MEMORANDUM

MACQUARIE HARBOUR MINING
E.L'S 21/2007 AND 22/2007

LITERATURE REVIEW, RECOMMENDATIONS AND LOGISTICS

Introduction

Coast and Mountain Exploration was engaged by Macquarie Harbour Mining (MHM) to:

"Prepare a short report on previous exploration work along the southern coast of Macquarie Harbour between Pelias Cove through North Butler Creek and extending as far east as Rum Point. The zone covered should extend inland no more than 5km. It is expected that this report should make specific recommendations as to what targets should be further investigated in the forthcoming field programme based on your own experience in the area."

The following considerations should be kept in mind.

- *Commodity emphasis on gold (+ or – base metals) mineralisation in the Neoproterozoic Double Cove Formation and Noddy Creek Volcanics/related intrusives.*
- *Inclusion of digital spatial data in a MapInfo compatible format where possible.*
- *Notes on ease of accessibility by land to any areas you are familiar with.*

Work Undertaken

MHM provided DVD's containing all relevant open file and published reports on the area which were sourced from the Mineral Resources Tasmania database. A total of 132 reports were viewed and pertinent information collected and compiled. This information is found as a table in Appendix 1

The MRT reports are in PDF format and the majority are company exploration reports. Sample location maps and sample ledgers were copied from PDF format to individual Jpeg files so that they could be registered in Map Info at a future date. These Jpeg files are contained in Appendix 2.

Based on the authors experience in conducting exploration on the southern shore of Macquarie Harbour over a 6 month period in 1999, a series of 'bullets points' list the issues that need to be considered in the logistical planning and operational implementation of field programmes.

Exploration History

Exploration in the modern, post war era commenced in 1956 with the **Mt Lyell-Electrolytic Zinc joint venture(L.E.E.)** which was conducted over a period of six years. Airborne magnetics, EM and scintillometer surveys were flown over an area that encompassed the SW quadrant of Tasmania from Queenstown to Port Davey. Follow up ground geophysical methods were utilised. In relation to the author's brief, the major discovery was the identification of the Hibbs Ultramafic Belt from Point Hibbs on the West Coast northwards to Macquarie Harbour and the six shallow diamond drill holes that were drilled on a fault related haematite-sulphide occurrence located on the beach at Pelias Cove.

Prior to this period, prospectors and Government geologists made reconnaissance forays which were confined to the west coast and the Macquarie Harbour foreshore.

From 1964 until 1972 a second major exploration programme was carried out by **BHP** over the same SW quadrant. A systematic geological survey type approach was undertaken with regional mapping being a feature of this work. A major distinction is apparent between these two major mining houses; with the LEE taking a predominantly airborne geophysical approach and BHP a contrasting geochemical path with 5,750 stream sediment samples collected and analysed for Cu, Zn and Ni. Work relevant to the MHM brief includes the identification of base metal anomalism within the Lucas Creek Volcanics; and a coincident EM and geochemical zinc anomaly in the Hibbs Ultramafic Belt at Noddy Creek. Whilst this anomalism at Noddy Creek was drilled by BHP and subsequently downgraded, it is located 3.5kms along strike and in the same Sheared Serpentinite unit (Cum) from the West Baylee drilling conducted by Pacific Nevada in 2000.

In 1983 **Amoco Minerals (later Cyprus Gold)** commenced exploration for a period of five years and initially flew an aeromagnetic and radiometric survey over their entire leasehold and a subsequent DIGHEM survey which included the Lucas Creek Volcanic Belt. Airborne EM anomalies within the Lucas Creek Volcanics were assessed by way of ground magnetics, VLF-EM and GENIE-EM ground geophysical surveys in conjunction with regulation stream and soil geochemistry. A second DIGHEM survey was undertaken in the Noddy Creek Volcanics complemented by one kilometre spaced, east – west traverses which delineated prospective acid volcanics within the predominantly andesitic suite. Mitre Geophysics conducted the evaluation of the geophysical data and recommended that seven anomalous areas be targeted for ground follow up. A change in perceived prospectivity saw the company's focus move to other parts of their tenement at Elliot Bay. The mapping from the previous thirty years had recognised that the Lucas Creek Volcanics were of intermediate to basic composition and essentially tholeiitic in character with Besshi style VHMS deposits the target. In contrast the Noddy Creek Volcanics are compositionally bimodal with a proportion of acid, calc alkaline volcanics which have a perceived higher degree of prospectivity and potential to host Kuroko style VHMS deposits. In short, the Noddy Creek Volcanics have attributes more akin to the productive Mt Read Volcanics to the north.

