agreement with Normandy (Kay and McKay, 1997) following the development of a small resource at Cindy.

In late 1994 the economic potential at Vera North was recognized, and 12 months later the Vera North orebody was discovered at depths greater than 250 m below the surface. An aggressive drilling campaign followed and outlined several discrete pods of mineralisation on the Vera-Nancy structure by early 1997. A total of 3.1 million tonnes at 14.0 g/t gold, for 1.4 million ounces, were outlined (Figure 2) and mining commenced in late 1996 (Evans and Jones, 1997; Kay and McKay, 1997).

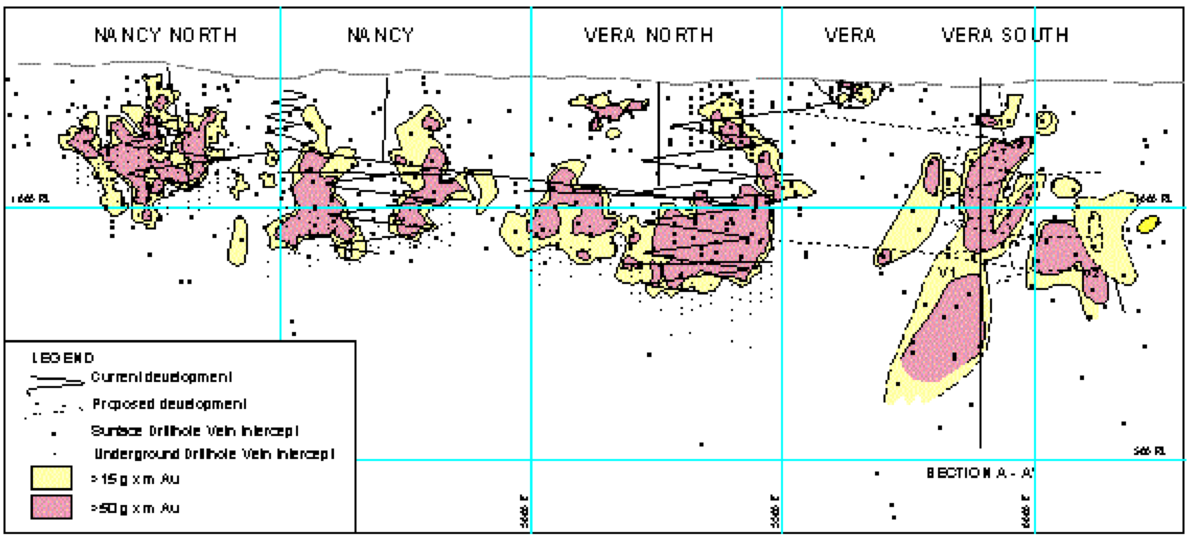

Figure 2. Longitudinal projection (looking NE) of the Nancy North, Nancy, Vera North and Vera South orebodies showing metal content contours in gram-metres,

GEOLOGY

Regional Setting

The geology and mineralisation of the Vera-Nancy orebodies has been described previously (Evans and Jones, 1997; Richards et al, 1997), and is summarised as follows. The PES is located at the northern margin of the Devonian to Carboniferous Drummond Basin, which is interpreted to be a back-arc extensional basin. The Pajingo orebodies discovered to date are low sulphidation quartz-adularia epithermal vein type with bonanza gold and silver mineralisation. Past production plus identified resources for the field total 6.2 million tonnes at 13.0 g/t gold, for 2.6 million ounces.

Cover Rocks and Regolith

Tertiary sediments of the Southern Cross and Campaspe Formations, and later Quaternary deposits, cover approximately 80% of the PES. The thickness (maximum 90 m) of these overlying younger sediments varies rapidly over short distances due to deposition on an incised topographic surface. There is a well-developed and lateritic weathering profile up to 120 m depth from surface.

Epithermal Gold Mineralisation

The vein deposits are structurally controlled with several different orientations, however most of the mineralisation is located within the northwest trending Vera-Nancy structural corridor (Figure 1). Vera South is located within the southeasterly extension of this structure.

