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Review of Geophysical Surveys in  
the Wallaroo-Moonta District S.A.

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REVIEW OF GEOPHYSICAL SURVEYS IN THE  
WALLAROO-MOONTA DISTRICT, SOUTH AUSTRALIA,  
DURING 1942.

REPORT 1942/26

1. INTRODUCTION.

The Wallaroo-Moonta copper field offers a challenge to modern geological and geophysical ore-finding methods. After the production of some 338,066 tons of copper valued at over 20 million pounds, large scale mining ceased in 1923. In spite of the present urgent need for copper, investigators have agreed that no good purpose can be served by re-opening the old mines and that any further substantial production from the field depends upon the discovery of new ore-bodies.

Since the ore-bearing rocks are almost completely covered by superficial deposits, it is not unreasonable to suppose that there are still undiscovered ore-bodies in the field. Nevertheless some 30,000 feet of diamond drilling have been carried out in the past and the results, generally speaking, have been very poor. This is not surprising, perhaps, when the local nature of the ore occurrences and the vast extent of barren country rock is contemplated. It appears therefore that there is a clear task for geological and geophysical methods to select sites where diamond drilling will have the maximum chance of intersecting ore.

The masking of the surface geology immediately suggests the application of geophysical methods and in 1929 some work was carried out at Moonta by the Imperial Geophysical Experimental Survey. After a limited amount of work this Survey was forced to the conclusion that the field presented great difficulties to electrical prospecting, owing principally to the screening effect of the saline overburden. Since 1929, however, geophysical technique has progressed considerably, and more is known concerning the physical conditions on the field. In view of the possible prize at stake it was therefore decided early this year to re-open and carry out further geophysical surveys. The work was carried out in close co-operation with the South Australian Mines Department, which had previously made extensive investigations of the structural geology, and had recommended the use of geophysical methods.

2. GEOLOGICAL BACKGROUND.

Numerous geological and mining reports have been prepared concerning the Wallaroo-Moonta field, those by Dr. R.L. Jack, Dr. L.K. Ward and Mr. S.B. Dickinson, being of particular interest for the geophysical work. In the recent report of the last named, "The Structural Control of Ore Deposition in Some South Australian Copper Fields", a close analysis was made of mine records in order to elucidate the structural control of the ore deposits in order that it may be used as a tool in the prediction of possible ore repetitions.

As a result of Mr. Dickinson's investigations, some immediate diamond drilling was recommended, and several areas were selected as offering scope for geophysical work. These areas, amounting to about 2800 acres, are shown on Plan (1) accompanying this report. In some areas it was anticipated that the geophysical work would throw light on suggestions arising out of the geological examination. In other areas the geophysical work was designed to explore ground where there is comparatively little geological information.

It was arranged that any indications of ore or structural features favourable to ore deposition, arising out of the geophysical surveys, would be tested with the diamond drill by the South Australian Mines Department. A particularly favourable feature of this geophysical campaign is that the close co-operation with the South Australian Mines Department facilitates discussion of results from time to time with the geologists who have studied the field.

### 3. THE GEOPHYSICAL SURVEY.

Owing to the anticipated technical difficulties referred to above it was considered advisable to make a particularly cautious approach in the application of geophysical methods to this field. Consequently before undertaking the main campaign, preliminary surveys were made during March on several small areas to determine which methods, if any, were likely to yield satisfactory results. Use has been made of the following methods: - magnetometric, resistivity, self-potential, potential ratio, electromagnetic. As anticipated, the effect of the saline, and thus highly conductive, overburden made difficult the interpretation of the results given by most methods. It was demonstrated, however, that significant results could be obtained by the use of the electromagnetic method. On test areas there was a satisfactory correlation between the known geology and the indications given by this method.

It appears that the electromagnetic method offers a ready means of locating and tracing lode fissures under cover. It might be pointed out that when a geophysical survey indicates structural features rather than ore-bodies directly, as on this field, it is necessary to study such features with particular care in the light of available geological evidence, before deciding whether the features are sufficiently indicative of ore to warrant drilling.

After consideration of the above factors the routine surveying of the field was considered warranted. The survey was commenced towards the end of May and is still in progress. The areas so far examined in detail are shown on Plan (1). The survey of some of the most promising areas is nearing completion and it was considered advisable to review the work at this stage in order to determine further programme.

The field party consists of two technical officers, Mr. R.F. Thyer, and Mr. O.A. Zelman, the former being Officer-in-Charge. Several unskilled men, recruited as required in the district, are used in the field work.

The results obtained to date on the various areas are dealt with below, the brief reviews being based on Mr. Thyer's field reports. Although some of the principal results are already discernible it should be emphasised that final interpretations have not yet been made. Some results are so evident that it is possible to make a drilling recommendation on the preliminary field interpretation. In general, however, it will be necessary for some time to be spent in the office finalising the reduction and plotting of the data, and giving close consideration to the interpretation of the results with one or more consultations with the geologists of the South Australian Mines Department, before all final conclusions can be reached.

#### 4. MOUNTA LAYOUT NO.1. (Beddomes).

This area is shown on Plan (1) and includes Area No.1, recommended by the South Australian Mines Department.

The electromagnetic survey gave a relatively strong indication over the known section of Beddomes lode, but apart from this the profiles obtained over the greater part of the area are remarkably featureless. The geophysical results give no reason, therefore, for supposing that there are any lode fissures of major importance within the area.