(N.B. Amoco used the stratigraphic nomenclature of 'The Muddy Cove Volcanics' for 'The Noddy Creek Volcanics')

In 1992, **Plutonic Operations** commenced exploration with a lease that covered the entire belt of Cambrian volcanics from Mainwaring Inlet south of High Rocky Point on the west coast, northwards to Hogans Cove and Birches Inlet on Macquarie Harbour. The initial fieldwork was concentrated on three discrete areas within the tenement. In the context of this brief, the Briggs Creek area, located 5.5kms south of Asbestos Point, was chosen as it contained anomalies numbered 2, 3, 4 and 5 from the Mitre Geophysics airborne EM analysis. No further investigation at Briggs Creek was warranted due to a lack of significant stream and soil geochemistry and a lack of alteration in the rocks

The latest exploration in the five kilometre environs of the southern shore of Macquarie Harbour was carried out by **Pacific Nevada** over three years from 1998. Four prospects were delineated by way of a systematic regional stream sediment and pan concentrate programme. Two prospects-North Butler and Pelias Cove are situated in the Proterozoic rocks of the Double Cove Belt and the other two prospects within the Cambrian Noddy Creek Volcanics which are part of the Point Hibbs Belt. Follow up soil geochemistry plus ground IP and EM were a prelude to 3-6 drill holes being completed at each of the prospects.

Discussion

Set out below are prospects identified by previous exploration that fall within 5km of the southern shore of Macquarie Harbour. These prospects are listed from west to east. Each prospect is discussed with a brief description of the results obtained and scrutinises whether further work is warranted.

Lucas Creek Volcanics

Work Undertaken

The initial investigations were carried out by BHP where anomalous Cu, Zn and Ni values were found coincident with aeromagnetic anomaly No 123. . Follow up detailed stream, bank and ridge soil sampling returned values that were considered to reflect the background values of the mafic volcanics rather than any mineralisation. The three anomalous lead values of 105,109 and 178ppm were located consecutively from the left bank of the western tributary of Lucas Creek. Follow up work by BHP failed to detect the source of the anomaly.

Amoco's initial work concentrated on the ground follow up of DIGHEM anomalies. The survey defined a large number of very conductive formations within the adjacent sediments but no bedrock conductors within the volcanics. No significant geochemical anomalies were detected in soils overlying the sediments and the anomalies were explained as formational boundaries or as shales that were locally pyritic or graphitic. Mitre Geophysics noted an unusual DIGHEM response over two lines close to the lead anomalism recorded by BHP. Ground follow up by way of two

traverses included 100m spaced soil sampling, which was closed up to 25 m over the geophysical anomaly plus GENIE ground EM and ground magnetics. A short stream mapping/sampling traverse of the BHP anomalous area was also completed. No anomalous geochemistry was obtained and previously reported gold values were not replicated. The GENIE survey did not give a response. As a result the Lucas Creek Volcanics were downgraded.

Assessment

Coarse gold was observed in two stream sediment samples and geochemically detected in another from streams draining the ridge forming the Lucas Creek Volcanic unit. Gold was observed in pan concentrates but was not evident in soils within these small drainage basins. This area lays 2kms west of the gold anomalous drainage defined by Pacific Nevada at Pelias Cove and I suggest that Tertiary gravel input may have contaminated the sampling in both cases.

Pelias Cove.

Work Undertaken

The sulphide occurrence on the strandline at Pelias Cove beach was discovered in 1957 by L.E.E. and tested by trenching, drilling and a ground EM survey. Mapping of a small group of offshore rocks suggested that the mineralised body extended 95 feet into the harbour however the EM survey indicated that there was no strike continuity inland.