The epithermal gold mineralisation is located within quartz veins hosted by proximal andesitic volcanic rocks. The mineralisation at Scott Lode has been dated as Middle Carboniferous (342 Ma; Perkins, 1993). The veins occur as discrete steeply plunging ore shoots with short strike lengths developed in dilational positions within the Vera-Nancy structural corridor (Figures 2 and 3). The fault geometry and the interplay of crosscutting and/or splay faults controls these sites. They occur over a strike length of 2.1 km and the main structure can be confidently interpreted over a strike length of 6 km.

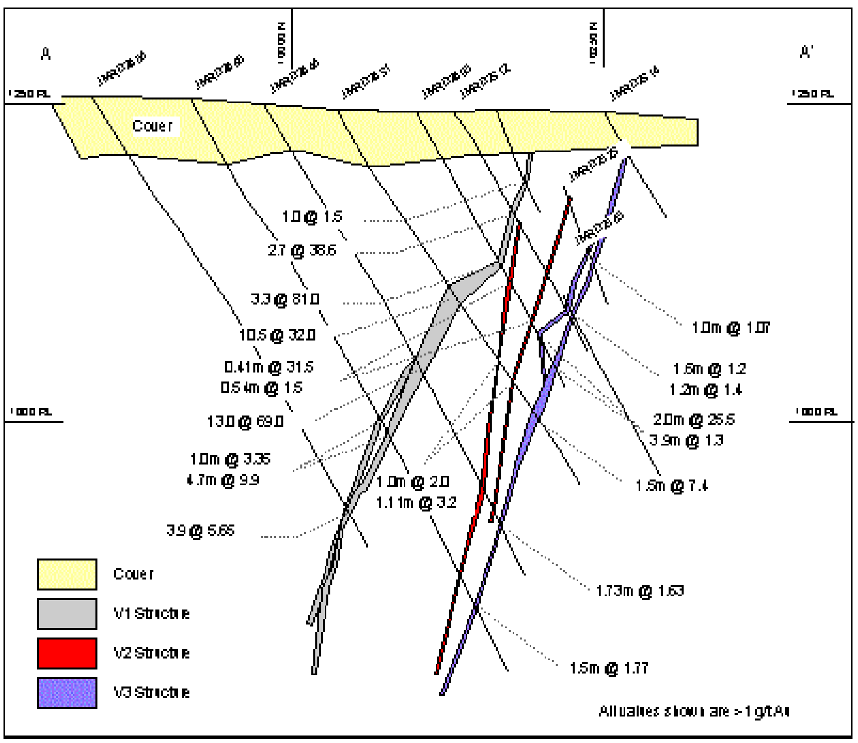

Figure 3. Cross Section – Vera South

The mineralised lodes are generally narrow (1 to 10 m) and vertically extensive. The gold is fine-grained (5 to 150 microns) and mostly occurs as electrum within epithermal textured quartz veins or breccia containing quartz fragments/matrix. Mineralised quartz veins have a close spatial association with multiphase and overprinting hydrothermal breccias.

Alteration assemblages spatially associated with the vein mineralisation are complex with evidence of overprinting events. A halo of phyllic alteration (silica-pyrite-sericite/illite) is developed up to 50 m from the host structure with silica-pyrite most intense adjacent to the quartz veining. Distally there is widespread propylitic alteration. Kaolinite and/or illite–smectite alteration commonly overprints the phyllic alteration.

Comparison between Vera-Nancy and Vera South

In many respects the geology and mineralisation at Vera South are similar to that at Vera-Nancy, with some notable differences as outlined in Table 1.

