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EXPLORATION LICENCE 1636 - FOUNTAIN HEAD
FOR THE PERIOD
20TH SEPTEMBER 1980 - 19TH SEPTEMBER 1981

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This report describes an exploration programme of geological mapping, photo-interpretation, rock chip sampling and stream sediment sampling in an area of outcropping South Alligator Group sediments along strike and close to the major Cosmopolitan Howley Gold Mine. Although not all analytical results have been received to date, it appears several areas are worthy of follow-up for stratiform Au, Ag, Cu, Pb and Zn mineralization.
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INTRODUCTION

Exploration Licence 1636 covering 8.99 square miles was granted on the 20th September, 1977. This is the Annual Report for the 4th year of tenure. The area of the Licence is now 1.28 square miles. Stephens (1978) described Geopeko's regional geological mapping in the Hayes Creek area, including EL 1636. Aerial magnetic and radiometric survey data, and ground follow up results were subsequently produced in 1980.

During the 1977 to early 1980 period, Geopeko's exploration in the area was mainly targeted at the Iron Blow-Mt Bonnie mixed sulphide type deposits within the Kapalga Formation. However, exploration in the nearby Golden Dyke area in 1980 showed that lower section of the stratigraphy are also prospective for stratiform base metal gold deposits. Orientation surveys in the Golden Dyke area indicate that these deposits can be successfully explored for using an initial programme of detailed geological mapping, rock chip sampling and stream sediment sampling. The results of such a programme conducted in the EL 1636 area are presented in this report.

LOCATION

EL 1636 is located on the Tipperary 1:100,000 sheet 14/5, being on the Stuart Highway southwest of Fountain Head siding.

SUMMARY

Traverse mapping and photo-interpretation has accurately located the position of certain subunits of the South Alligator Group. The particularly favourable Middle Member of the Koolpin Formation, which contains stratiform gold mineralization at the nearby Cosmopolitan Howley and Golden Dyke mines, was chip sampled at regular intervals. Stream sediment samples were taken over the entire area.

Zones of favourable sulphidic BIF, and BIF anomalous in gold and arsenic were located within this Middle Member.
DESCRIPTION OF AREA: EXPLORATION LICENCE 1636

Commencing at the intersection
thence proceeding to the intersection of
thence proceeding to the intersection of
thence proceeding to the point of commencement

Area: 1,284.5 square miles
3,326 square kilometres

EXTRACT FROM TIPPERARY SHEET 15/5
SCALE: 1:100,000

FIGURE 1
LOCALITY PLAN
GEOLOGY

Previous Work:
The regional geology of the Pine Creek Geosyncline was described in Walpole et al (1968). Sullivan and Iten (1952) mapped the Cosmo/Hayes Creek area, concentrating on the Cosmopolitan Howley mine and the areas to its east, now covered by EL 1636 and mineral leases 1596B to 1608B (inc.). Twist (1975), Ryan (1976) and Vanderplank (1965) describe the geology and potential of the Cosmopolitan Howley mine, which lies approximately 2 kilometres to the west of EL 1636. Stephens (1978) used traverse mapping and photo-interpretation to gain a fairly detailed picture of the geology of the Cosmo/Hayes Creek area.

General Geology:
All the major lithologies in the area belong to the Lower Proterozoic Pine Creek Geosyncline. The oldest sediments in the area are schists of the Wildman Siltstone, Mount Partridge Group. These are conformably overlain by a heterogenous sequence of mudstones, banded iron formation, volcanic chert and greywacke of the South Alligator Group, and a flysch-type sequence of the Burrell Creek Formation, Finnis River Group.

The Wildman Siltstone and South Alligator Group were intruded by sills of the Zamu Dolerite prior to mid-greenschist facies metamorphism and regional deformation at about 1800 m.y. The Fenton Granite, which lies under superficial cover to the south of the area, was intruded at about 1720 m.y. (Walpole et al (1968)).

Mineralization types recorded in the Cosmo/Golden Dyke area include greywacke-hosted tin-quartz veins, e.g. Hayes Creek mine; quartz mica pegmatite-hosted tin, greywacke-hosted gold-quartz veins, e.g. Yam Creek; stratiform base metal sulphide bodies, e.g. Iron Blow, Mount Bonnie; and stratiform gold-sulphide bodies, e.g. Golden Dyke, Cosmopolitan Howley.
Procedure:
Detailed traverse mapping, both across and along strike, was completed by C. Wilkinson (Plate 1). Chip samples were taken at regular intervals, where outcrop permitted, across certain selected stratigraphic intervals within the Middle Member of the Koolpin Formation. The position of these samples is shown on Plate 2. The mapping data and sample locations were recorded directly onto 1:5,000 scale (blow up) photographs and transferred to base sheets.

Stratigraphy:
A stratigraphic column of sediments found in the area mapped, compared with those in the Golden Dyke/Mount Bonnie area, is shown in Figure 2.

The lithologies of the area are described in detail by Stephens (1978), and generally need not be further described here. Figure 2 indicates the relation between Stephens (op cit) subdivisions and those used in this report.

The Middle Member of the Koolpin Formation, which is of particular economic interest, does deserve further description. This unit is composed of an alternating sequence of banded iron formation and mudstone.

The banded iron formation beds are 5 to 15 metres thick, and where intersected in diamond drill holes in other parts of the Cosmo/Burrundie area, are comprised of alternating laminae which may contain quartz, chert, actinolite, stilpnomelane, garnet, biotite, siderite, dolomite, pyrite, pyrrhotite, arsenopyrite, hematite and magnetite. In outcrop the laminations are defined by quartz, clays and various iron oxides. Pods and lenses of sugary quartz are concentrated in certain bands, and range between one centimetre and three metres in thickness.