In 1999, Pacific Nevada flew an aeromagnetic survey of the northern part of the Double Cove Belt and conducted a regional stream sediment programme which detected coarse, anomalous pan concentrate gold in a drainage of limited size; (1500m X 500m) immediately south and contiguous with the Pelias Cove prospect. Tertiary gravels were a feature of soil sampling over the ridges and spurs in this drainage and this was suspected as being the source of the gold. Microscope examination noted the nuggetty morphology of the gold grains and suggested that the gold had not been transported a great distance from its source. Pacific Nevada conducted an IP survey and subsequently drilled 3 of the 4 planned holes to cover two resistive anomalies under Tertiary gravels, one soil base metal anomaly and the Pelias Cove sulphide occurrence. DDH-PC 1 and 2 identified silica-talc alteration systems up to 50m wide and DDH-PC 3, 200m south east of the massive sulphide outcrop detected a fault associated silica flooded zone with open space vuggy textures. The drilling intersected major fault zones in each hole with the loss of the drill string in DDH PC-1.Poor analytical results were obtained and the source of the gold was not clarified.

The issue as to the provenance of the pan concentrate gold has never been satisfactorily determined. Boyle R.W. in the text '*The Geochemistry of Gold and its Deposits'* notes that 70% of gold deposits, regardless of the genetic model of mineralisation, have an arsenic anomaly. The soils at Pelias Cove did not give any

support in the toxic elements. The decision to undertake soil geochemistry as well as the decision to drill at Pelias Cove was not made by the author. My experience of the West Coast is that Tertiary gravels carry ubiquitous gold and to a lesser extent ruby tin and that the existence of Tertiary gravel deposits should give reason for caution **prior** to exploration expenditure. A simple test, prior to any soil geochemistry, geophysics or drilling would have been to reconnaissance map the spatial distribution of the gravels and then seek MRT permission to excavate, by hand if necessary, a series of test pits. The gravels could then be bulk sampled and their auriferous nature determined.

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North Butler

Work Undertaken

The North Butler prospect was a 'Greenfields' discovery by Pacific Nevada as part of this company's regional stream sediment reconnaissance programme in 1999. The initial stream sediment, pan concentrate and rock chip sampling returned values up to 564ppb Au in soil and 477ppb in rock with significant alluvial gold in the pan. Copper up to 1060ppm in rock was also noted. Subsequently a soil geochemistry grid, ground magnetics and concomitant mapping was implemented. Highly pyritic and graphitic black shale units were noted and these were found to correspond with responses from earlier airborne EM surveys. An IP survey and a ground magnetic survey was completed to aid the mapping due to the paucity and often deeply weathered nature of the outcrop.

Nigel Hungerford from Flagstaff Geo Consultants noted that anomalous gold soil values had a vague spatial relationship to two distinct SW-NE faults which are evident on the RTP image. This suggests a likely conduit for mineralising fluids. Rock sample values indicate that the volcanic/extrusive sequence has elevated Cu/Zn which is to be expected but it also showed that Au/As anomalism was restricted to the sedimentary package , and in particular to the basal carbonaceous unit. This suggests a possible chemically reactive unit.

Six diamond drill holes were cored with low gold results returned with the best (100-140ppb) values obtained from semi massive pyrite intervals in the black shale horizons. There exists at North Butler a nexus between the gold values obtained from the soil sampling and the values obtained from the drill core. This discrepancy between surficial values and drill core is unresolved but Lindsey Newnham has postulated that surface growth enhancement in an acid environment may be the cause.

As a result of AMOCO's 1985 DIGHEM survey, Mitre Geophysics consultant, John Bishop, nominated Butler Creek as an anomaly worthy of follow up investigation. This anomaly is two kilometres to the south west of the drilling undertaken by Pacific Nevada at North Butler. A reconnaissance traverse by AMOCO was made to check a linear magnetic trend with similarities to the known ironstone occurrence further south at 'Anomaly 128'. Utilising ground magnetics and soils geochemistry the work returned poor results.

