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QUARTERLY REPORT
OCTOBER-NOVEMBER-DECEMBER, 1972
REDBANK
EXPLORATION LICENCE APPLICATION-609

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Triako Mines N.L.

31 December, 1972
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INTRODUCTION

Geological exploration on the Redbank Prospect area was commenced by Triako Mines in the last quarter. Senior geologists Dr. H. van den Heuval and Mr. J.A.J. Smit, arrived at Redbank early in October; their main objective was to evaluate previous exploration and to outline a new exploration programme.

Prior to commencement of field work, senior geologists and geophysicists spent considerable time in head office, reviewing all data in an effort to develop a reasonable geological model which could be tested by an intensive programme. Appendix III is a summary of one such model.

SUMMARY

The Redbank field has good indications for further ore reserves. Geological evidence suggests that besides vertical structures, either pipes or mineralized fractures, horizontal mineral zones may also exist. Both types are probably lower in copper grade than those encountered in the pipe deposits (in the order of .5 to 1.5% Cu), but their tonnage potential is appreciably greater.

In an effort to locate mineralized zones of both types, a programme with a regional approach will be undertaken.
RECOMMENDATIONS

A. Further detailed field work in the Wollogorang and Lower Gold Creek Formations should be undertaken in an effort to better understand the tectonic framework of the breccia pipes. At present it appears that substantial sub-horizontal movement was significant in the area. High fluid pressures in these zones may have penetrated higher stratigraphic horizons along intersection vertical breakage planes causing brecciation and mobilization of carbonates and sulphides.

B. The idea of mineralized bedding horizons should be followed up. This would entail detailed inspection of existing drill holes.

PREVIOUS WORK

The geology of former Authority to Prospect 2885 has been adequately mapped at a scale of 1:50,000. Parts of the area have been briefly prospected, and new occurrences of copper and lead mineralization located, however, little follow up work was undertaken.

The latest geological and economic assessment of the Redbank prospect was presented by A.A.C. Mason in December, 1971. The geological data was interpreted by Newmont geologists, as narrow mineralized breccia pipes within the Gold Creek Volcanics. Dr. B. Marshall of Harbourside Oil, summarized the Bluff and Sandy Flat deposits as breccia vents, produced
by hydrothermal explosive activity centered along old tectonic trends and aided by monocline downwarping of the depositional interface, now expressed as thickenings in the Gold Creek Volcanics. Chalcopyrite and pyrite mineralization is thought to have been introduced by hydrothermal spring activity, following the explosive phase.

The collapsed volcanic pipe theory appears to have greatly influenced exploration of the prospect area. Most of the obvious breccia pipe structures have been mapped and tested in detail. Two such structures, Sandy Flat and the Bluff prospects, hold the main known ore bodies. Both have been extensively tested by diamond drilling but are still open on some sides.

GEOLOGY

Regional

Previous exploration placed very little emphasis on the tectonic setting of the Redbank prospect. The prospect area, being part of the Wearyang Shelf of the McArthur Basin, is characterized by thin sedimentary units which are gently folded and occasionally block faulted. The area is believed situated on the hinge line between the sedimentary shelf and the outlying deeper basin structures. Rapid facies changes, typical of a hinge location and shallow water depositional environments, have been observed in the Gold Creek Volcanics and in the Wollogorang Formation.
The geological age of the Redbank sediments is within the time span 1600 to 1520 million years, the latter date being based on age determinations of the Packsaddle Rhyolite, a time equivalent of the Gold Creek Formation. This determined time limit makes the deposit virtually time equivalent to the Mt. Isa and McArthur River deposits.

**Wollongorang Formation and Gold Creek Volcanics**

To date, results of field work undertaken by Triako geologists have led to new ideas, relating mainly to the boundary facies between the Wollongorang Formation and the Gold Creek Volcanics. Wollongorang facies are comprised of finely bedded, laminated, partly dolomitic sediments with inter-bedded, locally cross-bedded sandstone which becomes increasingly tuffaceous and coarser grained. This sequence is overlain by a succession of massive tuffs and flows of the Gold Creek Volcanics. The boundary between the two sequences appears conformable and in general transitional.

Several known copper occurrences in the region are located within the boundary facies of the two formations. Some of the tuffaceous grit sequences at the base of the Gold Creek Volcanics have been found to contain disseminated chalcopyrite mineralization.

