DEPARTMENT OF MINES
SOUTH AUSTRALIA

EXPLORATION SERVICES DIVISION

ANABAMA FAULT PROJECT

PART A

Regional Geophysical Interpretation of the Southern Half of OLARY and the Northern Half of CHOWILLA 1:250 000 sheet areas

PART B

Detailed Geophysical Interpretation of Gravity and Vehicle Mounted Magnetic Traverses in Anabama and Lilydale 1:63 360 sheet areas.

by

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ABSTRACT

A qualitative interpretation of the aeromagnetic and bouguer gravity data of the southern half of OLARY and the northern half of CHOWILLA 1:250 000 sheet areas was undertaken to resolve the regional structural picture and to locate the position of the 'Anabama Fault'. This showed that the southern area is comprised of both more dense and magnetic rocks than is general for rocks of Adelaidean age, which occur to the north. A comparison of the interpreted magnetic susceptibilities and specific gravities with data from diamond drill hole is outlined. Three major directions of dislocations were resolved having orientations north-south, northwest-southeast and northeast-southwest. The relation of the Anabama Granite and Quondong Aeromagnetic Anomaly to these dislocations are outlined.

Detailed geophysical traverses of the Anabama Fault revealed a complex zone of small scale faults, with a zone of igneous activity. The overall geological picture could be considered as a hinge zone, a region of thrusting or a gradational zone between two metamorphic units. The metamorphic rock unit in the south could be considered as either Paleozoic or Willyama age being higher in metamorphic grade than the Adelaidean rocks. Further stratigraphic drilling should verify the age of this metamorphic basement.

INTRODUCTION

At the request of B.P. Thomson, of the South Australian Geological Survey, Regional Mapping Division, a reconnaissance geophysical interpretation and detailed magnetic and gravity traverses were made over an expected fault zone known as the Anabama Fault, located south of the known "basement" outcrops in the Anabama 1:63 360 sheet area.

The Anabama Fault was considered by Thomson (1969) to be an extension of The Redan fault zone which occurs south of Broken Hill, N.S.W. The speculated position of the Anabama Fault was defined by the sudden and marked linearality along the southern boundary of isolated outcrops of Adelaidean rocks and Willyama rocks at the hills known as Two Brothers. In the area of the Anabama Fault a strong magnetic lineament, trends in a SWS-ENE direction, and is considered by Thomson and others to define the approximate position of the 'Anabama Fault'. This magnetic lineament is however, more likely to be produced by a discontinuous zone of ironstones.

This report for the convenience of the reader will be divided into two major parts.

PART A. considers the regional geology, aeromagnetic and bouguer gravity data confined by latitudes 32°30' to 33°30' and longitudes 139°30' and longitudes 139°30' to 141°0'.

PART B. considers that detailed study of the magnetic trends, zones and basement depths in Anabama and Lilydale 1:63 360 sheet areas, and the detailed ground magnetic and gravity traverses conducted in 1972.

The locations of areas of geophysical interpretations of Parts A and B of this report are shown in fig. 1.