Assessment

The work programme undertaken was systematic and appropriate. Ten of the soil sample localities that returned gold values in excess of 100ppb were selected by the author for re-sampling. Each sample hole was relocated and sampled and then the auger was taken to North Butler stream where it was scrubbed clean with a brush prior to the next sample being collected. This was done to eliminate any possibility of contamination between sample sites. No Tertiary gravels were observed on the high flanks of this drainage so any alluvial input could then be discounted. The gold tenor of all ten sample sites was replicated. In short the anomalism remains unresolved. It should be noted that an extensive area of surface carbonate-silica-pyrite-sericite alteration was encountered from the mapping and only one of the drill holes (NB06) targeted this alteration, the reason being that there was no supporting geochemical support. The balance of the holes were drilled to test IP and Au/Cu soil anomalies. Surprisingly the alteration in NB06 had no coincident IP response yet in the core pyrite is pervasive at 2-5% and locally up to 10%. Some of the pyrite appears syngenetic but Pacific Nevada considered that the majority was epigenetic. This discrepancy remains unresolved. The spatial distribution of the alteration remains open to the North East.

"*The programme did succeed in defining a major sulphide rich system within a deformed zone of Cambrian (sic) volcanics and sediments adjacent to a regional structure. In the context of Tasmanian economic geology, this is viewed as substantially encouraging being broadly analogous to the setting of the Henty gold deposit to the north" –Lindsey Newnham*

It is readily apparent that a major NE trending structure transects the Sorell Peninsula from Macquarie Harbour through to the West Coast. To the south west of the North Butler prospect, known haematite-magnetite bodies are located along this feature, and limited work has been undertaken on these iron prospects which have returned low base metal values. None-the-less, these ironstone occurrences are indicative of alteration and mineralisation along this sparsely explored corridor. The area north of the North Butler prospect has been adequately covered by Pacific Nevada and scope exists to incrementally explore southwards.

West Baylee

Work Undertaken

West Baylee is another Pacific Nevada 'Greenfields' prospect that is located in The Hibbs Ultramafic Belt which is a 2 to 3 kilometre wide and 30 kilometre long structural corridor that separates a Cambrian sedimentary-volcanic sequence from a block of Proterozoic metasediments.

Highly anomalous gold values were obtained from both pan concentrate (>20000*ug*) and BLEG sampling (3490ppb) with nuggets up to match head size. In contrast -80# stream sediment values were low and rock chip sampling returned up to 123ppb. Subsequent gridding and soil geochemistry returned both low gold and arsenic results.

A gradient array IP survey identified a north east trending coincident high conductivity and low resistivity anomaly that was broadly coincident with weakly anomalous (40ppb) soil values and the 3490ppb stream sediment.

Subsequent fieldwork generated geochemical and geophysical anomalies associated with a sheared serpentinite-sediment contact and a separate zone of strong nickel anomalism associated with a magnetic unit within the ultramafic package. These were targeted by three diamond drill holes. The IP and geochemical targets at the lithological contact were interpreted to be due to weakly pyritic black shale units and there was a discrepancy between the highly anomalous Ni values found in the soil (>2000ppm) with the values returned in the drill core (<1000ppm). High Ni values are expected in mainland Australia over areas of ultramafics due to laterisation however this is uncommon in Tasmania and the cause is open to conjecture.

Assessment

The Hibbs Ultramafic Belt is comprised of a series of fault bounded and emplaced Cambrian ultra mafic and mafic lithology which Lindsey Newham has suggested has similarities to Beaconsfield in Northern Tasmania. Lindsey makes the point that only the northern portion of this 30km long belt has been systematically explored and it has only been drill tested in two locations-both within 2 kilometres of the Macquarie Harbour southern shore.

It should be noted that DDH WB 01 intersected a thick cover of sandy-quartz rubble and an extensive cover of quartz scree was noted during the mapping along hill tops and ridge crests which suggests contamination by Tertiary gravels. This calls into question the validity of the Pan Concentrate method in this terrain.