Table 1. Geological Characteristics: Comparison between Vera-Nancy and Vera South

Geology	Vera-Nancy	Vera South
Tertiary cover	Structure subcrops or obscured by thin (<10m) Tertiary sediments (Figure 1).	No outcrop. Covered by 40 to 50m of Tertiary sediments (Figure 1).
Mineralised structure	Northwest trending mineralised structure within Vera-Nancy corridor with subsidiary splays that lack continuity (Figure1).	At least four mineralised structures within Vera-Nancy corridor (V1,V2,V3,V4). Generally NW trending structures however 75% of resource contained within V1, which is a WNW trending curvilinear structure (Figures 1 to 4).
Vertical extent of mineralisation	Most economic grades are between 100m and 400m below surface. Little unmineralised epithermal quartz outside this range in RL (Figure 2).	Economic mineralisation defined to date from 100 m to 550 m below surface. Unmineralised epithermal quartz veins common outside this range in RL (Figure 2).
Au:Ag ratio	Varies from 1:1 at Vera and lower portion of Nancy to 1:4 in upper portion of Nancy (Figure 2).	Variable, but overall ratio of approximately 2:1.
Quartz vein texture and mineralogy	Broad textural zonation. Moss texture and colloform-crustiform dominant with lesser carbonate replacement.	Highly variable, commonly with late carbonate (dolomite-siderite).
Structural controls	Discrete lodes of high grade mineralisation within dilational jogs that have splay faults along major structure.	Geophysical and geological evidence for cross cutting structure/s influencing distribution of high grade lodes, in addition to dilational jogs (Figures 4 and 5).

VERA SOUTH DISCOVERY

The Vera South orebodies are located from 200 m to 800 m southeast along strike from the Vera Pit (Figures 4 and 5) beneath up to 40 m of younger cover. The area was first targeted at the end of 1996 during systematic exploration along the Vera-Nancy structural corridor. It was initially not interpreted to be highly prospective because gradient array resistivity data from a regional survey, so helpful elsewhere in outlining the position of the Vera-Nancy structure, showed a low order response and it was orientated east-west rather than northeast-southwest (Figure 4). Surface geochemistry is not an effective tool for delineating targets at Pajingo because of the Tertiary sediments, which cover the mineralisation and contain clasts of auriferous epithermal quartz which can lead to surface gold anomalies up to 1 km from source.

As there is no outcrop, interpretation of the resistivity (Figure 4) and airborne magnetic data guided the initial drilling. The first 20 drill holes were drilled due north in order to test this interpreted east-west orientation. The results were mixed, with several structures intersected; some with bonanza intercepts, however correlation between holes was tenuous. A detailed gradient array survey oriented in a northeast-southwest direction was completed in early 1997 and this revealed that the interpreted east-west structure was more likely to be an artifact of line spacing and survey orientation. Subtle northwest-southeast trends could be recognized in the data (Figure 5) and this supported the possibility that mineralised structures were oriented in this same direction.

Drilling recommenced with holes directed to the northeast. Again the results were mixed. As it eventuated, these holes unfortunately managed to intersect both the “gap” between the V1 and V2 lodes, and barren quartz in V3. Drilling at Vera South was then suspended to enable a geological re-interpretation. The Battle Mountain site exploration team was convinced after their experience at Vera-Nancy that Vera South remained prospective, but the drilling to date indicated the prospect had limited size potential.

Drilling recommenced in late 1997. The five holes in this programme intersected significant mineralisation in what are now referred to as V1 and V2. Further holes drilled in March 1998 following the wet season provided more ore grade intercepts, and confirmed the economic potential of the resource. Resource extension drilling has continued since then by testing potentially mineralised areas based on a continually evolving model rather than a strict grid pattern. By June 30th 1999 the inferred resource at Vera South had grown to 2.0 million tonnes at 14.1 g/t gold for 889,000 oz gold at a total discovery cost of $5.47 per ounce.

EXPLORATION METHODOLOGY

The key exploration tools used for the Vera South discovery proved to be drilling and to a lesser extent geophysics. Detailed airborne magnetics, which delineates structural trends defined by magnetite destruction, and gradient array resistivity surveys (Figures 4 and 5), which can detect silicified structures through up to 50 m of cover, were used. These methods only provided a guide and could not be used to reliably plan drill holes. Since the discovery, other geophysical methods have been trialed over Vera South, including CSAMT and TDEM. Neither has proved to be cost effective and/or useful.

