EL10121

Year 1
Borroloola Area
05 - 09 - 02
04 - 09 - 03

By Robert M Biddlecombe
THIRD SCHEDULE
(Plan of Area)

EL10121
5 BLOCKS
16.5 sq kms
WORK COMPLETED

Review of all previous work by B.H.P Carpentaries mining, Mt Carrington mines was undertaken. Negotiation to interest a joint venturer in the basin adjacent to the fault zone. Site visits and traverses of area to confirm the presence of the basin as shown on geological maps.

FUTURE PROGRAM YEAR 2

Geophysical work and one hole into centre of basin to test for mineralization. This work to be undertaken by Borrooloola resources during the 2004 dry season.
**EXPENDITURE YEAR 1**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field trips (including vehicle costs, accommodation, camping costs, incurred by RM Biddlecombe)</td>
<td>4000</td>
</tr>
<tr>
<td>Administration costs</td>
<td>1500</td>
</tr>
<tr>
<td>Research</td>
<td>1000</td>
</tr>
</tbody>
</table>

Total $6500

**EXPENDITURE YEAR 2**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geophysical work on mini basin</td>
<td>10000</td>
</tr>
<tr>
<td>Drill hole into basin centre</td>
<td>25000</td>
</tr>
<tr>
<td>Administration</td>
<td>5000</td>
</tr>
</tbody>
</table>

Total $40000
INTRODUCTION

One day was spent on-site at Gordon's copper prospect in the McArthur Basin, N.T. together with the EL holder Mr Bob Biddlecombe who acted as a guide and Mr John Hartley a geological consultant. The site visit was arranged by Mr Graeme Hutton representing Faustus Nominees P/L, a potential joint venturer on the EL covering the prospect. A helicopter was made available to get aerial views of the site and to visit any areas of special interest within the inferred mini-basin south of the prospect.

The field visit was made to assess the applicability of certain mineralization models to the area around Gordon’s copper prospect.

MINERALIZATION MODEL

A number of genetic models have been canvassed to help explain the mineralization at Gordon’s copper prospect and to assess the potential for additional mineralization. Some of these papers were circulated previously to interested parties whilst others are attached to this report. The attached reports include two models for the Nifty copper deposit which occurs as stratabound ore lenses in dolomitic host rocks in a Proterozoic basin. The Nifty deposit occupies the keel of a syncline and is proximal to a regional fault.

Other genetic models that have been considered seek to explain the numerous stratiform Zn-Pb-Ag±Cu deposits in the Proterozoic succession of Northern Australia. These papers often assign a sedimentary exhalative origin to the deposits. Most, if not all of the deposits occur in the keels of synclines near a regional fault. Replacement, diageneric, epigenetic and sedimentary exhalative models have all been suggested by various authors to account for stratiform or stratabound base metal deposits hosted in
Proterozoic sedimentary successions undergoing extension, normal faulting, rifting and late stage sag basin development. Of these the sedimentary exhalative model appears to have a more general application and to be the most robust.

Ideas expressed in "A Genetic Model for the HYC Deposit", 1998, by Ross Large et al and "Application of Conceptual Models for Sediment-hosted Ore Deposits in the Discovery of the Nifly Copper and Adjacent Zinc-Lead Deposits, Yeneena Basin, Western Australia", 1993, by D.W. Haynes et al (both papers attached to this report) appear to have most relevance to Gordon's copper prospect. Key exploration parameters from the two papers have been synthesized to come up with a model that may be appropriate for the area.

The essential features of these two models are quite similar and include:

1. An actively subsiding mini basin
2. A bounding fault issuing syn sedimentary metalliferous brines into the mini basin
3. A density contrast between relatively low SG seawater and relatively high SG metalliferous brines (i.e. so that the brines are bottom hugging and form a metal-charged brine pool at the bottom of the mini basin)
4. A source of sulphate (i.e. from gypsum in the evaporites)
5. Anoxic conditions in the bottom of the mini basin including a source of carbon (i.e. from black, carbonaceous shale) to reduce the $S^{+6}O_4$ to reduced $S^{2-}$ which is then available to complex with and precipitate insoluble Cu, Pb, or Zn sulphides during simultaneous deeper water sedimentation.

It should be emphasised that in a system where simultaneous sedimentation and precipitation of sulphides is occurring, base metal rich ore hosted in bedded black shales will be strataform at the local scale but transgressive at the deposit scale. The ores characteristically mimic both bedding and the shape of the brine pool from which the sulphides were precipitated.
GEOLOGY

The following observations were made during the field visit and on a previous inspection of the diamond drill core from BHP’s MYD-007 stored in the Mines and Energy core shed at Winnellic.