Reference should be made, however, to two relatively strong indications which just appear on the south-east corner of the layout. Their position is approximately shown on Plan (1). As these two indications fall roughly on the strike extension of Beddomes lode, it is proposed to trace them further in a southerly direction and endeavour to determine whether they have any significance.

## 5. WESTERN EXTENSION OF KURILLA LODES.

This area is shown on Plan (1) and was selected to cover the possible westerly extensions of Morphett's and Hall's lodes.

On Plan (2), accompanying this report, some of the features of the Kurilla area are shown in greater detail. The main layout of geophysical traverses, referred to in the field as Layout (4), extends westerly from the westerly end of Morphett's ore-body. A subsidiary layout of traverses, referred to as Layout (A), extends easterly from the westerly end of Morphett's ore-body.

Three sites for diamond drilling had been selected on the possible western extension of the Kurilla lodes by Mr. Dickinson, as a result of his structural studies. Drilling is at present taking place at the first of these sites and the hole has reached a depth of 270 feet, the proposed depth of the hole being 500 feet. This area was selected for geophysical examination in order to obtain a plan of the lode fissures so that the above site might be reviewed before drilling actually commenced.

Reference to Plan (2) will show that where the geophysical survey covered Hall's and Morphett's lodes, electromagnetic indications were found corresponding in position to the known lodes.

The results of the survey suggest that Hall's lode fissure extends westerly as a weak feature to traverse 1,000W where it dies out. The fissure may re-appear between traverses 1400W and 2000W since there is a weak electromagnetic indication just south of the base line in this vicinity. Morphett's lode fissure appears to die out before layout (4) is reached. Nevertheless the electromagnetic results suggest that near traverse 400E on layout (A) Morphett's lode may have a northerly branch, which extends from traverse 400E, on layout (A) to traverse 1200W on layout (4).

By far the most important feature in the results, however, is the strong electromagnetic indication which was obtained on layout (A) between traverse 500E and 1500E. This indication was first detected on layout (4) and later was examined more closely by the work on layout (A). Reference to Plan (2) will show that the indication lies about 200 feet northerly from Morphett's lode and trends approximately parallel to it in strike. Satisfactory features of this indication are its intensity and good definition. From what has been said above, it will be realised, however, that at best it indicates the presence of a new fissure. A favourable interpretation is placed on the indication for various geological reasons. For instance Mr. Dickinson suggested following the steep pitch of the axes of vein flexures concave to the south as one of his ore-finding principles on the Wallaroo field, and it will be noted from Plan (2) that the indication has this favourable trend. Consequently it is recommended that this indication be tested by diamond drilling at an early date.

It might be mentioned that the above indication lies entirely within a mining lease held by an Adelaide syndicate.

## 6. DEVON AREA.

An area to the west of the Devon lode, its position being shown on Plan (1), was covered by geophysical survey. This is part of the large area No. 5 recommended by the South Australian Mines Department.

Sites for drilling had also been selected on this area by Mr. Dickinson and it was hoped that the geophysical survey would map the lode fissures, if any, and so permit modification of the drilling sites if necessary.

As the result of the electromagnetic survey a weak indication was found over the known Devon lode. This indication dies out, however, only some 300 feet westerly from the known lode workings.

The routine examination of the area with the electromagnetic method yielded a number of weak indications of limited length. These do not appear to have much significance on a preliminary examination, but more detailed analysis will be applied to them at an early date.

#### 7. MOONTA AREA NO. 2.

This area is part of Area No. 2 recommended by the South Australian Mines Department and lies to the south-east of Elder's lode. Its position is shown on Plan (1).

Work is still in progress on this area but already some indications have been found with the electromagnetic method which may denote the discovery of some new shears to the south-east of Elder's lode. One set of indications has the strike of Elder's main lode, while another indication has the strike of the Elder's west lode. Further work is necessary however before these results can be confirmed.

#### 8. CONCLUSIONS.

The geophysical surveys on the Wallaroo-Moonta copper field have been reviewed at this stage since the examination of all the areas suggested by the South Australian Mines Department would tie up much of the geophysical staff and equipment for a lengthy period, which can only be justified if it appears that satisfactory results are being obtained. Geophysical surveys are urgently required on various fields in Australia and some of them cannot be commenced until staff and equipment are released from the Wallaroo-Moonta surveys. Up to date the field party has spent about 4½ months on the Wallaroo-Moonta field and an area of about 460 acres has been covered in close detail. The examination by the party of all the areas suggested by the South Australian Mines Department would require about a further 18 months or so.

An examination of the geophysical work to date shows that promising results have been obtained in some parts of the field. The value of such results can now only be tested by diamond drilling and it is urged that the indication of a possible new shear to the north of Morphett's ore-body, referred to in section 5 above, be tested at an early date.

This indication on the Kurilla area is certainly the most promising result to date. Other indications have been obtained, however, as described above, but these will require further analysis and consideration in consultation with the geologists of the South Australian Mines Department before any drilling recommendations can be made.

It appears that in about a month's time the most promising areas on the field will have been examined by geophysical methods. It will be advisable at that stage to take the party from the field at least temporarily in order that all reduction and plotting may be brought up to date. The resumption of the surveys at a later date will depend partly upon the results of the close examination that will then be made of the data. Resumption of the field work, however, will depend largely upon the success or otherwise obtained by drilling recommended on the Kurilla area.