DEPARTMENT OF MINES
SOUTH AUSTRALIA

CONFIDENTIAL

GRAVITY INVESTIGATIONS IN THE MOUNT DAVIES REGION OF SOUTH AUSTRALIA.

by

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GEOLOGICAL SURVEY OF SOUTH AUSTRALIA

Rept. Bk. No. 665
G.S. No. 1952
S.R. 11/2/87

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DEPARTMENT OF MINES
SOUTH AUSTRALIA

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ABSTRACT

Gravity surveys were made in December 1960 over areas of ferruginous and silicious laterite in the Mount Davies region in the extreme northwest of South Australia, an area in which a sill-like body of basic and ultrabasic rocks, The Giles complex, intrudes Archaean metasediments. Nickel mineralisation is associated with the laterites.

The surveys have indicated that the Gravity method is successful in delineating the ferruginous laterite bodies and has been used to determine the extent of one such body at Claude Hills, however the method would appear to be successful in tracing the silicious laterite only under very favourable conditions. Gravity surveys can be used also to trace the basic and ultra-basic rocks of the Giles complex under more recent cover.

INTRODUCTION:

Extensive nickel mineralisation was discovered in 1953, near Mount Davies, Tomkinson Ranges in the extreme north-western corner of South Australia by a South Australian Mines Department field party under the leadership of R.C. Sprigg. A major exploration campaign was conducted in the area between 1955 and 1958 by South Western Mining Ltd., subsidiary of International Nickel Co., and holders of Special Mining Lease No. 33 over the area. An investigation is now being made of the nickel mineralisation and regional geology by the South Australian Geological Survey to make and independent appraisal of the economic potential of the area and to contribute to the knowledge of the geology of the State. The work which is the subject of this report was undertaken to test the applicability of gravity surveys to the search for nickeliferous ore bodies in the region and was carried out in December 1960.

GEOLOGY:

The geology of the Mount Davies Region and of the nickel mineralisation is discussed in detail in "Preliminary Report July 1960, on Regional Geology and Nickel Exploration in the Mann 4-Mile sheet and adjoining areas", by Brendan P. Thomson, M.Sc. and R.S. Mirams, B.S.c. (unpublished report, South Australian Mines Department G.S. 1782, SR 11/2/87). The report makes reference to previous work in the area.

The Mount Davies region, lies in the Mann - Tomkinson - Blackstone chain of ranges, which run generally east-west and are flanked to north and south by extensive deserts. The ranges rise sharply up to 2,000 feet above the general plain level, itself about 2,000 feet above sea level, and are apparently subject to active erosion.

Many thousands of feet of Archaean medium to coarse grained clastic sediments with occasional dolomites were deposited in the area and subsequently highly metamorphosed to form a variety of gneisses, granulites, and minor quartzites. Into these rocks are intruded locally, granites and minor pegmatites and in the Mount Davies region and extending over 100 miles into Western Australia the layered basic and ultrabasic rocks of the Giles complex. A large proportion of these rocks are of norite gabbo composition but substantial bodies of olivine and pyroxene rich ultrabasics occur. The complex is broadly concordant with the metasediments and was apparently sill-like in character and of great aerial extent, the main sill having a thickness of the order of 10,000 feet. The entire region is traversed by numerous swarms of dolerite dykes from 30 to 500 feet in thickness. The dyke rocks approach norite and gabbo in composition and also occur as minor sills.

The metasediments were moderately folded prior to the introduction of the Giles complex and further violent folding occurred during or after its emplacement. The basic dykes were then introduced along active shears and tension cracks. Further tectonic activity occurred and the layered rocks of the Giles

complex now lie in a near vertical position.

The area was peneplained in middle to late Tertiary time and was subject to weathering which resulted in the formation of gossan-like ferruginous laterite over the ultrabasic areas. A large part of this laterite has subsequently undergone silicification and it was in this silicified laterite that nickel mineralisation was first observed. Extensive drilling of the main laterite outcrops near Mount Davies has shown primary mineralisation of the ultrabasic rock to be of the order of less than 0.2 per cent nickel. It would appear that the mineralisation is largely surface concentration from the original silicate mineral complex of the ultrabasic rocks. The ferruginous unsilicified laterites have the appearance of red, yellow and brown clayey ochre and at Claude Hills, the largest deposit found in the Mount Davies region (and also in a much more extensive deposit at Wingellina in Western Australia, 18 miles northwest of Mount Davies), the ochres contain in places over 1 per cent nickel.