Stratigraphy

Gordon’s copper prospect is hosted in the Amelia Dolomite Formation of the lower McArthur Group. The dolomite-rich McArthur Group, comprising mostly shallow marine sediments, feature prominently in the north-northwest trending Batten Trough which represents the rift phase of basin formation and sedimentation in the McArthur River area.

The E-W striking fault breccias that host the copper mineralization at Gordon’s prospect are hosted in Amelia Dolomite near its contact with younger Roper Group sediments to the north. In outcrop and in diamond drill core it was observed that the Amelia Dolomite is comprised dominantly of dololutite and dolomitic mudstone with subordinate interbedded dolarenite. Adjacent to the mineralized fault there is abundant evidence in some of the bolder outcrops of soft sediment deformation including slumping and brecciation.

The diamond drill core (BHP’s MYD-007) features the widespread presence of indicators for an evaporite origin for the Amelia Dolomite including cauliflower chert and gypsum pseudomorphs.

Diamond drill hole MYD-007 penetrated through the Amelia Dolomite via a transition facies into the underlying Mallapunyah Formation. This formation displays reddish hematitic tints (below 197m in the drill core) in contrast to the dark grey, less oxidized Amelia Dolomite above it. The unit displays many of the features of shallow water littoral sedimentation including an abundance of red mudstone, siltstone and minor sandstone often with dessication cracks, cauliflower chert and halite casts (see also colour photographs of HYC core, p. 1348 in Large et al).

To the south of the prospect there are rather prominent outcrops of whitish coloured sandstone and dolarenite. These appear to belong to the Tatoola
Sandstone. MYD-007 was collared in this formation. Because of its positive outcropping pattern, light colour and sedimentary textures including cross bedding and ripple marks, the unit can be used as a marker unit.

Stratigraphically above the Tatoola Sandstone is a recessive unit, the Tooganinie Formation. This is comprised of highly dolomitic siltstone and mudstone that weathers with a typical scalloped carbonate/karst surface. It outcrops south of the Tatoola Sandstone.

Further south still, the Proterozoic succession is concealed beneath unconformable Cretaceous sediments.

It should be stressed that in any basin, diachronous sedimentation will result in facies changes recording the progression from shallower to deeper water conditions and these facies variations will reflect both the energy (e.g. grain size) and slope gradient (e.g. sedimentary breccias, slumps). It is possible that the slumped and brecciated dololutes near the fault at the northern edge of the mini basin will pass into a more shale-rich facies in the middle of the basin where lower energy conditions would have prevailed.

**Stratigraphic Evolution**

In the diamond core the stratigraphic column appears to record marine transgression over still-stand, shallow, oxidized (reddish, hematitic tints) evaporitic basement (i.e. Malapunyah Formation). When sag phase subsidence commenced and water depth began to increase (albeit still at relatively shallow depths) the reddish coloured, oxidized, evaporitic sediments have given way to darker coloured, less oxidized dolomite-rich sediment (i.e. the Amelia Dolomite) during marine transgression.

The transition between the two formations records a transition from oxidized still-stand conditions, the commencement of basin subsidence and then marine transgression. The transition to active subsidence/sag is recorded by a colour change from reddish hematitic tints to darker less oxidized tints.

*The recognition of this colour transition will be important when logging core drilled to find support for a SEDEX mineralization model (see colour photograph and script on page 1348, Large et al).*
Structure

The copper mineralization at Gordon’s prospect outcrops along an E-W trending, south dipping fault structure that approximately marks the boundary between McArthur Group sediments and Roper Group sediments to the north. South of the fault the outcrop trace of the sediments, together with strike and dip information obtained from outcrops, appears to indicate the presence of a mini-basin about 1,000m across (as defined by outcrop of the Tutoola Sandstone Formation). A north-northwest trending fault, identified in the field as a silicified and quartz veined fault scarp, probably represents a splay of the Four Archers Fault. This fault bounds the Batten Trough to the west and hence is pretty much the mirror image of the Emu Fault on the eastern side of the trough near the HVC orebody. It forms the western boundary of the mini basin. The southeast margin of the mini basin appears to be demarcated by the hinge zone of a south-southwest trending shallow-dipping anticline that strikes about 190 degrees (i.e. to the SSW) thereby indicating a trend towards basin closure. The south and southwest margin of the basin could be obscured under Cretaceous cover but the area was not visited and hence this cannot be confirmed without another visit.