Extensive medium scale folding and warping of the Wollongorang Formation, indicated by aerial photography and maps, could be partly attributed to differential compaction of the greatly varying lithologies, possibly aggravated by slight tectonic movements within the shelf area.
In the top sequence of the Formation strong distortion of bedding occurs locally, suggesting brecciation and folding caused by differential movement of water logged, partly solidified sediments.

MINERALIZATION

The breccia pipes so far drilled show that the mineralization is concentrated towards the top and bottom of the Gold Creek Formation, a position where more sedimentary influences are apparent. Inspection of drill core in the lower mineralization zone suggests:

1. Mineralization is closely associated with the less deformed parts apparently strongly concentrated within two particular gritty to sandy tuffaceous units. The unit can also be seen as mineralized matrix within brecciated zones.

2. Mineralized occurrences of the two rock types are known outside the Breccia pipes.

3. Brecciation as observed is very similar to the intraformational breccia observed in the Mount Isa district (Kennedy Siltstone overlying the Mount Isa ore horizon). In Mount Isa, brecciation is strongly controlled by bedding but occasionally steeply crosscuts adjacent sediments and is accompanied by recrystallization of carbonate and sulphides.
4. Horizontal shearing is prevalent in the zone, and the Roman Nose breccia pipe shows a sub-horizontal offset in the order of 70 feet.

5. As presented in Blanchard's report, the volcanics are unusual in their high alkali content (resp. 13.4 and 14% Na₂O + K₂O), low Cu (1.2 and 0.4%) and Mg (0.18 - 0.14%). Both very rich sodic and potassic rocks were indicated.

It should be noted that the Gold Creek Volcanics represent the last, and in general, a more acid phase of an extensive volcanic cycle. These volcanics hold considerable potential for base metal mineralization even without known ore grade occurrences.

Source of Mineralization

The initial volcanic activity is believed responsible for the introduction of soluble copper which, together with available sulphides, probably derived from the laminated sediments, precipitated as chalcopyrite. Diagenetic processes led to the chalcopyrite migrating and becoming stored in the permeable tuffaceous grit. Massive volcanics have in places trapped the migrating mineralizing solutions. Warping and folding followed, and at intersections with a regional joint system, the cupriferous solutions precipitated in narrow crescent shaped tension wedges.
It should be appreciated that the understanding of structures at Bluff and Sandy Flat is not complete and the proposed model does not necessarily replace the theory of volcanic explosion and collapse pipes. However, one aspect warranting stress is the possible relationship between ore and the depositional environment during the change from the Wollogorang Formation to the Gold Creek Volcanics.

FUTURE EXPLORATION

Geological Programme

Exploration targets outlined to date include:

1. Pipe-like orebodies indicated on the surface as apparent collapse structures.

2. Ore grade mineralization which is a direct extension of known bodies or within the vicinity of known bodies.

3. Partly strata bound remobilized copper mineralization.

4. Silver, lead and zinc mineralization related to altered tuff.

The initial programme would be centered on the "Prospect Area" and the known ore occurrences, where systematic exploration would include auger drilling and/or back hoe trenches. Detailed geological mapping of the area, combined with a thorough study of the available core should provide an understanding of the ore occurrence and its related structures.
Further exploration of the boundary sequence between the
Wollogorang Formation and the Gold Creek Volcanics will be included in the
programme. This will involve more detailed mapping of structures,
regional trends and facies changes as well as the testing of the sequence
for copperiferous units.

Geophysical Programme

The four exploration targets outlined in the preceding section,
pose a separate problem geophysically.

1. Pipe like ore bodies are at present known to be small in
area, but they do give rise to a geophysical expression.
particularly with IP/resistivity. Wholesale coverage of the
potentially mineralized area would be unnecessary and the
use of geophysics would only be warranted if a geological
or geochemical expression required the confirmation that
sulphides were present.

2. Once mineralization is established, extensions of the
mineralization could be detected by IP/resistivity or gravity.

3. Stratabound or near horizontal sulphide mineralization,
possibly at the surface or at depths up to 1,000 feet,
could be detected by 'vertical electrical drilling', using
an augmented IP/resistivity method such as an expanding
Wenner configuration or a variation thereof.
4. Other base metals associated with the altered tuff could be identified by the IP/resistivity method likewise.