The only surface geochemical method trialed has been MMI, however the results to date have been difficult to interpret.

CONCLUSIONS

The Vera South resource was finally recognized after 12 months of persistent exploration by the site team, and 28 drill holes. Earlier discovery was thwarted by thick cover, which effectively masked the geological, geophysical and geochemical expression of the orebody. Based on experience gained from previous exploration in the vein field, the sporadic bonanza intersections coupled with intense alteration and major structures provided the exploration team with the confidence to persevere with drilling at Vera South.

The Vera South mineralisation has not been fully closed off, and it is clear that the Vera-Nancy structural corridor and other structures in the vein field are still highly prospective. The exploration history of Vera South confirms that epithermal quartz vein style gold and silver deposits are not easy to find, especially under cover, and a considerable amount of detailed exploration, particularly drilling is required. Pajingo ore is high grade, has favourable metallurgical properties and delivers low cost ounces, making it a particularly attractive target at current gold price levels.

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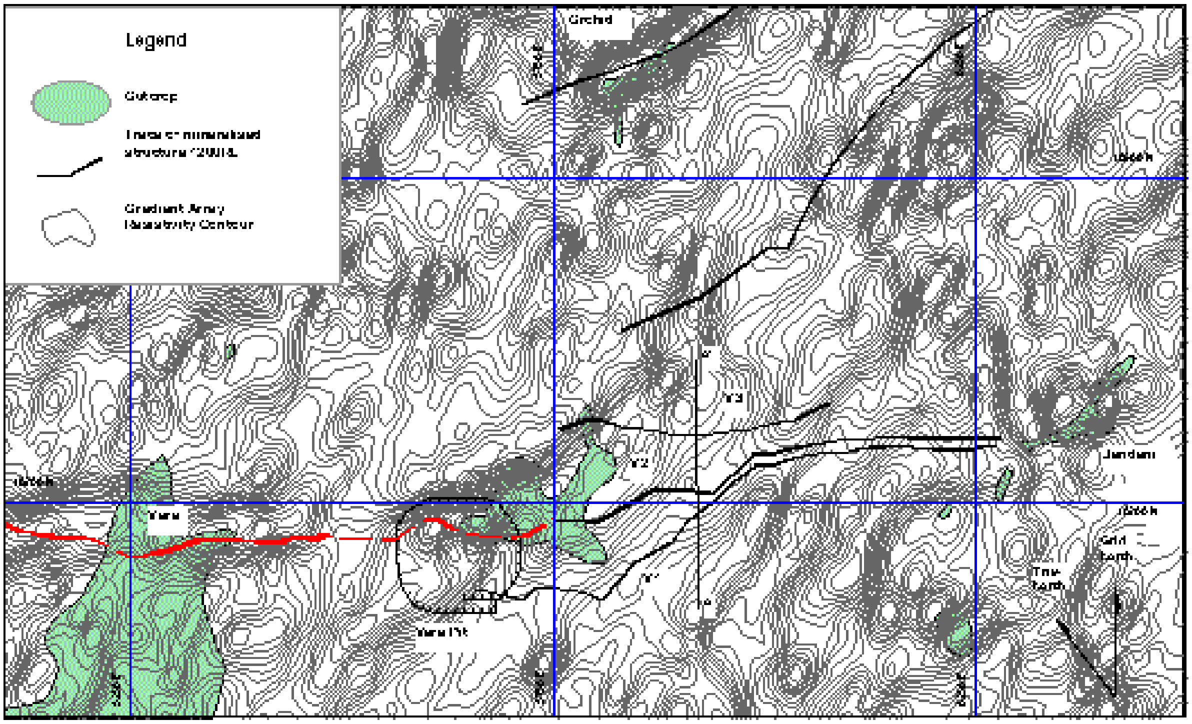

Figure 4. Gradient array resistivity contours from regional survey with lines oriented True North showing mineralised structures at 1200 RL, outcrop, and location of cross-section in Figure 3.