The laterite surface is uplifted, broadly arched and extensively eroded. Quaternary deposits, mainly sand dunes, pediments and recent alluvium cover considerable areas. The western end of the Claude Hills body is concealed under a thin sand cover. This deposit and also the northwestern end of the Scarface Zone, an area of silicified laterite near Mount Davies, were considered by Thomson and Mirams to be the deposits in the area most likely to have an extension under the Quaternary cover.

PREVIOUS GEOPHYSICAL WORK:

South Western Mining Ltd. conducted extensive geophysical surveys and research in the Mount Davies region.

Ground magnetometer surveys were conducted over all important rock types in the area and aerial magnetic surveys were made by the Bureau of Mineral Resources for comparison purposes. It was concluded that the magnetic method was not a useful guide to ore bodies due to the masking effect of magnetite which occurs

both in the Giles complex and in the older rocks.

Geochemical methods were tried but gave no positive results.

Electromagnetic survey methods were used extensively in the search for sulphide ore bodies with no positive result. A great deal of experimentation and research went towards solving the problem of overcoming the conductive effects of saline groundwater. Both aerial and ground surveys were made and five anomalies were selected for drilling. None of the anomalies was caused by sulphides.

Resistivity surveys were attempted and it was found that formation boundaries could be projected in areas covered by overburden and jasperiodal laterite.

Regional gravity surveys have recently been made both by the Bureau of Mineral Resources and the South Australian Mines Department but the results are not available at the time of writing this report.

A regional aeromagnetic survey has been completed by the Bureau of Mineral Resources and the results are being reduced by the South Australian Mines Department.

METHODS USED AND RESULTS:

Gravity surveys were made over both Scarface Zone and the Claude Hills area, to find out if the gravity method is useful in tracing possible extensions of these bodies under younger cover.

The following approximate average densities were determined for the rocks of the region.

Pyroxenite	3.2
Norite	3.0
Silicious laterite	2.7
Ferruginous laterite	1.7

Scarface Zone:

A traverse was run over Scarface Zone with stations located every 100 feet by chaining and levelled by observation of

the vertical angle. The bearing of the traverse was obtained from an uncontrolled photomosaic of the area. The Bouguer gravity anomaly was computed for each station to an arbitrary datum, using an elevation correction of 0.060 milligals per foot corresponding to a density of 2.7, as almost all of the relief on the traverse line was caused by hills of silicious laterite. No topographic correction was applied as it was considered it would be negligible.

The survey indicated a strong regional gradient positive to the southward of over 10 milligals per mile and superimposed on this a small negative residual anomaly of less than one milligal over the outcrop of silicious laterite.

It is considered that the regional anomaly is caused by the dense rocks of the Giles complex which in this area are thickening very rapidly to the south. It is considered that the residual anomaly of less than one milligal is too small to trace the silicified laterite in this area with strong regional gradient. The laterite is overlain by unknown thicknesses of light overburden and underlain by basic and ultrabasic rocks of varying densities. The density contrast between the laterite and basic rocks (0.5) is too small for the successful use of gravity surveys on this problem.

Claude Hills Zone:

A similar traverse was run over the Claude Hills body but as in this area almost all the topographic relief is caused by hills of ultrabasic rock, an elevation correction of 0.053 milligals per foot was used corresponding to a density of 3.2

A broad positive anomaly corresponds to the area underlain by basic and ultrabasic rocks and superimposed on this a negative anomaly of over 2 milligals over the outcrop of the ferruginous laterite. A grid of gravity stations was established using the old baseline established by South Western Mining Ltd. Stations were located by chaining at 100 feet intervals on traverse lines 800 feet apart and levelled by observation of the vertical angle. The bearing of the baseline was determined by

solar observation. The Bouguer gravity anomaly was computed to an arbitrary datum for each station. No topographic corrections were applied as they were considered negligible.

The gravity stations and values were plotted on a geological map of the area and contours of the Bouguer gravity anomaly were drawn.

The survey indicated the ultrabasic rock outcrops of Claude Hills to be located on a regional gravity high as is to be expected because of the high density of the ultrabasic rocks. Superimposed on this broad gravity high is a gravity low which coincides with the area underlain by ferruginous laterite. The negative anomaly covers an area 6,000 feet by 1,000 feet which would appear to be the area underlain by ferruginous laterite. This result is to be expected from the low density of the ferruginous laterite overlying basic and ultrabasic rocks of high density. The survey also indicates by the steep gravity gradient that the margin of the Giles complex to the south of Claude Hills is within 2,000 feet of the baseline.

CONCLUSIONS AND RECOMMENDATIONS:

The work done has indicated that geophysical gravity surveys can be of great use in determining the extent of deposits of ferruginous laterite but could only be used under exceptionally favourable conditions to trace deposits of silicious laterite. The gravity method would also appear to be of considerable use in tracing the basic and ultrabasic rocks of the Giles complex under more recent cover.