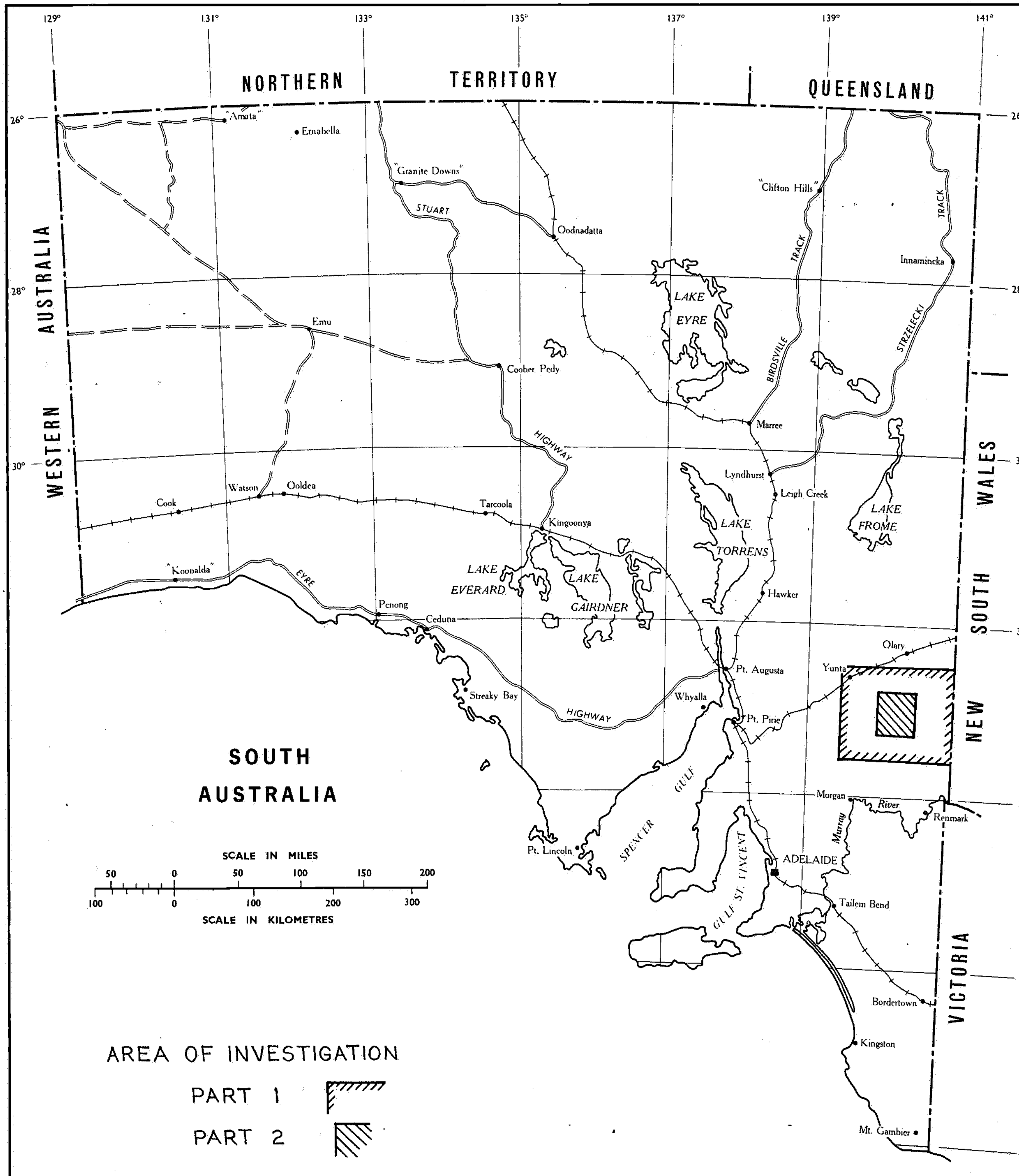

FIG. 1

DEPARTMENT OF MINES —— SOUTH AUSTRALIA

Compiled.	ANABAMA FAULT PROJECT	Date: Jan 1973
Drn. A.F. Ckd.	LOCATION OF GEOPHYSICAL SURVEY 1972	Drg. No. S 10144 FG

P.F. No. 55850 994.2

PREVIOUS GEOPHYSICAL SURVEYS

REGIONAL DATA

Aeromagnetic Surveys

The 1:250 000 sheet areas of OLARY and CHOWILLA were flown by Adastra Huntings Geophysics Ltd. in 1955 and the Bureau of Mineral Resources in 1961; (Young, (1963)) on behalf of the South Australian Department of Mines. The relevant contoured data is shown in fig.2.

The aeromagnetic survey north of latitude 33°15' was flown in 1955, along lines orientated north-south, with a flight line spacing of 1 mile and a ground clearance of 500 feet (a.g.l.). The area south of latitude 33°15' was flown in 1961 along lines orientated east-west, with the same flight line spacing and ground clearance as the previous survey recording both aeromagnetic and radiometric data.

In 1969, Geophysical Resources Development Co. Ltd. flew an aeromagnetic and spectrometer survey over Special Mining Lease No. 274, Radium Hill area, held by Longreach Group, Managment Pty. Ltd; McIntyre (1970). This survey was flown along east-west lines at an altitude of 300 MTC (300 feet above ground level) with a flight line spacing of 0.25 miles. Although this survey is just outside the present area of investigation, it should be considered when investigating the extension to the east of the Anabama Fault Project.

Young (1963), reporting on the aeromagnetic and radiometric data of the B.M.R. 1961 survey, considered that the magnetic trends of 060° located in Pine Valley probably followed structural trends of the Upper Proterozoic rocks. He also considered that the linear magnetic anomalies were associated with the Florienton and Morgan Faults. These faults extend southwards through Murkaby, Koomootoo and Lindley 1:63 360 map areas and into RENMARK 1;250 000 map area. He states that "the source rocks were basic intrusion erected along the fault zone".

Young considered that the general decrease in magnetic disturbance from the northwest to the southeastern corner of CHOWILLA reflects an increasing thickness of Murray Basin sediments in that "the Murray Basin sediments were less than 1000 feet thick in Pine Valley and about 3000 feet thick in Chowilla.

The radiometric results of Chowilla indicated an increase in background level in Murkaby and Pine Valley.

Gravity Surveys

The Regional Bouguer Gravity Contours shown in fig.7 are based on a helicopter gravity survey with a density of 1 per 16 square miles, conducted by the Bureau of Mineral Resources in 1971. This survey covered OLARY and the portion of CHOWILLA west of the former Radium Hill-Mannum power line. The area east of the power line route was surveyed by Hackathorn Oils Ltd. in 1965, Blumer and Webb (1965).

Some detailed gravity traverses along seismic lines were conducted by the S.A. Department of Mines in 1963, Seedsman (1963), Seedsman and Kendall (1964), and Kendall (1965).

Seismic Surveys

The refraction and reflection seismic spreads in the south-eastern portion of the area recorded a number of seismic horizons at particular depths along the Mannum-Radium Hill Power line and along the Hyperna Line, Kendall (1965).

The seismic velocities recorded have been correlated with particular stratigraphic units, which are given below.

Velocity Range	Stratigraphic Units
4300 to 7400 ft/sec	Tertiary and Lower Cretaceous (Thornton (1972))
12000 to 14000 ft/sec	Lower Permian
16000 ft/sec	Devonian (?)
17000 to 2000 ft/sec	Basement

The velocities assumed to correlate with basement have a wide variation in seismic velocities ranging from 17000 feet per second, with most values at 18750 ft/sec, (Thornton 1972). The Hyperna line, Kendall (1915) has a wide range in basement velocities probably caused by basement lithological variations. The portion interpreted as basement with velocities ranging from 14600 to 16100 ft/sec may represent a small area of Permian sediments.

The interpreted seismic basement surface contours and Mines Administration Pty. Ltd. rotary drill hole depths, referred mean sea level are shown in fig.3.

These contours show that the basement surface in the area is generally less than 1000 feet, below sea level, and shallows towards the north and northeast. The well known Canegrass Lobe and continuation of the Renmark Trough are shown in Pine Valley and Canopus respectively.

Thornton (1972) considers that this basement is comprised of Kanmantoo metasediments and gneisses.

DETAILED DATA

Detailed Radiometric Surveys

In 1970, Austral Exploration Services Pty. Ltd. on behalf of Mines Administration Pty. Ltd. flew with a two channel scintillation spectrometer the area defined by latitudes 32°30' to 32°56' and longitudes 140° to 140°30', Special Mining Leases Nos. 282 and 416. Webb (1970).

