TOMINGLEY GOLD PROJECT – GEOLOGICAL SETTING AND MINERALISATION

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Abstract

The Tomingley Gold Project includes a large north-south oriented tenement package covering Ordo-Silurian volcanics and sedimentary rocks with minor intrusives. Significant mineralisation in and about the Project Area includes the Wyoming Gold Deposits, the Peak Hill Gold Mine and the historic Myalls United Gold Mine.

The eastern Lachlan Orogen in southeastern Australia is noted for its major porphyry-epithermal-skarn copper-gold deposits of late Ordovician age. While many small quartz vein hosted or orogenic lode-type gold deposits are known in the region, the discovery of the Wyoming gold deposits has demonstrated the potential for larger lode-type mineralisation hosted within the same Ordovician volcanic stratigraphy.

Outcrop in the Wyoming area is limited with the Ordovician sequence obscured by clay-rich cover of probable Quaternary to Cretaceous age with depths up to 60 metres. Regional aeromagnetic data define a north-south trending linear belt interpreted to represent the Ordovician andesitic volcanic sequence within probable Ordo-Silurian pelitic sediments.

Extensive drilling has identified substantial mineralisation associated with sericite–carbonate (ankerite)–albite–quartz-(± chlorite ± pyrite ± arsenopyrite) alteration of an andesitic feldspar porphyry intrusion and adjacent volcaniclastic sediments. The Wyoming deposits appear to have formed as the result of a rheological contrast between the porphyry host and the surrounding volcaniclastic sediments, with the porphyry showing brittle fracture and the sediments ductile deformation, and many similarities to well documented lode-style gold deposits. The age of the alteration and mineralisation remain problematic but a relationship with possible early to mid-Devonian deformation is considered likely.

The mineralisation at Wyoming is in stark contrast with that at Peak Hill, located just 12 kilometres to the south, where mineralisation displays all of the characteristics of a high sulphidation style epithermal deposit.

Regional Geological Setting

The Wyoming deposits are located near the eastern margin of the Junee-Narromine volcanic belt, just east of the interpreted Parkes Thrust. This structure separates the flat lying Goonumbla volcanic complex from a thin slice of north-south trending andesitic volcanics identified by regional aeromagnetic data and interpreted to be equivalents of the Goonumbla volcanics (previously named Mingelo volcanics). The Tomingley Gold Project covers much of this interpreted north-south belt extending almost the entire length of the tenement and being about 2 kilometres in width north of Trewilga reducing to approximately 500 metres width in the south (Figure 1).

The Goonumbla volcanics are overlain by sediments thought to be equivalents of the Cotton formation. Although Sherwin (1996) suggest that the Cotton formation may have been contemporaneous with deposition of the Goonumbla volcanics, Squire et al (in press) suggest that differences in detrital composition and biostratigraphy means the units are distinctly separate, and are perhaps part of the Silurian Forbes group. At this stage there is no data to support either argument at Wyoming although where mapped, the sediments consist of well-bedded fine quartzose sandstone and laminated siltstone with a diagnostic basal quartz rich conglomerate.

The Ordovician rocks west of the Parkes thrust are weakly deformed, with broad open folds and sub-greenschist metamorphic assemblages (Sherwin 1996). In contrast, the Ordo-Silurian sequences east of the fault, including the rocks hosting the Wyoming deposits, exhibit tight to isoclinal folding, strong axial planar cleavage with greenschist metamorphic assemblages.

Northwest trending transverse structures are also evident in regional magnetic and gravity data, and rarely as faults mappable in outcrop. These structures appear to be long lived fundamental crustal breaks that were irregularly reactivated throughout the geological development of the Eastern Belt. They also show a relationship to intrusive centres and mineralisation where the structures intersect and occasionally offset the arc parallel structures (Squire et al 2003).

Wyoming Geology

The immediate Wyoming area is almost entirely covered by alluvial sequences of clays, sand and gravel of Quaternary to Cretaceous age up to 50 m thick.
The gold deposits at Wyoming are hosted within volcaniclastic sediments, rare lavas and shallow intrusive porphyritic rocks. The volcanic units are of trachy-andesite to basaltic trachy-andesite in composition with very rare detrital quartz in the volcaniclastic rocks which are dominated by well bedded sandstones and siltstones with minor breccias, lithic conglomerates and black mudstones. The dominant sandstones and siltstones have a primary composition of plagioclase and augite but are now largely altered to sericite, carbonate, chlorite, albite with the rare primary quartz.
The volcaniclastic units are intruded by numerous coarse feldspar ± augite porphyritic bodies of trachy-andesitic to mafic trachy-andesite affinity. These bodies are weakly concordant to the bounding sediments and are interpreted as sills. The identification of rare peperitic textures suggest that the intrusions were emplaced at a relatively shallow level. A narrow, marginally discordant, chlorite-talc schist has also been located by drilling just to the east of the porphyry sills at Wyoming One. This may have a mafic-ultramafic precursor, similar to olivine rich lavas (picrites) which are known from the Molong Belt (A Crawford, pers. comm. 2004).
To the west, the andesitic volcaniclastic sequence is in sharp contact with well foliated fine grained sediments that are interpreted to correlate with rocks of either the Ordo-Silurian Cotton formation or the Forbes Group. The contact does not appear to be faulted. The eastern margin of the volcaniclastic sequence is uncertain.
A detailed deformational history of the Wyoming deposits cannot be determined at this stage, however a number of empirical observations have been recorded from orientated drill core. The andesitic volcaniclastic sequence strikes north-northwest and dips steeply east. Current interpretation suggests that the Wyoming One feldspar porphyry is located near the axis a tight, easterly vergent, antiform.
Within the massive feldspar porphyry, brittle fracture is dominant and a number of vein directions are evident. Major structures are orientated west-northwest, exemplified by the near vertical faults that appear to dislocate the porphyry and several sub-parallel vein sets within the porphyry. A pervasive set of shallow north dipping veinlets also have a west-northwest to east-northeast strike.
Recent structural analysis and modelling indicates a complex structural history involving a sinistral transpressional event with a rotation of the stress field to develop the mineralised vein array seen at Wyoming One, the structures at Wyoming Three and the regional foliation.