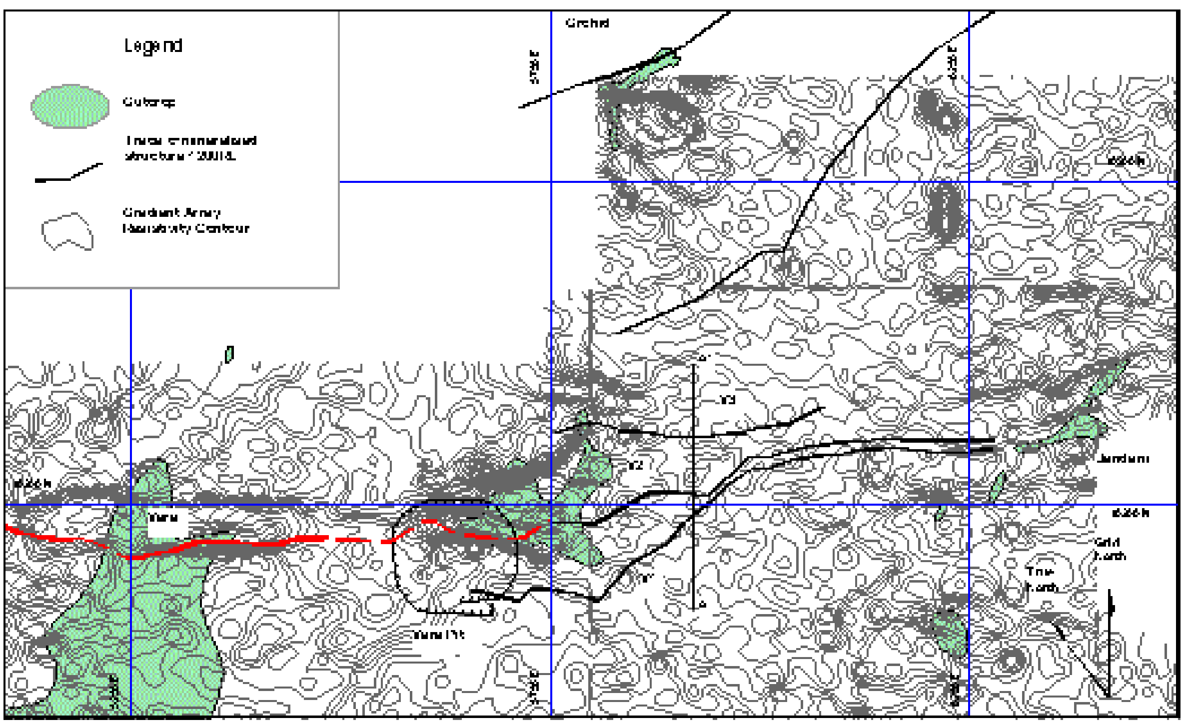

Figure 5. Gradient array resistivity contours from detailed survey with lines oriented Grid North showing mineralised structures at 1200 RL, outcrop, and location of cross-section in Figure 3.

REFERENCES

Evans, R.C., and Jones, B.H., 1997. The discovery and evaluation of the Vera-Nancy Deposit, North Queensland. *World Gold '97 Conference Proceedings*. The Australasian Institute of Mining and Metallurgy:233-237.

Kay, B. and McKay K., 1997. Vera-Nancy Gold Discovery: Not Just Geology. *New Generation Gold Mines, Case Histories of Discovery*. Australian Mineral Foundation:1.1-1.5.

Perkins, C., 1993. Isotopic Dating of Precious and Base Metal Deposits and their Host Rocks in Eastern Australia. *Final Report April 1993, AMIRA Project P334.*

Richards, D.R., Elliott, G.J. and Jones, B.H., 1998. Vera North and Nancy gold deposits, Pajingo. In: *Geology of Australian and Papua New Guinean Mineral Deposits*, Eds: D.A. Berkman and D.H. Mackenzie. The Australasian Institute of Mining and Metallurgy, Melbourne:685-690.

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