The area was flown in east-west strips, along north south lines having a separation of 0.2 miles and a ground clearance of 150 feet. Webb (1970) interpreted the profiles of the channel recording Uranium and Thorium (energy above 1.6 $m_c v$) to contain two types of anomalies, which are given below:

Type (i) Anomalies with limited extent, recorded as very sharp peaks

Type (ii) Anomalies with appreciable extent along the flight line and often recorded on more than one line. The anomaly of Type (i), probably represents a considerable amount of statistical noise, and the number of point sources appears to be related to the survey flying bands. Type (i) should therefore be treated with caution. The results of type (ii) anomalies indicate a high degree of radioactivity in the area of known granite, which may extend south of the known extent of the Anabama granite. Webb (1970) also considers that some anomalous areas, south of the high ground could indicate radioactive areas beneath sedimentary cover. These results indicate a radiometrically high zone, near Lilydale Homestead. These results initiated the reconnaissance drilling programme of Mines Administration in S.M.L's 282 and 416 for sedimentary uranium deposits.

Detailed Magnetic and I.P. Surveys

Most of the detailed geophysical groundwork has been done by Asarco (Aust.) Pty.Ltd., and the South Australian Department of Mines in search for porphyry copper deposits in the Anabama Hill and Netley Hill areas, located in the Anabama Granite.

At Netley Hill, Asarco Aust. Pty. Ltd. conducted a ground magnetometer survey and grid over Netley Hill, Satkoski (1970). Since that date I.P. surveys have been conducted by the Department at Anabama Hill; Pilkington (1971, 1972) and Wightman (1972a) and at Netley Hill, Taylor (1972), Wightman (1972b) and Ramakrishna (1972).

PART A

REGIONAL GEOPHYSICAL INTERPRETATION OF THE SOUTHERN HALF OF OLARY AND THE NORTHERN HALF OF CHOWILLA 1:250 000 sheet areas

In order to obtain a better understanding of both the geological and geophysical factors in this region, the known regional geology has been summarized and preliminary geophysical interpretation of the aeromagnetic and bouguer gravity contours has been given.

REGIONAL GEOLOGY

Willyama Block

The Willyama Block shown on fig.4 is interpreted by Thomson (1969) to be confined by the northwest trending major shear called the MacDonald Shear Zone and the north-east trending Anabama - Redan lineament (fault zone). The basement fold structures within the Willyama Block have an overall northeasterly trend which is considered to reflect the major structures of the gneisses. These gneisses are considered to form a vast synclinorium trending and plunging north-easterly.

The basement rocks of the Willyama Complex, after Mawson (1912) have been subdivided into three provinces.

(i) The southern province consists of the oldest rocks which are high grade metamorphic sillimanite-garnet gneisses, with associated basic sills plugs and granitoid gneisses.

(ii) The central province is dominated by great bodies of intrusive adamellite, pegmatites and granitoid rocks, with basic plugs and sills.

(iii) The northern province has a lower metamorphic grade and consists of graphitic phyllites, metasediments and low grade amphibolite with thin iron formations. These rocks are considered to be equivalent to the Cleve Metamorphics of the Eyre Peninsula (Whitten, 1966a).

