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THE INVESTIGATION OF TWO TYPES OF  
GEOMAGNETIC ANOMALIES ON LYRE PENINSULA

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AEROMAGNETIC ANOMALIES ON EYRE PENINSULA <sup>1</sup>

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Approximately 40% of Eyre Peninsula is covered by 1-mile geological plans with a further 40% by 4-mile and detailed reconnaissance maps. Eyre Peninsula is completely covered by 1-mile aero-magnetic plans flown at 1 mile spacing, originally at 1500 feet elevation but more recently at 500 feet elevation. Ten areas of interest have been covered by aero-magnetic surveys at 300 feet elevation and  $\frac{1}{2}$  - mile or  $\frac{1}{4}$  - mile spacing. Approximately 60% of the total and all the detailed and more recent work has been reduced by the Exploration Geophysical Section of the Department which has also carried out the ground investigations.

Physiographically the peninsula may be divided into the Eastern Coast Plains, the Eastern Highlands, the Gawler Range Highlands and the Western Plain and Basin Area. The Eastern Plain borders Spencer's Gulf and is underlain at shallow depth by Pre-Cambrian sediments responsible for a number of aeromagnetic anomalies. Of the Eastern Highlands the Lincoln Uplands, the Kimba-leave Uplands and the Middleback Ranges are Archaean and contain numerous metallic mineral occurrences as well as iron formations responsible for large anomalies of the

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elongate asymmetric type. The Gawler Ranges have no record of mineral deposits. The Western Plain and Basin area is characterised by small widely spaced outcrops of an Archaean (?) basement complex separated by shallow Tertiary Basins and covered by Pleistocene to Recent sands. Large and intense though isolated aeromagnetic anomalies suggest that the Pre-Ambrian basement is by no means uniform or that there are anomalous rocks between the basement and the sandy cover.

The oldest rocks outcropping in the Peninsula are Archaean sediments (Flinders Gneisses of Johns, Gneiss Complex of Miles). Rock types range from undigested sediments (chiefly mono-mineralic rocks such as quartzites and dolomites) through metasediments (such as schists, amphibolites and migmatites) to foliated and banded quartzose - feldspathic gneisses with massive granitic types forming the centres of areas of more intense metamorphism. Conformably overlying these are schists, quartzites and jaspilites (Hutchison Schists of Johns, Middleback Group of Miles) which in general are somewhat similar to the Gneiss Group but have been subjected to less intense metamorphism. The metamorphic front transgresses the bedding e.g. at Lowell and Farramboe where iron formations have been metamorphosed. Basic dykes occur in the Middleback Ranges.

From 1950 to early 1958 the Department carried out an exploration programme in search for additional iron ore bodies in the Middleback Ranges. All the known iron formations in the Lincoln and Kimberley Uplands were also mapped. From 1958 to 1960 Departmental drilling was confined to geophysical targets in the Eastern Coastal Plains and in the Kimberley Uplands. These elongate asymmetric anomalies were found to result from metamorphosed iron formations.

For initial assessment of the Western Plain and Basin Area cross sectional profiles preferably along flight lines, were prepared for all the anomalies. These profiles together with

shape as defined by the contour "half way up" gave two types of anomalies, viz:-

- i equidimensional anomalies with symmetrical profiles thought to be characteristic of basic igneous intrusions.
- ii elongate anomalies with asymmetrical and / or serrated profiles thought to represent iron formations.

Three equidimensional anomalies were investigated in Western Yre Peninsula. Ground magnetic and gravity surveys of the Inkster anomaly (hundred barina) suggested a basic igneous rock with an S.G. of 0.3 gm./cc greater than its surround and containing magnetite, probably not of economic grade.

A small drilling programme was carried out by the Department using a light rotary plant producing sludge with diamond drill cores at intervals and always at the bottom of each hole. The sludge was washed <sup>and</sup> then logged by stereomicroscope and the cores were logged in the usual way. Drilling intersected gabbro (SG 3.18) surrounded by granite (SG 2.59) and under 150-200 feet of cover. Petrological examination of thin sections by the Australian Mineral Development Laboratories recognised the presence of 11.7% of magnetite and a total of 15.5% of heavy minerals (by weight) which confirmed the geophysical predictions.

Similar investigations of equidimensional symmetric anomalies in Hundreds Handada and Ripon also intersected gabbro carrying dense and magnetic minerals. Cover varied from 140 ft. to 425 feet +. Spectrographic analyses of core from all three anomalies were made to determine if any other potentially economic mineralisation was likely to exist. The geophysical and geochemical results will be described in greater detail.

Warrawee in Central Yre Peninsula was next

investigated. Previously this anomaly had been by-passed because its size (1) miles x 3 miles) would necessitate a big programme. Also it had an East-West strike at variance to the known grain of iron formations in the eastern half of the peninsula. A low level aeromagnetic survey ( $\frac{1}{4}$  mile spacing x 300 feet elevation) covering 260 square miles was first carried out.

Reduction of the low level survey showed that the simple asymmetric profile of the high level 1-mile survey was resolved into a serrated profile suggesting three southerly dipping sub-parallel horizons. This was more suggestive of three conformable ferruginous beds than an igneous intrusion. A gravity survey was initiated over that part of the central bed which had the highest aeromagnetic anomaly. Initially it was planned to use the low level aeromagnetic survey with only sufficient ground magnetic work to locate the aero-anomaly. Ground work confirmed that the magnetic and gravity peaks were coincident but drill hole siting on gravity results alone was not completely satisfactory. With the receipt of a quick reading magnetometer a complete ground magnetic cover was also initiated and the gravity survey was extended. A total of 125 miles of magnetometer and 125 miles of gravimeter surveys was completed over the whole area using stations at 200 feet centres on profiles 1000 feet apart. Under good walking conditions a geophysicist, assisted by a helper to carry one instrument could carry out a combined magnetic and gravimetric survey at two and a half miles per hour.

Testing by the Drilling and Mechanical Branch consisted of drilling by four types of plants, a combination (rotary - percussion) rig, a diamond drill, an auger drill and a percussion plant. A shallow shaft was also put down by the Mining Branch. The 153 feet of samples produced daily were

prepared at the drill site and logged there by stereo-microscope. This allowed continuous supervision and assessment of data and resulted in significant economics in drilling. Semi-quantitative estimates were made of mineral content. For 31 (thirty-one) rotary holes field estimates of grade from cuttings averaged within 1% of later analytical results. Two horizons of iron formation each over 1000 feet wide and with a 45° southerly dip were recognised. The third horizon was not tested.

This programme was terminated before completion when overseas interests took over the project.