## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>SUMMARY</td>
<td>2</td>
</tr>
<tr>
<td>CONCLUSIONS</td>
<td>5</td>
</tr>
<tr>
<td>RECOMMENDATIONS</td>
<td>7</td>
</tr>
<tr>
<td>TENURE</td>
<td>8</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>9</td>
</tr>
<tr>
<td>Ore Genesis and Lithogenesis</td>
<td>9</td>
</tr>
<tr>
<td>Previous Investigations</td>
<td>15</td>
</tr>
<tr>
<td>Future Work</td>
<td>16</td>
</tr>
<tr>
<td>APPENDIX &quot;A&quot;</td>
<td></td>
</tr>
<tr>
<td>APPENDIX &quot;B&quot;</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1 Sketch showing possible reason for absence of S.P. anomalies in association with magnetic anomalies

Plate 1 Sketch plan of geology and leasing, Eva Valley

Plate 2 Geological Plan, Eva Valley No. 1 & No. 2.
A 20 square mile A.P. was taken up at Eva Vale in 1960, embracing some small copper shows that lie in the close clycites were derived from sediment. Work so far carried out in the area is as follows.

a. A 1:50,000 scale reconnaissance mapping has been carried out over the whole area, and a report prepared by John Love.

b. A small area around Nos. 1 and 2 Prospects has been mapped at a scale of 100 feet to the inch. Though not complete, the results of this work are appended (Appendix B).

c. Self Potential and Magnetometer surveys have been carried out over selected areas. The results are embodied in a report by Bob Richardson.

d. Over 100 samples have been taken for trace element determination. The results of this programme are appended (Appendix).

e. One drill hole has been completed, the log of which has been calculated.

It is pertinent at this stage, before the 1967 field season begins, to examine the results so far achieved, to assess that we have learnt, and to plan carefully any extension of our investigations in the area.

The project is at a critical stage. Prospects of finding ore have not been substantially enhanced, though there remain some interesting possibilities, but we may be on the verge of making some important conclusions concerning the particular rock types and mineral deposits present. As this association is repeated elsewhere in the Top End, the importance of obtaining more general conclusions must be taken into account.

The purpose of this report is to collate, and present in a coherent form, the results of the various investigations. A sketch map of the area of principal interest is given in Plate 1. For a geological map of the whole A.P. reference should be made to the report by John Love.
The area lies roughly 30 miles NW of Katherine (about 64 by road), and immediately north of Eva Valley Homestead. A number of small copper shows are present, which are reported to have yielded a few tons of secondary copper ore carrying gold. I have been unable to obtain any production statistics from the Mines Branch. The three principal workings have been numbered as "Eva Valley 1", "Eva Valley 2", and "Eva Valley 3" (Plate 1). New prospects will be numbered consecutively as they are investigated. Hence the magnetic anomaly south of "1" becomes "Eva Valley No. 4".

Geology

The country rock consists principally of fine-grained detrital rocks, with some greywackes, of which at least some are turbidites. Bodies of massive crystalline diorite lie in the sediments. Immediately west of the largest of these lies a belt of disturbed and retextured sedimentary rocks with which are associated fine-grained, grey, fresh looking crystalline rocks for which the field name 'volcanics' is entirely apt. A thin band of banded iron formation lies between the volcanics and the diorite. The beds dip at moderate angles to the west in this area, but elsewhere a variety of dips is present, and because of poor outcrop, the regional structure is not clear.

Mineralisation consists of cupferiferous quartz veins associated with diorite; and cupferiferous ironstone bodies associated with the banded iron formation. Mineralisation in the b.f.f. coincides with moderate to strong disturbance in the host rock.

Neither field mapping nor petrological studies have sufficiently resolved the question of whether the diorites or the volcanics are derived from sediment, although John Love, who carried out this part of the investigation, leans to a sediment origin for all.

Geochemistry

Of some 105 samples taken, 36 were of diorite and 22 of undisturbed shale, siltstone, and greywackes, which is considered sufficient to yield reasonably reliable statistical results.
The material and give assays of 0.15% Cu, 1.3% Pb, 6.8% Zn, and 2.1 oz Ag between 338 and 339 feet. The altitude of this vein, as shown by the angle of its intersection with the core, is such that it cannot be projected anywhere near the target S.P. anomaly.
Diorite samples were significantly richer in vanadium, molybdenum, and nickel, and marginally richer in copper, lead, and cobalt. Only bismuth was higher (fractionally) in the sedimentary rocks. Contrast in the content of V, Mo, and Ni, was such as to constitute definite distribution patterns which are here denoted as the 'diorite pattern' and the 'sedimentary pattern' (See table A2).