Hill 99

Work Undertaken

This is another Pacific Nevada Greenfields prospect from 1999. Hill 99 is located in the Noddy Creek Volcanics which is considered to have heightened prospectivity. Brown *et al* state that these volcanics are "*the southern extension of the Middle Cambrian pyroxene-plagioclase phric andesitic rocks of the Lynchford and Que River (and hence also Hellyer) areas. As such it is a correlate of one of the more mineralised parts of the Mount Read Volcanics"* In short, the Noddy Creek Volcanics are a correlate of the Que - Hellyer Volcanics which host the namesake deposits.

The area in the vicinity of Hill 99 was deemed to be prospective due to the historically known massive pyrite-quartz outcrop near Asbestos Point. Reconnaissance stream sediment sampling returned values of low to moderate tenor with the highlight value of 5130*ug* obtained from a pan concentrate. Gridding and soil sampling delineated a south-west trending zone of copper and zinc anomalism striking inland from the coastal sulphide occurrence and broadly co-incident with a topographic high. A noteworthy feature was the existence of gossanous float boulders with gold values up to 50ppb and another float sample described as 'a chlorite altered lithicwacke' which

returned 92ppb. The tenor of the gold values in the soils were low- generally below the limit of detection, with a isolated peak value of 21ppb.

A gradient IP survey was undertaken which identified two targets. The first was a linear conductivity high of moderate intensity which was coincident with the Cu/Zn soil anomalism and the second was an isolated high phase, low conductivity 'bullseye'. This latter target was further tested by a ground TEM which returned unfavourable results for massive sulphides.

A three diamond drill holes were cored with two into the principal target which was the coincident soil and IP feature and the last into the bullseye target. Results were unfavourable. The IP and coincident geochemical anomaly was found to correspond with trace, disseminated pyrite and chalcopyrite and associated with carbonate – quartz veining, chlorite alteration and fuchsite-carbonate veining. The bullseye target encountered drill problems which forced the abandonment of the hole due to poor ground conditions associated with a shear zone and only 30m short of the target. Anomalous copper, lead and zinc were assayed in the last sample intervals of this hole.

As part of the AMOCO campaign, a second DIGHEM survey was flown in 1985 which failed to record any significant anomalies in the Noddy Creek Volcanics. Mitre Geophysics made the point that Pb/Zn VHMS deposits are unlikely to return a strong, high priority, anomaly and that any moderate response features also warrant further investigation. Using a list of seven anomalies recommended by Mitre Geophysics; in 1993 Plutonic Operations assessed four of those recommended which were located in the Briggs Creek area, 5 kilometres south of Hill 99. Results from this work were unfavourable.

In 1995 Plutonic reprocessed the 1984 AMOCO aeromagnetic-radiometric survey with a view to defining areas of felsic to intermediate volcanic stratigraphy within the Noddy Creek Volcanics. No anomalies were noted that had not been previously interpreted by AMOCO. In 1996 Plutonic flew an airborne EM-GEOTEM survey which in part covered an area both to the east and south of Hill 99. No significant conductive signatures were detected that would imply likely massive sulphide mineralisation.

Assessment

The source of the gossanous float boulders has yet to be established. The presence of fuchsite alteration is significant in a Tasmanian context as this green chrome mica is found as an alteration product at the Hellyer VHMS deposit and also at the Henty gold deposit. Thin section petrographic work on the drill core by Garry Davidson at CODES notes that the carbonate-sericite-pyrite alteration within the rhyolitic volcaniclastics in DDH H991 and H992 is strongly similar to the alteration noted at Henty and the footwall zones of the Rosebery and Hercules VHMS deposits.

A hydrothermal alteration and mineralisation system has been identified at Hill 99 in a Middle Cambrian sequence that is a correlate of rocks that host existing 'World Class' Volcanic Hosted Massive Sulphide deposits. Recent work by the Geological Survey of Canada indicates that the major VHMS districts in the world host on

average eight discrete mineralised orebodies. Consideration, with due reference to the ground conditions, may be given to redrilling H993 but from the other side of the fault to try and reach the IP target that was not successfully tested. The fact that no EM response was obtained may temper this.

Reconnaissance sampling should be extended to the south of the existing grid. There is no scope for expanding the reconnaissance eastwards as the existing gridlines terminate at the World Heritage Boundary.