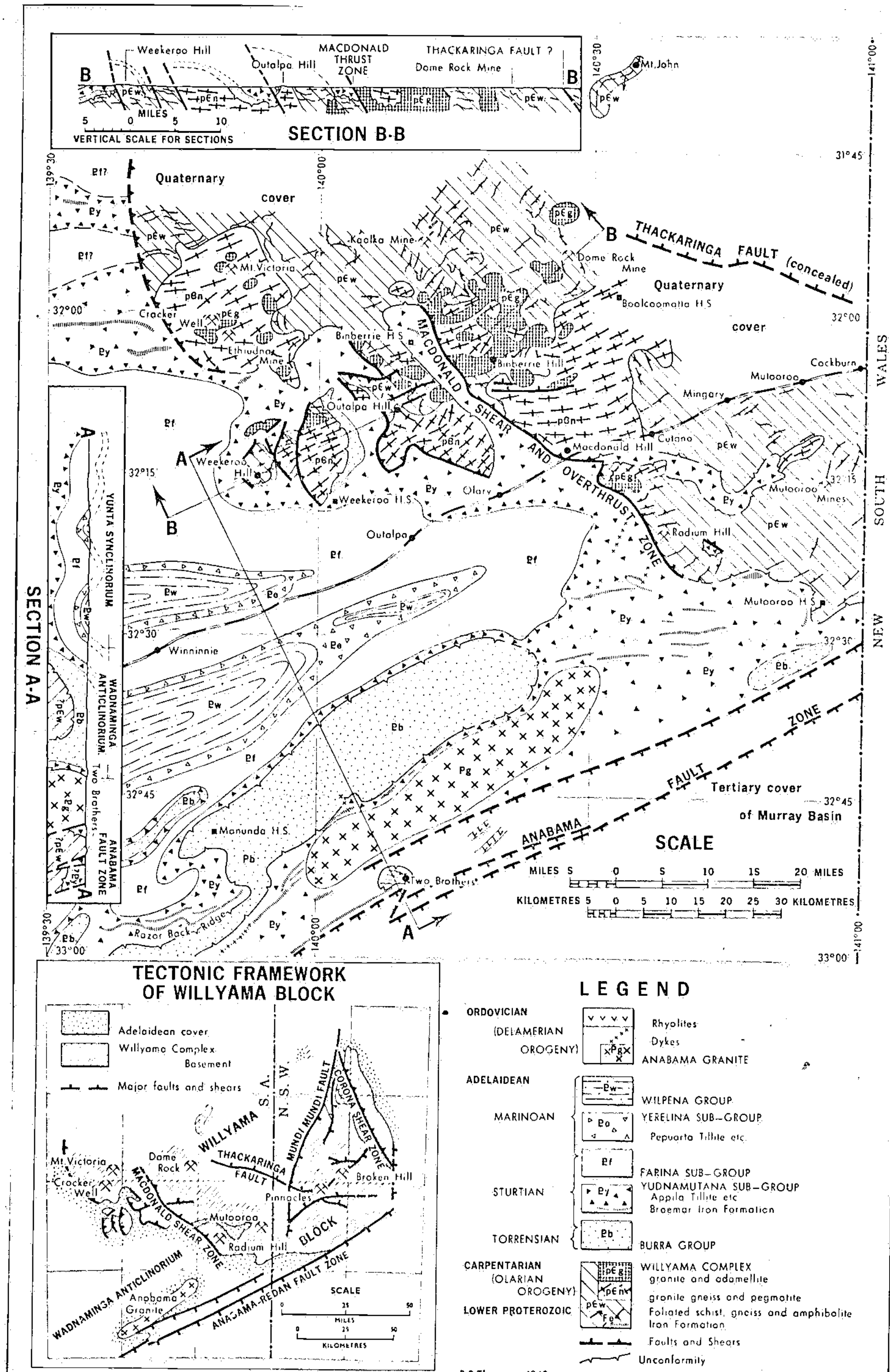

FIG. 4

DEPARTMENT OF MINES – SOUTH AUSTRALIA

Generalized geological map of the Olary Province, Willyama Block.

Compiled:		Scale:
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		Drg. No.

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Cooper (1972) reinterpreted previous workers isotopic age determinations in the Willyama Block, and suggests that the data fits two metamorphic episodes of 500 and 1700 m.y. The latter age is considered at present to be the earliest major period of metamorphism and mineralization.

ADELAIDE SYSTEM

The general regional fold structures of the Adelaide System in this area trend northeasterly until they are truncated by the MacDonald Shear and Overthrust Zone, in the northeast; they are situated to the north of the so called Anabama - Redan Fault zone in the south.

The oldest mapped Adelaidean, i.e. Burra Group sediments, in the area are restricted to an anticlinal feature called the Wadnaminga Anticlinorium, which extends for about 35 miles (56.3 km) in a northeasterly direction from Manunda Homestead. Mirams (1962), whilst mapping the Manunda 1:63 360 sheet area, found that "the Torrensian Series, Burra Group are restricted to cores of anticlines. These rocks could be divided into a lower arenaceous sequence and an upper sequence of slates and siltstones". The rock types can be considered as similar to those intersected in drill holes in the area under investigation. The lithologies in the drill holes are considered later (MINAD DRILLING DATA) in this report.

The lower sequences of the Burra Group consist of siltstones, sandstones and greywackes. The basal beds are not exposed. The upper sequence consists of slate and minor dolomitic bands. Towards the top, these beds become darker in colour due to carbonaceous material and pyrite, both of which occur as lenses and finely disseminated forms. These beds could produce anomalous I.P. results.

The Yudnamutana Sub-Group (STURTIAN) rest unconformably on the Burra Group and occurs in the southern and northern portions, see fig.4after Thomson (1969). This Sub-Group is considered to be glacigene and includes the lower glacial sequence, Coats (1964). The lower members of this sub-group consist of a sequence of arkosic quartzite passing into fluvio-glacial shales and siltstones, before the massive boulder tillite was deposited (Mirams,(1962). in Manunda. Whitten (1970) however whilst investigating Razorback Ridge Iron deposit considered that the lower members of the sequence were a tillite with a shaly matrix and an occasional quartzite bed. These passed up through boulder tillites, with a sandy matrix, and contained more frequent and thicker quartzites. These in turn are overlain by the Braemar Iron Formation, which according to Whitten (1970) is made up of two ore types, Tillitic and Bedded Iron Formation.

The stratigraphic column of the Braemar Iron Formation is shown by Whitten (1970) fig. 3. The thickness of the Braemar Iron Formation, ranges between 1470 to 2389 feet (488 to 725 m). The tillitic iron formations are between 100 to 400 feet (30.48 to 121.92 m) thick, and occurs in two horizons. The bedded iron formations are thinner and generally interbedded with shales.

On the basis of analyses quoted by AMDEL (Reports 115 and 310), Whitten (1962) normalized the percentages of both types of ironstones and showed that the bedded ironstone contained 16.7% more Fe_2O_3 and Fe_3O_4 than the tillitic ironstone. The hematite to magnetite ratios for the two ores according to Whitten (1970) are between 1.0 to 1.25 for bedded ore and 0.8 to 1.5 for tillitic ore.

The grade of the ore types given by the total iron percentages on assay results are as follows:

ORE TYPE	RANGE	NO.OF SAMPLES	MEAN %	STANDARD DEVIATION
Bedded Ore	35.4 to 45.0	5	38.42	3.45
Tillitic Ore	21.0 to 24.2	4	22.93	1.22

Magnetic susceptibility and specific gravity of core samples are given in Appendices 5 and 6 respectively.

The Farina Sub-Group (Sturtian), the Yerelina Sub-Group and Wilpena Group (Marionoan) situated to the north (shown in fig.4) are folded into a complex system of synclinal folds, trending northeast and closing to the northeast within the Yunta Synclinorium (Thomson 1969).

PALAEOZOIC

Cambrian

In the Anabama 1:63 360 sheet area specimens of a rhyolitic tuffaceous rock were samples from the hill situated west of Boucauts West Dam. Thomson (pers com) considers that these may be Lower Cambrian, or Ordovician Volcanics, but further work should be needed to verify these ages.

If the former age is correct, these tuffs could be correlated with the Truro Volcanics, situated near Dutton, north of Truro. Here volcanics are approximately 2000 feet thick consisting of basic and intermediate rocks, which were extruded in the "phase of Duttonian Folding". The latter age assumes that these acid volcanics were extended at the same time as the Anabama Granite was intruded.

KANMANTOO SEDIMENTARY TROUGH AND ASSOCIATED TECTONISM

At the present no known Kanmantoo sediments outcrop in the area north of Morgan. In the Renmark area, metasediments of a similar lithology have been intersected in drill holes in the Renmark Trough, and similar metasediments crop out in the Glenelg River and Casterton areas in western Victoria, Thornton (1972). It is assumed by Thornton (1972) that Kanmantoo sediments could extend across the lower Murray Basin to the Tasman Geosynclinal Belt.