It appears that a larger basin, defined by the distribution locally of McArthur Group sediments, has been divided into a number of mini basins by sag induced undulations in the bedding and possibly also by faulting. Dips around the outer margin of the basin appear to be around 35 degrees according to readings taken by Geological Survey mappers. My several dip readings and estimates of dips around the margin were in the range 35-45 degrees with the former more common, except near faults where dips are usually steeper. The BHP interpretive drill cross section seems to indicate a bedding dip of around 40-45 degrees south away from the mineralized fault. Observations of outcrop during a traverse across the centre of the mini basin showed that dips definitely get shallower towards the centre. I found no outcrop in the interpreted centre of the mini basin.

A feature of the more shaley sections of core near the top of MYD-007 is that they contain slickensided graphite bands strongly reminiscent of the graphite slicks found in most faults. These have been observed at a number of sedex base metal deposits in Australia and overseas where they have variously been described as stylolites, pinstripe rock or needle rock. I believe that these bedding parallel slip planes in the more ductile shaley units result from late stage basin loading during sag phase subsidence and consequent
bed extension continuing into early diagenesis. The more competent units seem to adjust to sag-induced bed extension by developing open space brittle stock works. These are often the receptacles for late stage remobilized base metal mineralization hosted in a carbonate gangue.

Mineralization

The mineralization at Gordon's prospect is comprised of brecciated, weathered and oxidized Amelia Dolomite with the supergene minerals malachite, tenorite and cuprite coating fractures and some less common grey to black chalcocite occluded in marble. In the drill core, chalcopyrite is the principal copper ore mineral. It mostly occurs in stockwork veinlets and in marble-sized iron rich carbonate, possibly siderite or ankerite. Pyrite is rare, indicating that there was insufficient reduced sulphur present to precipitate it (or other base metals) out of solution as pyrite. It seems to have combined with readily available carbonate in the absence of reduced sulphur in near surface oxidizing conditions.

Recrystallization of the carbonate seems to indicate that it has been affected by late stage heating, perhaps associated with the sag phase temperature increases due to crustal thinning during ongoing extension. Alternatively it may result from the enduring presence of proximal high temperature hydrothermal fluids/brines circulating in the fault.

Surface weathering and the presence of Fe$^{3+}$ and Mn$^{2+}$ oxides has resulted in the concentration of As, Cu and Co by scavenging in the surface environment. As and Co concentrations decrease markedly at depth.

Core analysis has shown that there is a 148m interval of highly anomalous Ag (up to 2.5 ppm with Detection Limit 0.2 ppm and Crustal Abundance at 0.07 ppm) Bi (up to 88 ppm with DL 10 ppm and CA at 0.17 ppm) above the transition from red tinted to dark grey sediment. It is interpreted from this that the fault discharged metalliferous brines over the whole time period that it took for the 148m of geochemically anomalous sediments to accumulate. This may indicate that a great deal of brine could have accumulated in the brine pool in the middle of the mini basin. At HYC, a similar colour transition marks the base of ore in the depocentre of the mini basin. Elsewhere in the core, anomalous concentrations of metals occur in the fault zone and in a supergene enriched layer near the surface.
Some ironstone lag was found littering the southeastern end of the basin. It is possible that the ironstone was sourced from weathering pyrite.

CONCLUSIONS

From the above observations it is concluded that the necessary prerequisite geological conditions have been satisfied that would permit the application of the integrated Large-Haynes model to the Gordon's prospect area. The area is deemed to be permissive for the model and hence this should form the basis for any future exploration. Such exploration is inherently high risk but high reward if successful.

RECOMMENDATIONS

Mapping

The area of interest should be mapped at a scale 1:2000 to determine the margins of the basin and to accurately locate the depocentre of the basin using scaled cross sections based on dip information gathered in the field.

Geophysics

Only a drill hole will unambiguously test the model. A variety of geophysical surveys could be carried out including gravity, IP and various electrical methods. It is suggested that if this intermediate step is considered, only a geophysicist who has had experience in the McArthur Basin should be consulted.

Drilling

Detailed mapping will locate the depocentre target. It will likely give some indication of the depth to be drilled. The transition to red sediments will indicate that the potential ore zone has been passed through if base metal horizons have not already done this. A single hole in the depocentre is considered sufficient to test the model.

Robert J. (Bob) Burke
Burke Geological Services
11 Langer Court
Fairview Park
SA 5126
Ph/Fax (08) 8289 0716
Email riburke@bigpond.com

1st August, 2003