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## MEMORANDUM

MJ/srd

To L.A. Newnham c.c. R.A. Shakesby

From M. Jones

Subject GOLD TARGETS IN THE MT. LYELL AREA

Date 8th October, 1984.

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**OPEN FILE**

A major gold-only deposit in the Mt. Lyell area, if it is present at all, has escaped detection by virtue of one or more of the following:

- gold is present in sub-microscopic form and was not picked up by early prospectors relying on the gold pan
- fine-grained gold was recognised but could not be traced to a source; probably quartz veins or gossans would be the only sources tested
- higher grades of gold may show an antipathetic relationship with base metal sulphides (or indeed sulphides) and many potentially prospective rocks would not have been analysed for gold.
- gold recovered from streams may be of supergene origin and, if leaching of disseminated gold in the weathered outcrops had occurred the source may have gone unrecognised
- structures containing small tonnage high grade ore shoots, or major veins carrying medium grade gold are exposed at levels above significant gold concentrations.

In August, following a week's discussions at Mt. Lyell with Mike Bird, Bill Brook, John Carwell and Garth Stewart, and subsequently with John Angus, limited field and drill-core examination and a review of relevant literature - mostly theses and unpublished reports - the following "stand-alone" gold targets were suggested.

- i) Small, high-grade vein deposits - a significant proportion of the gold produced from The Blow probably came from narrow veins, but the impression I have is that this contribution came from a number of very small, very high grade, ore-shoots.

This may have been a late-stage mineralization under relatively oxidising conditions; The "invariable presence of barite" associated with gold-silver rich ore veins was noted by Powell in 1894 and high-grade very fine grained gold is recorded in a pyrophyllite vein. (In passing it is of interest to note that a late-stage barite-precious metal vein assemblage in the San Juans-Slack 1980 - is ascribed to a separate hydrothermal system related to an intrusive dome).

Controls over 'bonanza' vein mineralization in epithermal systems include boiling of the ore solution or changes in wall-rock chemistry. If, for example, the hematitic Owen Conglomerate has modified ore solution chemistry and hence the presence of high-grade ore - which is suggested by at least one reconstruction for The Blow - the intersection of the conglomerate contact and a mineralized fault could localise as yet undiscovered ore shoots.

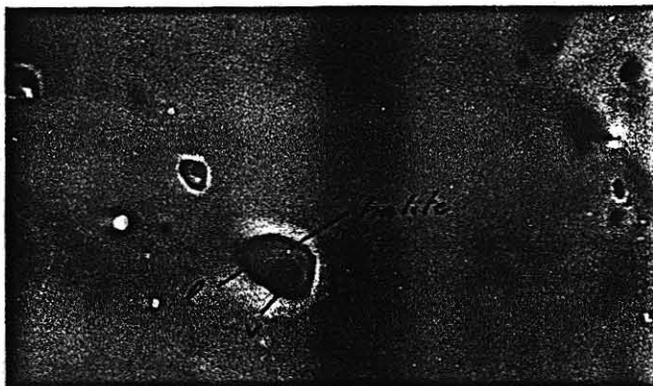
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In their own right such targets are probably too small and too difficult to find without extensive drilling. However, the structures considered prospective for high-grade copper mineralization in the Lyell Blocks area may conceivably host later (?) barite-precious metal assemblages and we need to make maximum use of the drill intersections from this programme. If an originally hematitic rock controlled barite deposition (cf. barite occurrences in the Old Red Sandstone of Scotland) is there any trace element zonation with respect to distance from ore? Bearing in mind the silver mineralization at Howard's Anomaly, essentially any hematite-barite intersection is worth analysing for Ag-Au.

Fluid inclusions may offer some guides to ore and a number of case histories document their application (eg. Buchanan 1980). Initially a reconnaissance qualitative study of vein material from dumps may provide an indication of the style of mineralization and controls of deposition and hence a constraint on the models we might apply:

eg. inclusions in quartz from The Blow show the presence of halite daughter minerals indicating high salinity ore fluids



- barite from the Lyell Blocks dump shows evidence of deposition from a boiling CO<sub>2</sub> - rich fluid -



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Finally, the documentation of early mining and the reconstruction of the geological controls of mineralized veins, such as Mike Bird has already done in a couple of areas, could have major predictive value.

- ii) Medium tonnage, medium to high-grade reefs - the major ESE structures of the Linda Valley are potential hosts for significant auriferous reefs and one target (McDowell's P.A.) is already being tested.