Geophysical methods would be used on the Redbank project as required to assist in development of the property.
EXPLORATION LICENCE APPLICATION 689

(FORMERLY PROSPECTING AUTHORITY 2885)

REDBANK NORTHERN TERRITORY

EXPENDITURE STATEMENT

EXPENDITURE FOR OCTOBER-NOVEMBER-FEBRUARY 1972 QUARTER

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APPENDIX II
### REPORT OF ANALYSIS

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**Remarks**

**Detection Limit:** 0.10

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**Sample No.** 2764  
**Sample Advice No.** 5722

**Project or Prospect:** Triako Mines N.T.  
**Location:** Redbank, N.T.  
**Date Received:** 7 Nov. 72  
**Date Reported:** 10 Dec. 72

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**PLACER PROSPECTING (AUSTRALIA) PTY. LTD.**  
**LABORATORY**

**WOODPARK ROAD, SMITHFIELD, N.S.W., PHONE: 632-3888**  
**Postal Address: P.O. BOX 85, MERRYLANDS, 2160**

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**Analyst:** [Signature]
PRELIMINARY GEOLOGICAL AND GEOPHYSICAL APPRAISAL - REDBANK

V.L.R. Furlong

and

K.M. Holt
PRELIMINARY GEOPHYSICAL APPRAISAL

REDBANK AEROMAGNETICS

GENERAL

Part of the results of the aerogeophysical survey flown over the Harbourside-Westmoreland A.P. No. 2885 has come to hand, namely the magnetics. The survey was flown with 1/8 mile spacings at a mean terrain clearance of 425 feet by McPhar Geophysics. Computer processing and contouring of the data was undertaken by Engineering Computer Services.

TECTONIC SETTING

Redbank Prospect is situated at approximately 17°12'S, 137°45'E on the far southeastern edge of the McArthur basin in a subzone known as the Woaryan Shelf. Redbank lies some 30 miles north of a stable E-W ridge locally known as the Pandanus Creek - Nicholson Granite area.

PROMINENT MAGNETIC FEATURES

The major lineations in the region are those lying in a NW-SE position and in parallel with the physiographic western edge of the Carpentaria Basin and eastern margin of the Mt. Isa Geosyncline. A major fault zone called the Calvert Fault lies some 30 miles to the south-west of Redbank also trending NW-SE.

LOCAL ANOMALIES

A microgranite (Packsaddle Micro Granite) lying some 12 miles northeast of Redbank appears as though it was emplaced as a sill with a low westerly dip. The hanging wall margins of the granite have localized concentration of magnetic material, however, these concentrations probably do not outcrop.
REDBANK

The remainder of the magnetics are generally quiet with the exception of the 12 square miles or so around the Redbank Area. In this restricted area magnetic lineations run contrary to the normal country rocks and the normal tension relieving features thereto related. Two major intersecting magnetic inclination directions are prevalent, E-W and NE-SW. Eight readily defineable lineations in each direction are present and intersect each other.

All of the so called pipes occur on or immediately adjacent to, the intersections of these magnetic lineations therefore it is my postulation that the magnetic lineations represent faulting along which some magnetic material has been localized. Likewise these fault zones have provided the plumbing necessary to have moved mineralized solutions about. One major E-W fault and the related intersections of the NE-SW faults clearly represents the line of pipes known as the Bluff, Quartzite, Roman Nose, Camp Valley, San Manual, Azurite and Redbank.

Other intersections clearly indicate the pipes known as Prince and Sandy Flat and the undefined mineralized zones known as Black Charlie and 7 Mile. Some 20 other major fault intersections are indicated in the magnetic data.

Two major intersections also have oval shaped, flat topped sandstone capped hills each about 1/2 mile in length on the long axis associated with them. It is possible they represent collapsed pipes that have been protected from weathering.

Although undoubtedly the 20 odd major fault intersections could represent potential mineralized sites, the most significant interpretation that can be postulated from the fault-fracture pattern is that this very shattered zone probably represents a caldera.

Further mineralization possibilities emanating from a caldera interpretation are set out in Kathy Holt’s geological appraisal, together with the mineralization possibilities that may be associated with the magnetic anomalies present along the hanging wall of the Pack-saddle Granite.