Mineralisation

Mineralisation has been identified at a number of locations within the volcanic belt but to date evaluation of deposits has focussed on the Wyoming and Peak Hill areas.

Wyoming

Gold mineralisation at Wyoming One is distributed both around and within a sub-vertical, south plunging, feldspar ± augite phyric sill. The deposit has been separated into distinct mineralised zones: the porphyry zone; contact zone; hangingwall zone; the ‘376’ zone and the ‘831’ zone.
Gold mineralisation is characterised by strong quartz ± carbonate (ankerite) ± albite ± pyrite ± arsenopyrite veins within intense sericite–carbonate (ankerite)–albite–quartz-(± chlorite ± pyrite ± arsenopyrite) alteration of the feldspar ± augite-phyric intrusion and the volcaniclastic sediments. The hangingwall zone appears stratigraphically controlled by a fine-grained carbonaceous mudstone and the ‘376’ and ‘831’ are high grade east west zones truncating and transecting the porphyry.
Gold mineralisation at Wyoming Three also shows a strong spatial relationship with feldspar porphyritic rocks however pervasive alteration is limited or absent with mineralisation hosted

within structurally controlled quartz ± carbonate ± chlorite ± pyrite ± arsenopyrite veining striking about 105°.
Resources at Wyoming One and Wyoming Three total 7.1 million tonnes grading 2.70g/t gold.

Peak Hill

The Peak Hill Gold Mine is located 12 kilometres south of Wyoming and the mine was operated by Alkane between 1996 and 2003 with the production of 150,000 ounces of gold from the oxide zone. Treatment was by heap and dump leach.
The alteration and mineralisation at Peak Hill display all of the characteristics of a high sulphidation style epithermal deposit. The Peak Hill deposit has a distinct sub-vertical zoning with a pyrophyllite and vuggy-quartz core, that today extends about 350 metres east-west and at least 550 metres north-south, which grades out through paragonite+muscovite, kaolinite to a chlorite+epidote alteration zone at the margin (Squire et al, in press). Gold-copper mineralisation is associated with late quartz-pyrite-barite veins and the highest gold grades occur mainly in microcrystalline-quartz–altered rocks in the paragonite+muscovite alteration zone, generally within 50 metres outward from the boundary of the pyrophyllite and vuggy-quartz core (Squire et al, in press).
Total sulphide resources at Peak Hill are currently 11.27 million tonnes grading 1.29g/t Au and 0.11% Cu. Mining of oxide deposits totalled 5.25 million tonnes grading 1.56 g/t gold.

Myalls United

Little is known about the geology of the Myalls United mine which is situated 1.5 kilometres south of the Wyoming One deposit. The two parallel quartz reefs hosted in ‘andesitic volcanics’ were mined to a depth of 200 metres between 1883 and 1912 with 70,000 ounces of gold produced (Clarke, 1986). Little recent exploration has been conducted as the mine was used as a disposal site for obsolete munitions and a mining reserve was constituted in 1976 to exclude future mining and exploration.

Other Prospects/Occurrences

Some 45 other prospects or mineral occurrences occur throughout the volcanic belt. Many of these have not seen any significant recent exploration and little recent drilling by Alkane.
Tomingley Prospects – drilling by Alkane along a structural trend north from Tomingley has identified a number of mineralised zones associated with alteration and veining within massive siltstone. The zones are situated below up to 70 metres of transported cover and appear to be structurally controlled orogenic styled vein networks. Better intercepts in the drilling included 3 m @ 4.93g/t Au and 24m @ 1.29 g/t Au at the Tomingley Two prospect. The Tomingley Prospects are aligned north-south for over 3 kilometres of strike and are interpreted as a fault controlled, regional fluid corridor which may well form the ‘plumbing’ to the Wyoming deposits and the Myalls United Gold Mine.
Black Snake / Trewilga – lode style sheeted vein system in volcaniclastic sediments. Limited drilling returning best intercept of 8m @ 1.6g/t Au and 0.37% As from 23m.
Smiths – quartz-carbonate veining within sericite-carbonate-albite altered feldspar porphyry having visual similarities to Wyoming One. Limited previous drilling returned 8m @ 0.49g/t Au.
Monte Carlo – veining and alteration associated with carbonaceous mudstones in a very similar stratigraphic setting to the hanging wall zone at Wyoming One.

Conclusions

The mineralisation at Wyoming has few documented affinities with the typical Ordovician aged magmatically derived deposits identified elsewhere in the Lachlan Orogen in New South Wales.

The style of mineralisation and associated sericite-carbonate-albite-quartz alteration assemblage is more typical of orogenic lode style gold deposits.
Within the Wyoming One deposit, the mineralised fluids are interpreted to have been focused by differential strain in and around the feldspar porphyry sills due to the rheological competency contrast between the sills and the bounding volcanic sediments. Higher grades (+5g/t Au) appear to be concentrated where the competency contrast is the greatest (ie Contact Zone) and by internal cross structures, sub-parallel to the 376 zone, within the feldspar porphyry body. The Wyoming Three quartz lodes appear to have similarities with shear hosted sheeted vein deposits, but also formed as a competency contrast between porphyry and volcaniclastic rocks.
The mineralisation at Wyoming is in stark contrast with that at Peak Hill where alteration and mineralisation displays all of the characteristics of a high sulphidation style epithermal deposit.

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