That the conglomerate, or structures within it, is of interest was evident as far back as 1894 when Powers commented "most of the gold and alluvial found in the Linda Valley - and for that matter in the neighbouring creeks also - is derived from the conglomerate which caps the mountains hereabouts".

A further point of interest is the similarity of stratigraphic succession to that in the Beaconsfield area. Arguably, significant ore deposits require more than one stage of metal concentration. If a sedimentary process (cf. the turbidite-hosted gold model) led to the development of a stratiform protore, later remobilization might conceivably deposit ore in major structures. Or simply in empirical terms the coincidence of favourable stratigraphy and major structures ('plumbing systems') makes an area more prospective.

At McDowell's there is some suggestion that early gold production came from clay rather than quartz veins and Solomon recorded sericitic alteration on one of the structures in the Mt. Owen area - the presence of vein quartz may not therefore be a necessary guide to mineralization. Apart from the ongoing programme at McDowell's field examination of major structures, recorded gold shows and alteration should be a matter of some priority. The main target would be a medium-high grade vein deposit (cf. Beaconsfield) but Mike Bird has pointed out the possibility of replacement mineralization where these structures intersect the Gordon Limestone.

- iii) Replacement deposits - the northern part of the lease area in the general region of the Comstock (which was a relatively high grade gold system in the context of Mt. Lyell) offers possibilities of replacement gold targets.

Silicification of a calcareous greywacke/conglomerate unit is evident in a number of drillholes and has only infrequently been assayed for gold. In C48 a twenty-five foot interval (590-615') assayed 1.6g/t Au. In a number of instances drilling was halted prematurely by the hardness of the silicified rock so that main zone of potential interest may have only been partly tested. Further associations which suggest the possibility of gold mineralisation include the inferred presence of significant barite or pyrite (FeS<sub>2</sub> analyses are often much higher than recorded visible sulphide would suggest - either barite, or considerable very fine grained pyrite, must be present), the occurrence

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of green sericitic alteration, mention of brecciation (C68) and fracturing (C56) and the presence of minor molybdenite (C48).

Replacement gold mineralization is also a possibility to the east of the Comstock workings in holes which intersected Gordon Limestone - in places logged as leached, friable and carrying very fine grained pyrite - but for which again no gold analyses were made.

The Comstock Tuff which overlies the silificied unit discussed above is a further potential host as it is a relatively permeable unit which would more readily allow the passage of hydrothermal fluids. (Indeed significant silver values are known in some Comstock Tuff intersections and any reference to gold potential could also extend to the possibility of bulk - mineable silver mineralization). Examples of such deposits are known eg. in the Creede area and in the Telluride Conglomerate referred to by Brook in his March, 1984 report.

The first pass approach to firming up some of these speculative ideas is to re-examine and sample any relevant drillholes that are still available. Field mapping, with an emphasis on alteration of the area west of Comstock should follow any encouragement from core assaying. The area to the east, underlain by Gordon Limestone, probably outcrops so poorly that surface geology won't be much help and we might have to consider one or two reconnaissance drillholes.

- (iv) Invisible gold targets in volcanic terrain - Following Springer (1983), I use the term "invisible gold" to refer to the styles of mineralization for which there is often little, if any, distinction between barren rock and ore - gold is very fine grained and unrelated to field indicators such as quartz veins.

Although a number of empirical associations link the varied examples of this class of deposit the presence or absence of any particular indicator is no guarantee of the presence or absence of gold.

What I think are significant indicators include the following:

alteration assemblages - a feature of many disseminated gold deposits in volcanics is the presence of high-alumina minerals (Schmidt, 1983), commonly pyrophyllite, but also including andalusite, kyanite and diaspore (Valliant et.al. 1983) and in some systems, topaz. However, mineralization at Hemlo appears to be associated with quartz-sericite alteration though perhaps significantly a green mica (with variable Cr, Ti, V and Ba contents) is also part of the assemblage (Goldie & Wallis, 1984). Green micas, usually assumed to be fuchsite, are recorded from many gold mines (Whitmore et. al. 1946). Pervasive silicification is yet another feature - often described in younger deposits as the result of deposition in a boiling zone; in older systems, "cherts" may represent replacement silicification or chemical sediments. The silicification may be associated with alunitic alteration in "hot spring" systems.