The mudstone beds are 3 to 25 metres thick and comprised of massive chloritic or biotitic mudstone. In outcrop these are pink or orange in colour.
Three to 20 centimetre thick graded siltstone beds are inter-bedded with both mudstone and banded iron formation.

Drilling in the Golden Dyke area has allowed a detailed subdivision of the Middle Member (Table 1). Although the outcrop in the mapped area is not excellent, it appears similar subunits also occur in EL 1636.

Structural Geology:
The sediments in the area define three major anticlines and several minor flexures, which plunge to the north west at 30 to 70 degrees. An almost vertical slatey cleavage defines the axial planes of these folds and is best developed in axial areas. Variations in cleavage and fold axis orientations suggest a second phase of deformation has broadly folded the earlier major folds and slatey cleavage.

Economic Geology:
The various mineralization types found in the area are described by Stephens (1976) and Goulevitch (1978). At present it is considered by Geopeko that stratiform base metal and gold mineralization offers the most economic potential in this area. The current exploration programme is therefore designed accordingly.

Three subtypes of deposit have been recognised in neighbouring areas:

1. Massive sulphide-type.
   These deposits are hosted by carbonaceous mudstone beds and are found throughout the Wildman Siltstone and South Alligator Group. They are dominantly comprised of pyrite or pyrrhotite with lesser amounts of arsenopyrite, sphalerite, galena, chalcocpyrite and various sulphosalts. They may contain anomalous to economic concentrations of Au, Ag, Cu, Pb, Zn, Bi, Sb, Co and Sn.

2. Tourmalinite type.
   Carbonaceous mudstone beds or lenses throughout the Wildman Siltstone and South Alligator Group may also host these deposits. Their known mineralogy consists of tourmaline,
**TABLE 1**

**SUBUNITS OF THE KOOLPIN FORMATION - MIDDLE MEMBER**

<table>
<thead>
<tr>
<th>NAME OF SUBUNIT</th>
<th>APPROXIMATE THICKNESS</th>
<th>DISTINGUISHING FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_5$ Iron Formation</td>
<td>15m</td>
<td>Certain intervals may contain abundant golf ball sized sugary quartz pods</td>
</tr>
<tr>
<td>$M_4$ Mudstone</td>
<td>3m</td>
<td>Usually contains sugary quartz pods 1 to 3 metres thick</td>
</tr>
<tr>
<td>$I_4$ Iron Formation</td>
<td>6m</td>
<td></td>
</tr>
<tr>
<td>$M_3$ Mudstone</td>
<td>15m</td>
<td></td>
</tr>
<tr>
<td>$I_3$ Iron Formation</td>
<td>6m</td>
<td></td>
</tr>
<tr>
<td>$M_2$ Mudstone</td>
<td>19m</td>
<td></td>
</tr>
<tr>
<td>$I_2$ Iron Formation</td>
<td>5m</td>
<td></td>
</tr>
<tr>
<td>$M_1$ Mudstone</td>
<td>9m</td>
<td></td>
</tr>
<tr>
<td>Black Rock Breccia</td>
<td>4m</td>
<td>Comprised of angular clasts 1 to 50cm across</td>
</tr>
<tr>
<td>$I_1$ Iron Formation</td>
<td>8m</td>
<td>Interbedded with abundant mudstone and graded siltstone</td>
</tr>
</tbody>
</table>
pyrite, arsenopyrite, chalcopyrite, galena and sphalerite. They contain anomalous to economic concentrations of Au, Ag, Cu, Pb, Zn, Bi, Sn and W.

3. BIF type.
This type is apparently restricted to sulphide-containing banded iron formation beds within the Middle Member of the Koolpin Formation. The mineralization can be anomalous in Au, As, Cu, Pb, Zn and W.

GEOCHEMISTRY

The area covered by EL 1636 has a moderate topography with a well developed stream network. The extensive occurrence, especially around the Golden Dyke Dome, of old alluvial gold workings prompted the conducting of an orientation study on stream sediments within the Golden Dyke Dome. The results of this survey showed that excellent definition of areas underlain by BIF can be achieved, and furthermore, that mineralized BIF and massive sulphide is also discernable. EL 1636 was therefore sampled in July and August, 1981 and 34 samples were collected at a density of approximately 10 samples per square kilometre (Plate 2).

Sampling was biased towards the sand-silt fraction by screening in the field at 4mm. Samples were sieved at the field camps at 630 microns (30 mesh). Following a heavy mineral separation using Tetra-bromoethane, the +30 heavy mineral concentrate was analysed for Au, Bi and Sb. The -30 fraction was analysed for Cu, Pb, Zn, As, Fe, Mn and Sn. Selected samples may be analysed for W at a later date.

For the period covered by this report assay results were not available.
CONCLUSIONS

1. The stratigraphy of the South Alligator Group in general, and the Koolpin Formation in detail is similar to that found in the Golden Dyke/Mount Bonnie area.

2. A detailed follow-up programme cannot be formulated before the analytical results are evaluated.

RECOMMENDATIONS

Any interesting zones located should be further explored with programmes of detailed geological mapping, chip sampling, stream sediment sampling and soil sampling. Ground magnetic and EM geophysics could be used if relevant.

Depending on the results of this work, testing should continue with costeasing and drilling.

EXPENDITURE

The minimum expenditure covenant for the 4th year of tenure was $5,000. Actual expenditure totalled $17,481. Expenditure since 20th September, 1977 now totals $28,408.
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