The survey has apparently dilineated the extent of the Claude Hills body and should be of considerable value in any project to test the body by drilling.

If it is considered from further geological work that there are any areas with any likelihood of ferruginous laterite deposits concealed by younger cover a gravity survey should normally be successful in locating any such body. Gravity surveys

should also be useful to determine if any area is underlain by rocks of the Giles complex.

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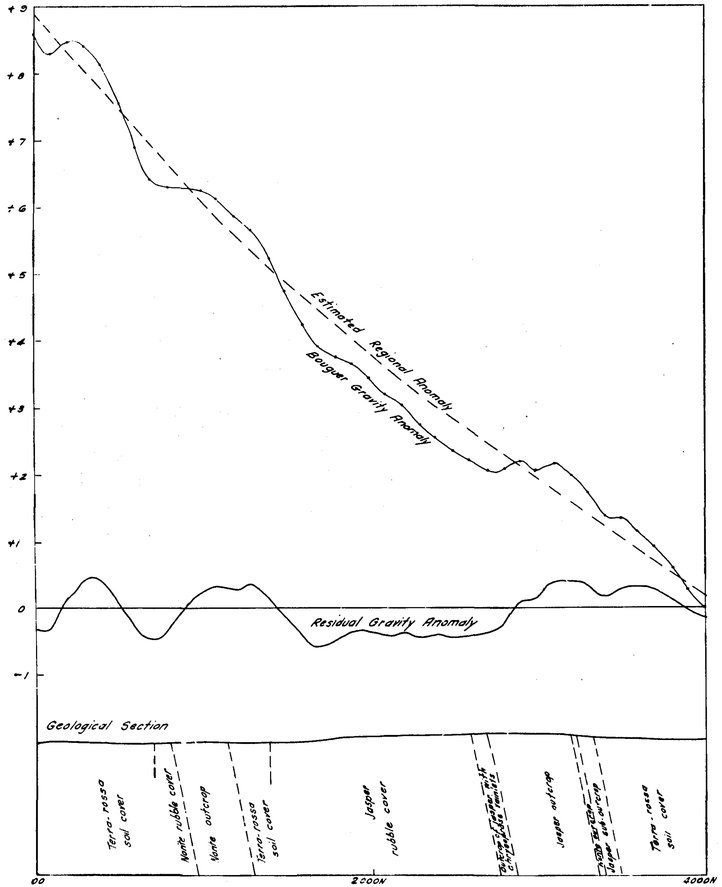
DMP:PAL
3/2/61



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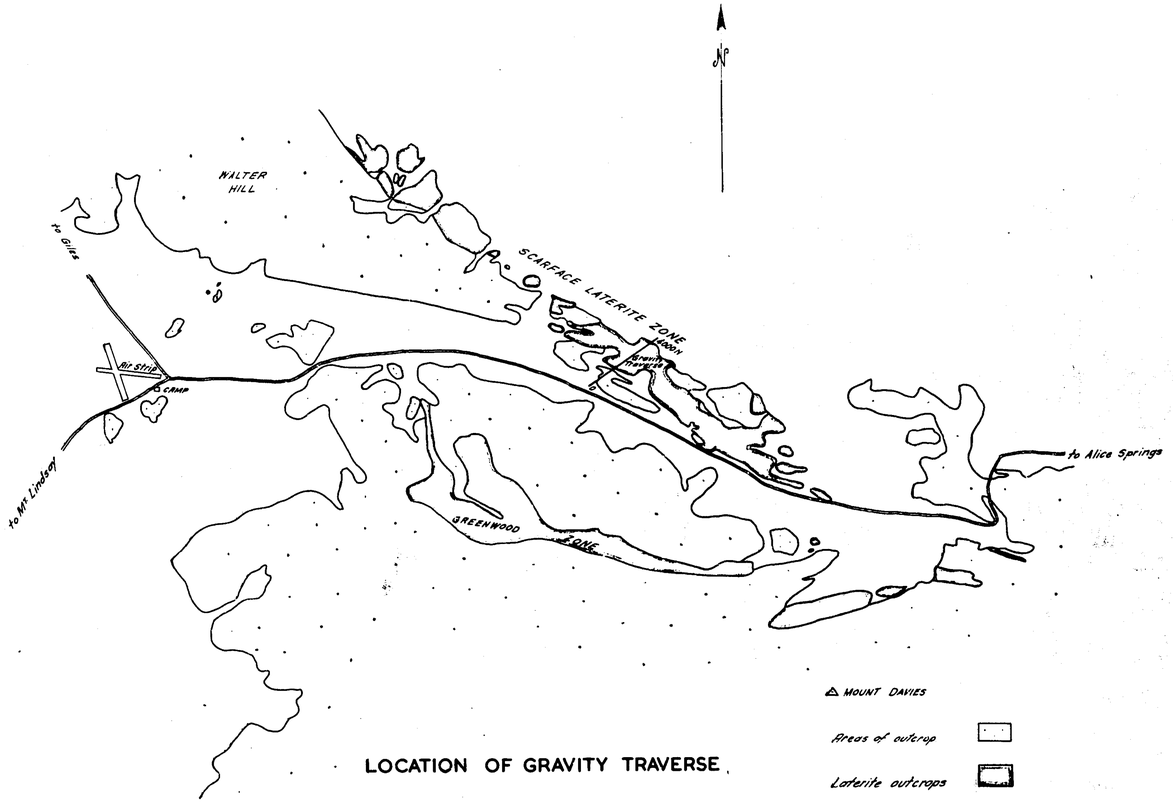
1 MILLIGAL TO 1 INCH