In Kangaroo Island, Fleurieu Peninsula, and along the eastern side of the Adelaide Geosyncline the Kanmantoo Group forms a very strong trough. This feature tends to parallel the older structures, and is associated with granites of Delamerian age i.e. Palmer Granite. This granite has an isotopic age of 490 m.y. using 99Sr/86Sr measurements. White et. al., (1967).

The Palmer granite is considered by White et. al., to have been derived from outside its present environment (presumably at greater depths) and not derived in situ by ultra-metamorphism and tectonism. The Anabama Granite may have a similar origin.

ANABAMA GRANITE

The Anabama Granite consists of a granitic complex of granite (granodiorite and adamellite), quartz porphyry, quartz feldspar porphyry and a network of felsite dykes and quartz blows. Two greissen areas were investigated by Asarco (Aust.) Pty. Ltd., Anabama Hill, Hosking (1970) and Netley Hill, Satkoski (1970). Specific Gravity data in the Asarco diamond drill holes are shown in Appendix 5.

Compston et al., (1966) sampled a microtonalite from Netley Gap, and an adamellite from the Anabama Granite, (Anabama 1:63 360 sheet area), and gave the following isotopic ages.

LOCALITY	METHOD	APPARENT AGES
Microtonalite Netley Hill	Rb/Sr and Sr^{87}/Sr^{86} (on Total Rock, Biotite and Plagioclase)	$435 \pm 55 \times 10^6$ years
	Ar^{40}/K^{40}	
	Biotite	427×10^6 years
	Hornblende	437×10^6 years
Anabama Granite Adamellite	Rb/Sr and Sr/Sr	$437 \pm 3 \times 10^6$ years

Compston et al., considers the true age of emplacement of this rock is greater than 430 m.y. and deduces that the Anabama Granite age corresponds to a major Palaeozoic metamorphism in the North Flinders Ranges.

The Anabama Granite and prophyry dykes have been investigated by Amdel for the South Australian Geological Survey and confirmed a Cambrian-Ordovician age. Thomson (pers. comm).

Thomson (1969) considers this zone of metamorphism forms part of an arc sweeping from Kangaroo Island north east around the Willyama Block and north eastwards to Mt. Painter and probably the Peake-Denison Ranges.

2. RESULTS AND INTERPRETATION OF REGIONAL DATA

It was considered necessary to interprete the geology based on the Mines Administration rotary drill holes and the regional geophysical data. As a prelude to the interpretation of the Anabama and Lilydale 1:63 360 sheet areas and to the detailed magnetic and gravity traverses. The interpretation of the data is described under the following:

a. Interpretation of the Sub-Surface Geology based on Rotary Drill Holes.

b. Interpretation of the Aeromagnetic Contours.

c. Interpretation of the Bouguer Gravity Contours.

a. Interpretation of the Sub-surface Geology based on Rotary Drill Holes.

The interpretated subsurface geology based on Mines Administration rotary drill holes in the concealed area south of the outcrops of Adelaidean rocks as shown in fig.5.

The locations, depth of the rotary drill holes are shown together with the depth to a metamorphic basement. Two basic lithological rock types were encountered, a quartzite in the north and to the south were phyllites, hornfels and slates. The interpreted contours of the top of this metamorphic horizon shows a general high south and southeast of Lilydale H.S. Unfortunately the holes located further to the east were too shallow to intersect this metamorphic basement.

The contours of the Pliocene-Eocene unconformity after Wecker (1971a) are shown in fig.5. These contours are considered to indicate a general increase in depth of the Murray Basin sediments towards the southeast. The sharp increase in gradient of these contours near Quondong Vale H.S. may correspond to a Pre-Tertiary topographic escarpment.

The contours of the known thickness of Tertiary sediments suggests that the quartzite forms a metamorphic surface as represented by the gradient to the north. This quartzite is probably Adelaidean in age, whilst the metasediments (phyllites) situated to the south, are suggestive of another metamorphic basement. The latter basement is considered to correspond to a shallower basement horizon as shown in fig.14 which is discussed later in Part B of this report.

b. Interpretation of the Aeromagnetic Contours.

The regional aeromagnetic contours based on the Adastra Huntings survey of 1955 and the Bureau of Mineral Resources survey of 1961 were reduced and contoured by the South Australian Department of Mines. The composite aeromagnetic contours for the area between latitudes $32^{o}30'$ to $33^{o}30'$ and longitudes $139^{o}30'$ to 141^{o} are shown in fig.2.

A qualitative magnetic interpretation of the contours was undertaken as a preliminary investigation of the site for detailed ground geophysical field surveys. This analysis was considered to be of particular value in delineating the probable position of the fault zone.

The magnetic parameters used as a criteria to determine the zone type are the degree of anomaly continuity from line to line (linearity) and the dominant amphitude range representative of each zone. The specified anomaly ranges were chosen by inspection of the overall anomaly pattern. An explanation of the limitations of such a classification is given by Gerdes et al., (1970).

The magnetic trends show a pronounced north-south direction in the southwestern corner of the area, and then changes direction to the northeast-southwest (060 degrees) in the remainder of the area. This trend direction reflects the arcuate fold system of the Adelaide Geosyncline.

Magnetic zones and their significance

The magnetic zonal classification is given in Appendix 4.

The significance of the magnetic types for the scale of 1;250 000 area discussed in detail, in Part B of this report. As a detailed zonal investigations based on the magnetometer charts were undertaken for Anabama and Lilydale.

The magnetic zone types and trends shown in fig.6 at the scale of 1:250 000 can be subdivided into 3 main provinces, which are separated by probable magnetic lineaments AA' and BB'.