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associated minerals - pyrite is nearly always present but in widely varying amounts not necessarily correlatable with gold grade. Thus in the Hemlo orebody there is 5-20% pyrite whilst Round Mountain, Nevada is a low-sulphide system with only 1-2% pyrite. In a number of deposits, base metals are present in only trace amounts (Hemlo: Cu 20ppm, Zn 80ppm); in other cases minor base metal sulphides are recorded eg. at Shamva, Rhodesia gold shows a close association with galena and sphalerite (Thomas and Stidolph, 1982). Molybdenite seems a common accessory and antimony and arsenic sulphides (eg. orpiment at Billilingra, N.S.W. - see Appendix) are recorded in a number of instances.

Barite is a widespread and significant indicator, present to 12% of the Main Hemlo Orebody. It was also the only previously recorded mineralization at Billilingra and the pyrite-quartz-pyrophyllite-barite assemblage is characteristic of Peak Hill, N.S.W.

Graphite, or carbon, may be more common - and significant - than the literature would suggest as in minor amounts it could be easily overlooked. 0.12% graphite is recorded from Hemlo and carbonaceous material appears to have had some role in gold localisation at a number of deposits including, Wau and Pueblo Viejo.

associated elements - these are really suggested by the mineralogy. Arsenic is perhaps the most generally useful pathfinder but Sb, Hg, Mo, and Ba may be useful guides.

structure - structures such as caldera - margin faults etc. have a local control over mineralization in acting as channelways for ore solutions. A more fundamental control may be exercised by major crustal fractures (eg. the 'breaks' of the Canadian Shield) and it is of interest that Goldie and Wallis discuss one interpretation of Hemlo as a mylonite zone.

How can these guidelines be applied to Mt. Lyell?

There is no shortage of pyritised, sericitised volcanics. Pyrophyllite is commonly reported - a thesis by Bryant describes a "concentration of pyrophyllite relative to muscovite in the 12W, Crown 2 and North Lyell areas and adjacent to the northern end of Crown 3", but apart from this I have seen no studies on its distribution. Barite is also common, and indeed may have gone unrecorded in many intersections, but again little quantitative data (except Hendry 1972) is available on its distribution. Green micaceous alteration (the batchelorite of early reports) is widespread and the Mt. Lyell system is anomalous in molybdenum. There are thus many broad similarities with volcanic-hosted invisible gold systems. As yet I am not aware of any aluminium silicate alteration assemblages, but if these are localised in a particular horizon they may have gone unrecognized.

To put these ideas to the test will require the alteration logging and sampling of a very considerable amount of core. The logistical problems in doing this are major - much of the core is difficult of access and a large number of samples will be generated.

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I suggest the first phase should look at drill core from the Western Tharsis - Lyell Corridor area. This will give us coverage of the pyritic Western Tharsis system as well as the pyrophyllite alteration of the North Lyell area.

Some surface work is also recommended in the way of rock chip sampling in the Comstock and Glen Lyell areas. These are similar, at least mineralogically to the Peak Hill, N.S.W. deposit and if sulphide hosted gold is very fine grained, as at Peak Hill, gold without a base-metal association could have been overlooked.



Mel Jones

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Appendix I

BILLILINGRA

Most of the examples discussed above are documented in (sometimes unpublished) literature. Of relevance to the gold search in western Tasmania is the recently reported gold discovery at Billilingra, near Bredbo in N.S.W. in Silurian acid volcanics for many years the target of base-metal massive sulphide search.

The gold prospect occurs in an area previously known only as a small vein barite occurrence:

BILLILINGRA

Agreement has been reached with Esso Exploration & Production Australia Inc. for Jones Mining Limited to earn a 50% interest in this area by expenditure of \$1,000,000. Esso hold three prospecting licences and one exploration licence at Billilingra 6.5 kms south of Bredbo in the Cooma district.

Report to  
Stock Exchange  
31.3.84

Rock chip sampling has delineated wide zones anomalous in gold within an acid volcanic sequence.

The surface anomaly has been defined over a strike length of 300 metres and varying in width from 40 metres to 75 metres. This zone was outlined by two geochemical sampling programmes. A gossan sampling programme yielded an average of 5.8 gms per tonne from eleven localities with four samples averaging 11.9 gms per tonne.

In the centre of the anomalous zone a 40 metre chip sample traverse gave an average value of 4.09 gms per tonne.

It is a low sulphide system and, apart from barite is characterised by the occurrence of pyrophyllite. Mapping by Bill Platts, an A.N.U. M.Sc. student has defined a long narrow epiclastic unit which hosts both the Billilingra mineralisation and a small stratiform Pb-Zn-Ba prospect (Harnet) some ten kilometres south. This unit is altered to kaolinite, pyrophyllite, (alunite) contains trace orpiment and overlies a thick sericitised ignimbrite sequence.