V.L.R. Furlong
GEOLOGICAL SEQUENCE

PACKSADDLE MICROGRANITE

- Masterton Formation
- Gold Creek Volcanics & Rhyolite Member
- Wollogorang Formation

TAWALLAH GROUP
(LOWER PROTEROZOIC)

Lower Sequence Including:
- Settlement Creek Volcanics (andesine basalt)
- Peters Creek Volcanics (andesine basalt)

LOWER PROTEROZOIC GRANITE BASEMENT
The Gold Creek Volcanics, Hobblechain Rhyolite and the Pack-saddle microgranite appear to represent different phases of an igneous intrusion to which the known mineralization is most probably related.

**Sequence of Events Leading to Mineralization**

Igneous activity seems to have occurred in two phases, beginning with the extrusion of andesitic-basaltic Peter's Creek and Settlement Creek Volcanics over the Proterozoic granitoid basement. A period of subsidence and quiescence which followed, provided a suitable environment for the deposition of shales and dolomites comprising the Wollogorang Formation.

Later uplift of the sedimentary deposits was accompanied by the development of vents penetrating the Gold Creek Volcanics and the Wollogorang Formation through which the Upper Trachyte unit became extruded. Parts of the Wollogorang Formation appear to have been forced into the overlying volcanics possibly by rising magma. These bodies of "intruded" dolomite may be akin to diapirs.

The Upper Trachyte Unit was the final extrusive phase, after which vents collapsed, leaving a fractured caldera, later to be intruded by a network of volcanic pipes. The Packsaddle Microgranite was probably the last intrusive phase, representing the top differentiate of the magma.
Mineralization would have been introduced in the last phases of the sequence outlined, that is, associated with the volcanic pipe injections and microgranite intrusion.

Significance of Carbonate and Carbonate Breccia

The presence of "carbonate breccia" or "dolomite breccia" as described in drill core logs can be attributed to assimilation of the dolomitic host by rising magma. Whether this breccia is actually assimilated Wollogorang Formation can be determined by detailed thin section study.

Descriptions of core by Hopwood indicate a close relationship between mineralization and carbonate material. This is probably carbonate derived from the Wollogorang Formation -- not carbonate derived from alteration of igneous material. Reasons are as follows:

(1) The carbonate is often described as brecciated, suggesting that it has been dragged into the magma.

(2) Vitrainite is commonly associated with mineralized calcite. Vitrainite is organic in origin and could not have originated from the magma.

This association should be in mind when checking for mineralization.
Favourable Mineralization Zones

All the igneous events mentioned occurred over a short geological span of time, and are associated with a sequence typical of a geosynclinal cycle - the Tawallah Group. Igneous activity commenced with extrusion of the basic Peter's Creek Volcanics and the Settlement Creek Volcanics. Following eruptions produced more intermediate to acid trachytes and rhyolites, and the last phase is represented by the acid purphyritic Packsaddle microgranite. Assuming that mineralizing solutions were derived from the single magma source, mineralization would tend to be associated with the final phases of igneous activity.

Based on the ideas outlined, the following zones are considered to hold good mineralization potential:

(1) Volcanic pipes and adjacent fracture zones which have been located and drilled, lie within a drainage anomaly encompassing an intensely fractured sub-circular zone, believed to be a remnant caldera. This fracture zone is a suitable ore trap.

(2) Domal structures found in the Gold Creek Volcanics are mapped "carbonate, tuff layers". Considering the tectonic activity involved at the time of magma intrusion,
it is conceivable that these structures are "diapirs" -- masses of brecciated dolomite extruded through overlying sequences. Fractures and brecciated carbonates are characteristic of diapirs. Such a zone would be suitable as an ore trap.

(3) The Packsaddle Microgranite, representing the last intrusive phase is another ore target zone. Hydrothermal Solutions, carrying ore material would tend to be concentrated with the last acid phase.

(4) Carbonate is a favourable "sponge" for mineralizing fluids. The dolomite adjacent to igneous intrusion is a likely target zone.
CROSS SECTION
PROPOSED CALDERA-REDBANK

Scale Horiz. 1" = 3600'
Approx. Scale Vert. 1" = 100'
V/H = 36

Wollongong Formation

Caldera Fracture Zone

Volcanic Pipe

Contact Zone

3

Contact Zone

Upper Trachyte Unit

Gold Creek Volcanics

Lower Tawallah Group