PROVINCE I

This province is characterised by high order magnetic type 6,7,8 and 9 zones, having dominant 060^{o} trend direction. The type 7,8 and 9 zones probably represent banded ironstones (Braemar Ironstones) and from their distribution indicate large scale fold structures. Most of the sources of these zone types appear to be shallow, within 500 feet (152 m) of the surface and have a northerly dip. This dip may be due to the presence of a strong remanent magnetisation direction in the rocks of the Adelaidean System.

The Anabama Granite may have been intruded in an 'anticlinal' structure with strong fault control. The geological dips suggest a general synclinal structure overturning towards the south, Blissett (pers.comm.). The high magnetic zones situated to the south and south-west of the granite may be interpreted to form a general synclinorium zone, overturning southwards. The overall axial plane trends at 060 degrees.

PROVINCE II

This province is characterised by magnetic trends orientated between 000 to 015 degrees. The magnetic zone ranges from types 1 to 7. The higher order zones (zone type 7) probably represent banded ironstone (Braemar Ironstones). Young (1963), considered that 'these may be basic intrusions'.

The two parallel belts of zone types 1 and 2, orientated at 020^{o} probably corresponds to basic intrusions, which are fault controlled i.e. extensions of the Morgan and Florienton faults. The lineament BB' is probably the magnetic expression of the Morgan fault.

PROVINCE III

This province is characterised by low amplitude magnetic anomalies, which have a general 060^{o} trend. This area forms the northwestern portion of the Murray Basin. The sources of the magnetic anomalies are due to either deep basement sources or another lithological suite of rocks. The magnetic zone types 5 and 6 in this area are of interest and appear to relate to faulting. A magnetic traverse was surveyed across one of these anomalies in the southern part of Lilydale, i.e. The Quondong Aeromagnetic Anomaly, which will be discussed in Part B of this report.

FAULTING

In this area there appears to be three distinct directions of faulting, which are as follows:

Type 1 Faults - defined by a general north-south strike direction and generally confined to Province II.

Type 2 Faults - defined by a general northwest-south-east direction and which appear to cross cut the Adelaidean rocks in Province I, but are also present within the Murray Basin area, Province III. This direction appears to have acted as a tectonic control for the Anabama Granite intrusion.

Type 3 Faults - defined by a general north east trend (060 degrees) and are considered to be parallel to the main axial plane direction of the Adelaidean rocks. The magnetic lineament AA' is of this type.

This lineament AA' has been correlated with the so called Anabama Fault, and its assumed continuation within the Redan Fault.

The structural discontinuities, trending between 030 to 050^{o} in Province III can be tentatively correlated with either major basement faults or lithological changes within the basement and/or country rocks.

c. Interpretation of the Bouguer Gravity Contours

The regional bouguer gravity contours shown in fig.7, were compiled from the gravity data as outlined in the section on previous geophysical surveys.

These contours indicate a general regional gradient increase towards the south east. This suggests that the Adelaidean rocks have a lower density than these rocks concealed in the northern portion of the Murray Basin.

The gravity low trending at 060^{o} with an amplitude of approximately 20 millgals located in Anabama is considered to be produced by the Anabama Granite intrusion. Tucker (pers. comm.) interpreted this anomaly as being produced by a trapezosoidal shaped cross-sectional body with an approximately 70^{o} north dipping limb and a vertical dipping south limb. The base of this body was considered to be at approximately 20 km from a mass diffiency estimates; for further details see Tucker (1972). (Ph.D. Thesis Adelaide University). The mean density of the granite is 2.64 gm/cc., which is only slightly different from the density of the surface Adelaidean rocks, i.e. 2.67 gm/cc. These Adelaidean rocks may increase in density with depth and metamorphic grade, which would increase the density contrast, as the density of the Anabama Granite is relatively constant.

The overall trend directions of the axes of the gravity highs and lows are between 050 to 060 degrees, with local variations of trends between 020 and 030^{o} located on the eastern and western extremities of the area as shown in fig.8. The former trend direction is coincident with the general fold direction of the Adelaidean rocks.

The steep gravity gradients shown in fig.8 are associated with three distinct trend directions normal to them, which are as follows;

Group 1. Between 030 to 060 degrees
Group 2. Between 140 to 150 degrees
Group 3. Approximately north-south

Group 1 is considered to correlate with either a lithological contact (discontinuity) or a fault. The contour line at 030 degrees considered normal to the gradient situated in the southeast corner correlates with the extension of the Hamley Fault, which was investigated in this area by Hackathorn Oils Ltd. Blumer and Webb (1965). The steep gravity change of over 30 milligals was interpreted by Blumer et. al; to represent a "fault with a throw of 5,000 to 6,000 feet with a top cover of over 2,000 feet".

Group 2 is considered to correspond to probable cross faults or tear faults. The two gradients at the northeastern and southeastern extremities of the Anabama gravity low probably are associated with cross features, which have given structural control to the granite intrusion at depth.

The major gradient situated at the bottom centre of the map appears to terminate the Canegrass Lobe. Blumber and Webb (1965) considered that this gradient could be interpreted as either due to a fault or to a change in density of the basement, whereas Seedsman and Kendall (1964), interpreted this gradient by assuming a density contrast of 0.5 gm/cc, and estimated that 'this fault could be expected to have a throw of 2,000 feet (610 m) with a depth of cover at its top of 1,500 feet (457 m), Blumer et al. (1965).

Group 3 is considered to represent north-south faulting. The fault suggested by the gravity gradient in the southwestern corner terminates the positive trends, and sub-parallels the Morgan and Florienton faults. The north south line normal to the gradients situated at the bottom centre are related to the western and eastern sides of the Canegrass Lobe. In addition the north-south line normal to the gradients on the eastern side of the area indicates a probable northerly extension of the Chowilla Fault.

d. Polynomial Surface and Residual Gravity of the Bouguer Gravity Contours

The regional contours are shown in fig.7 were overlain by a regular 4 mile grid and the bouguer values for data points at grid line intersections were then subjected to a computer programme. This programme involved the fitting of a low-order polynomial surface for the assumed regional potential surface. The polynomial surface was fitted using a conventional least square technique involving an orthogonal polynomial in the process. The values for the 6th order polynomial were computer contoured on a Calcomp 30 inch drum plotter to illustrate the assumed regional gravity pattern. These contours are shown in fig.9. The difference between the bouguer values and the regional values as computed by the polynomial were then computer contoured as the residual anomaly map, as shown in fig.10.

