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RECORD No. 1962/154

GRANITES GEOPHYSICAL SURVEY, NT 1939

by

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SUMMARY

This Record contains a summary of the results of geophysical surveys at the Granites goldfield, NT made by AGGSNA in 1939. Portion of the field was surveyed using the potential-ratio method; the whole of the field as known was surveyed using the magnetic method.

The potential-ratio method gave anomalies, some of which may be associated with the zones of narrow, rich, quartz leaders from which most of the gold production has come. The magnetic survey indicated a series of strong anomalies, defining a magnetic bed closely associated with the known mineralisation. It is recommended that the magnetic zone be tested by drilling, and that a selection of the potential-ratio anomalies be tested by trenching.

1. INTRODUCTION

During 1939 the Aerial, Geological, and Geophysical Survey of North Australia (AGGSNA) made geophysical surveys, using magnetic and electric methods, at the Granites goldfield, NT. Thyer, Rayner, and Nye prepared a report on the results of the surveys but it was not published, owing to the incidence of the Second World War. The information contained in that report is of considerable interest, particularly as the Bureau of Mineral Resources has made an aeromagnetic survey over the area during 1962. However, the results were discussed largely in terms of the geological examination of the deposits by Hossfeld. Later investigation has shown that several aspects of Hossfeld's interpretation can no longer be sustained, so that publication of the draft report in its original form is not warranted. As the geological information available is still quite inadequate to allow of definite conclusions as to structure, this Record is confined to a summary of the results, together with some comments on their possible significance for exploration in the light of present knowledge.

2. GEOLOGY

The Granites goldfield is about 300 miles north-west of Alice Springs. The country is arid and almost completely covered with sand. Outcrop is confined to a few low hills, on which the workings are situated. Because of this, and of the deep weathering of the outcrop, geological mapping is extremely difficult.

The first attempt at a comprehensive geological examination of the deposits was made by Hossfeld (1938, 1940). On the basis of the very small amount of evidence available to him, Hossfeld suggested the presence of a simply-folded structure of large dimensions. Since then, Anglo Queensland Mining Ltd, a subsidiary company of Mount Isa Mines Ltd, examined the area by trenching and diamond drilling. A brief account of the area, taking account of the information thus obtained, has been published by Hall (1953). Since then geological observations have been made by Crohn (1961). The following account of the geology is based on the reports of Hall and Crohn.

Plate 1 is a locality plan of the field. No attempt has been made to show geological features, except for the boundary of the granite (adamellite). The rocks are steeply dipping sediments, which have been folded, metamorphosed, intruded by granitic rocks, and invaded by ore-bearing solutions. Hall and Crohn agree that the structure deduced by Hossfeld is not supported by more recent evidence. Crohn's observations suggest that the structure at the eastern end of the field is likely to be extremely complex. In the central portion, covering the Bullakitchie, Longbottoms, and Golden Shoe workings, a main mineralised zone has been traced intermittently for more than a mile. It appears to be generally conformable to the trend of the sediments, and dips steeply to the north. In the Ivy/Quorn and Twin Hills sections, little mining has been done, and exposures are inadequate to support any definite conclusions.

The main producing sections of the field have been the central section and the Bunkers Hill/Chapmans Hill section. Two types of gold occurrence are present:

(a) narrow rich quartz leaders. These dip steeply, and cross the bedding at angles varying from 0 to 60 degrees. Production in the Bunkers Hill Chapmans Hill area has come from such leaders, and one very rich zone was mined in the Bullakitchie workings. The leaders do not persist in depth.

(b) the mineralised zone in the central section. It appears to consist of sheared and altered schist, with quartz and calcite veinlets, and disseminated sulphides. Exploration by Anglo Queensland Mining Ltd has shown that this zone carries low to moderate gold content over considerable widths, and persists to depths of 400 ft at least. However, reserves indicated were considered insufficient to warrant the large capital investment necessary to establish a mining operation in such difficult country.

3. GEOPHYSICAL METHODS USED

In order to assess the applicability of various geophysical methods, tests using the self-potential, electromagnetic, magnetic, and potential-ratio methods were made along several traverses over the Bullakitchie and Longbottoms workings. The self-potential tests showed no anomalies, and the use of the method was discontinued. The electromagnetic method indicated a number of anomalies caused by good conductors. However, it was found that these anomalies were located more definitely by the potential-ratio method.

The potential-ratio method had the advantage that it also located anomalies caused by zones of high resistivity and it was used for routine surveys over a part of the area. The magnetic method gave strong anomalies, and was used over the whole area.

The layout of traverses is shown on Plate 1.

4. RESULTS AND INTERPRETATION

Potential-ratio results

The potential-ratio results are shown on Plate 1 by the axes of indications caused by good and poor conductors respectively. Test traverses over the Bullakitchie workings showed that the worked area is associated with a zone of alternating good and poor conductors, and similar zones occur in many places. They trend generally parallel to the mineralised zone and lie mainly (but not entirely) north of it.

The potential-ratio method is particularly sensitive to conditions close to the surface, and indications such as these could be due to a variety of causes. However, it is possible that some of the zones of alternating good and poor conductors correspond to zones of small quartz leaders, which may be rich in gold. This possibility is supported by the fact that anomalies of this type occur at the Bullakitchie workings, in which such a zone of leaders was mined. It is not known whether any trenching since the date of the survey has been suitably located to check any of the anomaly zones.