Recommendations

1. The MHM prospectus indicates in Table 2.2, page 24, that in the first quarter of 2008 that all publicised data will be compiled and digitised into a standardised database. This appears not to have been done and it is the most pressing and necessary recommendation of this report.

The BHP programme from 1964 to 1972 collected 5,750 stream sediment samples and assayed for Cu, Zn and Ni. Similarly AMOCO, Plutonic and Pacific Nevada all conducted significant stream geochemical work. Once this information is captured in a digital format, spatial element distribution maps can be constructed in Map Info to define potentially subtle and previously unrecognised anomalism.

In 2004 Discovery Nickel held E.L 22/2007. This company acquired from Mineral Resources Tasmania the geochemical data from 15,000 stream sediment samples which were processed to produce geochemical maps. As this tenement is largely similar to the MHM holdings on Cape Sorell, it is suggested that negotiating to purchase this data set from Discovery Nickel may be more financially prudent that attempting to acquire it directly from MRT and to then pay for a GIS consultant to process the data a second time. *"There is no point in reinventing the wheel!"*

2. If it has not already been done**,** Featherstone Consultants who prepared the Independent Geologists report for the MHM prospectus should be approached with a view to retrieving all digital data utilised in the said report.

3. The brief for this report was that the area of study was to be no further inland than 5 kilometres. Given that MHM is a junior mining house with a small and limited exploration budget, I am surmising that the 5 kilometre limit was imposed so that walking could be utilised for access rather than helicopters. It is apparent that first pass exploration has already been conducted in this zone with anomalism discovered, prospects downgraded and areas relinquished. Once the GIS data is assembled any holes in the coverage can be ascertained but it is highly likely that the area of study provided to the author in this brief has been comprehensively assessed and that there is little to no scope of exploration success. Having said that:

4. '*Look for elephants in elephant country'*

Pacific Nevada identified two 'Greenfield' hydrothermal alteration and mineralisation systems at the North Butler and Hill 99 prospects. Both of these prospects are located adjacent to large, 30km+ long structural breaks which would provide fluid pathways for mineralisation. These conduits have only been drilled in the northern 2 kilomteres

of their extent. An *'Elephant'* has been located, now its time to look for the rest of the herd! Once the spatial distribution of existing samples is plotted, it is recommended that a staged process of reconnaissance be undertaken at these two prospects. At North Butler the existing helipad could be utilised as a base camp and an access track cut to allow field crews to operate in the drainages to the south. Likewise at Hill 99 the existing baseline should be extended southwards for access.

The airborne geophysical surveys conducted by previous exploration companies primarily targeted VHMS mineralisation with magnetics and radiometrics used for regional lithological discrimination and EM for specific conductors that could be followed up with ground assessment.. Critically the two Pacific Nevada prospects, whilst having only low levels of metal, were associated with substantial alteration. This alteration, having no discernable geophysical 'thumbprint', was located solely by geochemical means. To date the EM surveys have failed to detect significant conductive signatures that have indicated mineralisation and it is recommended that the geochemical approach be maintained.

5. The issue of Sovereign Risk needs to be addressed by MHM, specifically at the Hill99 prospect. As noted previously, the eastern edge of the grid lines abut the WHA boundary which precludes exploration in that direction. Hill 99 is also proximal to the National Park Service administered Sarah Island and the tourism operations operated by Federal Hotels. On shore at the northern end of the grid there is archaeological evidence of convict era brick making kilns, clay quarries and bricks. In short this area is intrinsically a valuable cultural asset and any postulated mining would face environmental, regulatory and social licence hurdles.

6. Of the five prospects discussed in this report only two-North Butler and Hill 99 - are considered to warrant further investigation and such work is along strike from these areas as the prospects themselves have been comprehensively tested.

Conclusion

Along the southern coast of Macquarie Harbour between Pelias Cove through North Butler Creek and extending as far east as Rum Point and extending inland no more than 5km, there are no areas that warrant further investigation.

MHM will need to consider the prudent use of helicopters and to commit to operations inland of this 5 kilometre zone in order to discover new prospects.

The compilation of a digital database and the capture of all available data and its use in a GIS format is a matter of urgency. No planning of exploration work can be done until such time as this is completed.