Regional Polynomial Surface Contours (fig.9)

The 6th order polynomial surface shows the assumed basement configuration at a depth of approximately 14 miles (22 km). These contours show the increase in gradient towards the south-east, as reflected by the large gravity high in that area. This gravity high is the deeper basement feature of the Canopus gravity high. The latter was referred to by Drew et. al., (1969), from the bouguer contours of CHOWILLA. This deeper basement feature has a NW-SE trend direction and is terminated along the southeastern side by a steep gradient. This gradient indicates that the Hamley Fault is a basement feature.

The regional gravity lows located in the west and north-eastern areas of fig.9 reflect that the Adelaidean Rocks have a relatively low density root. The western gravity low strikes north-south and probably correlates with a region of unstable isostatic equilibrium. The gravity low in the north eastern corner is smaller in magnitude and probably indicates a thinner sequence of Adelaidean rocks.

The steep gradient in the north east corner is over emphasised and probably distorted by the edge effect on the polynomial surface in this region. If real, this gradient probably represents a deeper expression of the MacDonald Shear Zone.

The 6th Order polynomial contours show a predominant north-south direction in the centre of the area. This direction indicates a possible orientation of a major basement feature. The surface expression of approximate north-south features are reflected by the following:-

(i) The major axial direction of the Adelaide Geosyncline.

(ii) The Morgan and Florienton faults located on the western side of the area.

(iii) The Chowilla Fault is situated just south of this area and probably extends northwards into the area on the eastern side. This fault has a throw to the west of 6,000 feet based on seismic data, after Associated Australian Oilfields N.L. (1968) and disturbs the character of the eastern flank of the Renmark Trough, Drew et al., (1969).

(iv) The axial direction of the Canegrass Lobe is north-south and a pronounced north-south structure can be seen to extend southwards on the Bouguer gravity contours of RENMARK. (1:250 000 sheet area).

The north-south deep basement trend shown in fig.9 is considered to be the northerly extention of (iv).

The northeast-southwest lineament, i.e. the so-called Anabama Lineament (Fault) is not clearly resolved at this depth. A possible expression of a NE-SW feature is represented by the steep gradient between the basement Canopus gravity high and the gravity low in the northeastern corner of the area. This gradient appears to disappear or die out against the major north-south basement feature.

The Anabama gravity low is not represent by the 6th order polynomial surface. This confirms the limited depth extent of the Anabama granite as interpreted by Tucker (pers.com.). It should be noted that the mean density of the granite was 2.64 ± 0.09 gm/cc to a sample depth of 600 feet for Asarco drill holes 1,2 and 3. The granite has a relative constant density variation with depth, for this relatively uniform intrusion.

RESIDUAL GRAVITY CONTOURS

The residual contours shown in fig.10 reflect the same anomaly distribution as the original bouguer gravity data. The resolution of the individual anomalies is better, except that some of the smaller anomalies shown by detailed data do not appear, due to the filturing produced by the spacing of the reduction grid. The structural interpretation of the residual contours is shown in fig.11.

The area can be divided by a prominent feature PP', which has a north east-southwest trend. This feature PP' is indicated by the following:

(i) A discontinuous steep gravity gradient.

(ii) A line of small positive residual positive anomalies located immediately south of the feature PP^1.

This feature PP^1 can be considered as a discontinuity produced by either a lithological contrast or a fault. The significance of this feature will be discussed in Part B of this report. The area north of PP^1 is dominated by the Anabama Granite gravity low, which has already been discussed.

The three positive anomalies located in the western part of the area having amplitude of 4.8, 8.6, and 7.1 milligals respectively may be correlated with ironstone formations (Braemar Iron Formation equivalents). The positive gravity anomaly, with an amplitude of 8 milligals situated in the northeastern corner of the northern region, is slightly displaced from the known outcrop of Yudnamutana Sub-Group (Braemar Iron Formation).

The two elongate gravity low regions situated just north of the feature PP^1 can be considered to be either a zone of low density basement rocks, or a shallow basin filled with Tertiary rocks. The former could be produced by acid igneous rocks. Further north of this zone, there are outcrops of rhyolitic tuffs which could increase in thickness southwards, Thomson (pers. comm.).

The Mines Administration Pty. Ltd. rotary drill hole data suggest a slight increase in thickness of the Teritary and Quaternary cover in this region. If the later is the case, this low gravity zone may have economic potential such as sedimentary uranium deposits.

The region south of the feature PP[1] has a higher density than those attributed to Adelaidean rocks (green schist facies) and should be correlated with higher grade metamorphic rocks, i.e. either Willyama or Palaeozoic metamorphic

The gravity low having an amplitude of 12 milligals, located in the centre of the area occurs over the Canegrass Lobe. Based on refraction seismic surveys, this Lobe is considered to contain Permian sediments, Seedsman (1963); Seedsman and Kendall (1964). The depth to basement in this sub-basin is estimated at 4000 ft. below M.S.L. This sub-basin is controlled by north-south faults on the eastern and western extremities forming a graben feature. Three additional gravity lows located to the northeast of the former gravity low may correlate with either similar but shallow sub-basins, or granite intrusions.

A number of linear discontinuities defined by gravity gradients or dislocations in the residual pattern represent either lithological discontinuities of faults. The dominant direction south of PP' is north-south.

PART B

DETAILED GEOPHYSICAL INTERPRETATION OF ANABAMA AND LILYDALE 1:63 360 SHEET AREAS

1. DETAILED GEOLOGY OF THE ANABAMA AND LILYDALE 1:63 360 SHEET AREAS

The Anabama sheet area was preliminarily mapped by Currie (1970). No outcrops have been identified for Lilydale as most of the area is covered by Quaternary deposits. The outcrop geology of Anabama and Lilydale is shown in fig.12 at the scale of 1:125,000.