The volcanic rocks sampled had a diorite pattern whereas the disturbed sediments had a sediment pattern. Even b.i.f. with high base metal values, reported low in vanadium content. Disturbed b.i.f. has enriched metal values, and disturbed sediments have higher metal content than undisturbed sediment. Quartz, ironstone and chlorite veins showed little enrichment where associated with diorite, but a slight enrichment where associated with sediment.

However it must be emphasized that in most cases not enough samples have been taken to draw any valid conclusions.

Geophysics

Two magnetic anomalies, and two rather complex S.P. anomalies, were located. The S.P. anomalies lie in a 200-foot thickness of sediments between b.i.f. and diorite. They are irregular and required considerable smoothing of the profiles. So far they have not been related conclusively to any known surface feature.

The magnetic anomalies are located on the down dip side of b.i.f. outcrop where the b.i.f. is disturbed; and in one case rich in copper. S.P. and magnetic features do not coincide, and the primary, undisturbed b.i.f. does not appear to be magnetic.

DDH EV 1 was drilled to test a Self Potential anomaly but passed well below it and failed to reveal any sulphide mineralisation, either in lode form, disseminated in the sediment or at the diorite-sediment contact, that could be related to the S.P. anomaly. A one-foot thick sulphido-rich quartz vein was
CONCLUSIONS

1. In the absence of clear-cut geological evidence, the pattern of trace metal distribution indicates a probable igneous origin for the diorite. Similarly the volcanic rocks are thought to be igneous.

2. The diorite cannot be looked to as a source of large-scale mineralisation, though it may have contributed small amounts of metal to associated quartz veins.

3. The volcanics proper also cannot be considered as a source of ore on the retextured sediment hypothesis. However, associated sediments may have been enriched in metal during concomitant volcanicity.

4. Some metal at least has been generated by the sediments during diagenesis and concentrated in veins and preconsolidation disturbances. The b.i.f. has been particularly favoured.

5. The two types of mineral assemblage; quartz-iron-copper-diorite and iron-copper-quartz-b.i.f. probably have different origins. The latter offers better prospects for finding large quantities of ore though the former might yield richer ore bodies.

6. On present evidence there does not seem to be a source rock present of large enough volume to have given rise to large size ore bodies of high grade. However, our knowledge of the volcanics disturbed sediment belt is too slight to draw any valid conclusions in this respect, so that some ore potential still remains.

7. Ore may still be sought in the disturbances in the b.i.f., in quartz veins associated with diorite, and elsewhere in the volcanics-disturbed sediment belt.

8. The most likely cause of the S.P. anomalies is small sulphide-bearing quartz veins similar to those exposed at the surface. However, some doubt still remains, and one more S.P. anomaly should be drilled, vertically, in a final attempt to solve this
9. E.R. anomalies in virgin country should always be tested initially by vertical drill holes aimed at the anomaly centre.

10. The magnetic anomalies almost certainly derive from concentrations of magnetite emplaced on disturbances in the b.i.f. The origin of the magnetite is unclear, but it probably derives from remobilisation of the iron in the b.i.f. Copper mineralisation can be expected in conjunction with the magnetite, of whatever origin.

11. Trace metal contrast sampling, if properly controlled, can provide valuable information on petrogenesis.

12. The Eva Valley area is worth more investigation on both ore search and research grounds. In ore search because potential, though not high, remains. In research because a careful study of this area can give information on similar areas in the Top End that are currently unavailable but that, on our present knowledge, may have an equivalent potential.
RECOMMENDATIONS

1. Stadia mapping and magnetic coverage should be extended southwards to close the anomaly at No. 4 Prospect and to complete geological coverage of the outcrop.

2. Subject to completion of the above, a drill hole should be placed to the best advantage to test the anomaly.

3. A short vertical hole should be drilled at 1590 S, 125 W. This hole should locate the source of the S.P. anomaly at this position, whether it strikes parallel to the bedding, or, as seems possible, in an easterly direction. If this hole fails to locate sulphides, the S.P. anomalies can be discarded as deriving from bodies too small to be of interest.

4. Detailed photoscale mapping of the bi.f. - volcanics - disturbed sediment belt as shown in Plate 1 should be carried out. Stadia mapping of selected small areas could follow if required.

5. Subject to the results of the drilling at No. 4, No. 5 Prospect should be mapped.

6. Air core drilling should be continued to provide a base for a statistical evaluation of the results.

7. A fourth mineral lease should be pegged as indicated on Plate 1.

8. A previously run Self Potential survey should be repeated immediately after the wet season.