LOCATION OF GRAVITY TRAVERSE.

SCALE:- 3600 FEET TO 1 INCH

To accompany report by D. Pegum

S.A. DEPT. OF MINES

Associated Drawing	No.	No.	Amendment	Exd.	Date

Reg. No.
D.M.
Compiled from

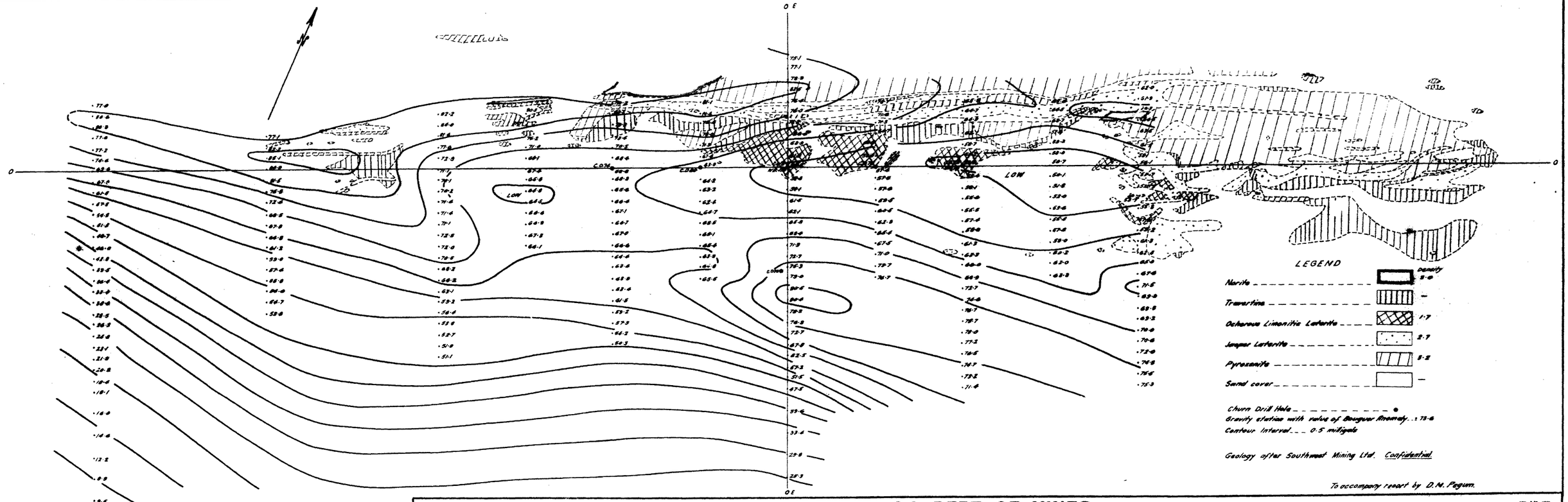
MOUNT DAVIES REGION
SCARFACE ZONE
BOUGUER GRAVITY ANOMALY

Approved | Passed
Director of Mines

Drn. D.P.
Tch. A.O.W.
Chd.
Exd.

Scale: 61 - 30 Ad

Date 27 - 1 - 61



To accompany report by D.M. Pagum.

S.A. DEPT. OF MINES

Associated Drawing	No.	No.	Amendment	Exd.	Date

Req. No.
D.M.
Compiled from

MOUNT DAVIES REGION
CLAUDE HILLS ZONE
BOUGUER GRAVITY ANOMALY

Approved	Passed		Scale : 400' to 1"
		Drn.	60-638
		Tcd. R.G.W.	
		Ckd.	
Director of Mines		Exd.	Date 22-12-60