Magnetic results

The magnetic results are shown on Plate 1 as contours of vertical magnetic intensity with reference to an arbitrary datum. The profiles have been smoothed to remove erratic anomalies caused by magnetic material very close to the surface. The main feature of the results is a zone of strong and regular magnetic anomalies; this zone is closely associated with the mineralised areas over the whole field. There is no information at present on the nature of the rocks causing these anomalies.

Samples of outcropping rocks were tested, and found generally non-magnetic, with the exception of some pieces of ironstone rubble. A sample of this material was examined mineragraphically by Dr Stillwell of CSIRO to discover whether it might be the weathered equivalent of some rocks that at depth might be the cause of the anomalies. However, the results were inconclusive. Dr Stillwell's report is attached as an appendix.

It is sometimes possible to infer the cause of anomalies by analogy with other better-known areas in which similar anomalies are obtained. However, in the southern portion of the Northern Territory, magnetic anomalies that are superficially similar have been observed at the Jervois Range, the Davenport Range, and Tennant Creek. These three areas are geologically quite dissimilar and none has any obvious geological resemblance to the Granites. Therefore, speculations of this nature are pointless in the present case. All that can be said is that a strongly-magnetic bed is present, which from its persistence in length and its close association with the known mineralisation, must be an important feature in the geological setting of the field.

5. CONCLUSIONS AND RECOMMENDATIONS

As regards further exploration, the two types of gold occurrence may be considered separately.

The quartz leaders are unlikely to make any substantial contribution to ore reserves, but are attractive to the small parties interested in the field at present. The potential-ratio anomalies may be valuable in detecting zones of such leaders, and their significance should be tested. Crohn (1961) notes that the Bunkers Hill/Chapmans Hill section appears most favourable for the occurrence of the leaders. This section was not covered by the potential-ratio survey. However, testing of a representative selection of the anomalies in the central section should give an idea of the value of the results.

With regard to the possibility of discovering large tonnages of ore, the magnetic results appear to be the most significant. There is a strong case for testing the magnetic anomalies by drilling, based on the following considerations:

(a) the magnetic bed is an important factor in the geological setting of the field, and it is desirable that its nature be known.

(b) although there is no reason to expect that the magnetic bodies carry gold contents of importance, their close association with the known mineralisation shows that this is not impossible. If the magnetic bodies contain gold, the prospects of developing large tonnages of ore will be greatly increased.

(c) information on the nature of the magnetic bodies will be an important factor in the assessment of the results of the aeromagnetic survey that was recently completed.

Four drill-hole sites have been selected for testing the nature of the magnetic bodies:

	Collar site		Layout
No. 1	210W	130S	Ivy/Quorn
No. 2	6830E	1195S	Bullakitchie
No. 3	540[illegible]	190N	Bullakitchie
No. 4	6050W	70S	Ivy/Quorn

All holes should be vertical and continued to 600 ft. If it is considered desirable to shift the collar positions to allow for dip of the formations, the above sites should be considered as targets, to be intersected at a depth of 500 ft.

From the economic aspect, Sites 1 and 3 appear the most favourable, as they are most closely associated with known mineralisation. However, Sites 2 and 4 are on the strongest anomalies, and thus have the best prospects of providing definite information on the nature of the magnetic bodies. In present circumstances, it is considered that this aspect should have priority.

It is recommended that:

(a) the possible significance of the potential-ratio anomalies be brought to the notice of the parties interested in the field, and a representative selection of the anomalies in the central section be tested by trenching, under close geological supervision,

(b) if the tests under (a) show that the potential-ratio results are of value in prospecting for zones containing quartz leaders, consideration be given to extending potential-ratio surveys to other portions of the field,

(c) diamond-drill holes 2 and 4 be drilled to investigate the formations causing the magnetic anomalies.

6. REFERENCES

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APPENDIX

MINERAGRAPHIC INVESTIGATION OF C.S. & I.R. REPORT NO. 204

SURFACE IRONSTONE FROM THE GRANITES, CENTRAL AUSTRALIA

A specimen of surface ironstone from the Granites, Central Australia, has been submitted for examination by the Aerial, Geological, and Geophysical Survey of Northern Australia.

The ironstone is magnetic and is important in the interpretation of the results of a magnetic survey.

The examination of polished surfaces of the ironstone shows that it consists of limonite studded with numerous particles of magnetite partly altered to haematite. Most of the particles are less than 0.04mm in length. In many cases they are obviously unoxidised residuals in limonite, but sometimes they are characterised by crystal or cleavage boundaries, and not by corroded margins. The development of haematite in these particles of magnetite is clearly visible in polarised light, because haematite is anisotropic and magnetite is isotropic. In many cases the narrow bands of haematite conform to the octahedral partings of the magnetite and sometimes a thin band of haematite occurs on the margins of the magnetite. The sharp outlines of some of the particles can probably be attributed to the development of haematite along the octahedral cleavages, giving a semblance of crystal outline. It is likely that the ironstone has been derived from primary magnetite, but the nature of the magnetite rock is obscure. The specimen is somewhat cavernous as a result of leaching and traces of kaolinitic material and quartz in the cavities suggest an association of the magnetite with silicates.

Signed Frank Stillwell.

13/2/1941.

THE GRANITES GOLDFIELD N.T.