Mines Administration undertook a reconnaissance drilling programme to evaluate the potential of sedimentary uranium in the soft rock portion of S.M.L. 282 (Brady's Dam Area) and S.M.L. 416 (Postmark). The main interest, in the Cainozoic section present along the north western margin of the Murray Basin, was aroused by the anomalous radiometric response, detected as part of the Airborne Spectrometer survey conducted by Austral Exploration 1970.

The geology was reported by Bryan (1971) and Wecker (1971a) for S.M.L. 282; and Wecker (1971b) for S.M.L. 416. All drill holes were logged for Self Potential, Resistivity and Gamma Response.

The main interests in this study for the Anabama Fault project are two fold:

(1) A disconformity was established between sediments of the Pliocene-Eocene age. The contours of the erosion surface shown in fig.5 after Wecker (1971a), indicated a steep gradient running in a northeasterly direction through Quondong Vale Homestead. This may represent a fault scarp having topographic expression of 50 feet (15.24 m), and may reflect a deeper basement feature.

(2) Basement lithologies (metasedimentary) and depths were obtained from drill hole data.

Two main types of lithologies were encountered in the drill holes logged by the company geologist.

(a) Quartzite was encountered in two rotary drill holes BF1 and BF6 situated in the northern extremities of the lines - Anabama.

(b) Phyllites consisting of black slates, greenish phyllites and hornfels have been encountered south of the quartzite, and are generally restricted to the area south of Lilydale Homestead. An isolated drill hole P27 also encountered this rock type.

The quartzite may be Adelaidean and the phyllites could be either Palaeozoic meta-sediments or older rocks of Willyama age. The degree of metamorphism would favour them being Palaeozoic rocks.

2. RESULTS AND INTERPRETATION OF AEROMAGNETIC DATA OF ANABAMA AND LILYDALE 1:63,360 SHEET AREAS

The magnetic lineament AA' as described in Part A, was not clearly defined at the scale of 1:250 000. It was considered necessary to undertake a preliminary interpretation of the original aeromagnetic charts to see if any small amplitude anomalies could be used to separate the shallower and deeper osurces along the proposed fault line. All the anomalies were transferred into the planometric flight line plot (scale 1:47520) and the magnetic anomalies were trended and classified into particular zone types as given in Appendix 4. In addition, magnetic source depths determinations were undertaken, to define the magnetic basement. This data was compiled at the scale of 1:125,000 for both Anabama and Lilydale. The magnetic trends and zones are shown in fig.13, and magnetic basement depth contours are shown in fig.14.

Magnetic Trends

The magnetic trend directions are generally at 060^{o} as described in Part A. A number of smaller amplitude anomalies were resolved in the concealed area have a similar trend.

Significance of the Magnetic Zone Types

The classification of zone types is given in Appendix 4, and the magnetic parameters used as a criteria to determine the zone type are the degree of anomaly continuity (linearity) and the dominant amplitude range representative for each zone.

Type 1 and 2 zones are interpreted to represent weakly magnetic sediments and/or metasediments or granodiorite. The type 2 zone situated in the northwestern corner of Anabama is considered to be a more basic portion of the Anabama Granite. The type 2 zone situated in Lilydale could represent a lithological change in basement or be due to a weakly magnetic material in the overlying sediments, e.g. glauconite in Lower Cretaceous rocks, Thornton (1972).

Type 3 zones are interpreted to represent an increase in the magnetic content of the sediments and metasediments. This rock type is generally restricted to the southern part of Anabama and Lilydale. The type 3 zone, located west of Amateur Dam, is considered to be produced by rocks of Adelaidean age. This statement will be considered later, in the section on ground magnetic traverses.

Type 4 zones. This zone type is considered to come from two different sources depending on their location. The type 4 zones occuring in the Tertiary cover area in Lilydale are considered to be of similar origin with rocks of slightly more magnetic content than those of type 3 zones, whilst those striking northwest-southeast are interpreted as related to dykes and/or faults. The type 4 zone located in areas of Adelaidean rocks, correlate with magnetic bands within the Yudnamutana Sub-Group, probably the tillite (Appila Tillite) or relate to the so called rhyolitic tuffs of (Lower Cambrian age ?) (Thomson pers. comm).

Type 5 zones are interpreted to represent an increase in the magnetic content of the sources outlined by type 4 zones. The group of zone types 4 and 5 located along the southern boundary of the Anabama Granite may represent slightly metamorphosed Yudnamutana sediments. Those type 5 zones to the south of the latter, probably represent either magnetite bands in tillite or intermediate igneous intrusions and extrusive rocks.

Type 6 zones are considered to correlate with more magnetic metasediments than

those in type 5 zones, and with basic rocks. The type 6 zone correlates with poorly magnetic Braemar Iron Formation. The type 6 zone situated west of Cronjie Dam occurs over rocks mapped as Willyama Complex, Currie (1970). Lenses of geothite after magnetite were found outcropping in the Two Brothers area. In addition, it is possible that basic igneous rocks which have not been identified to date may be present. The type 6 zone located in Lilydale, probably is produced by either an iron rich metasediment or a basic intrusion. The source dpeth of this anomaly is 1680 feet (512 m), below ground level. This later zone corresponds to the Quondong Aeromagnetic Anomaly, see ground magnetic traverse 12.
Type 7,8 and 9 zones are considered to represent a progressive increase in magnetite content in the Appila Tillite, i.e. Braemar Iron Formation which is known to crop out in Manunda.Mirams (1962), and Whitten (1970).
Type 11 and 12 zones are considered to represent non-magnetic metasediments and acid igneous rocks. These zones have no definite linearity. The transition between these two zone types is not definite as it is probably due to a gradational increase in magnetite content. The type 11 zone occurs over the Anabama Granite and over the non-magnetic Burra Group rocks located north of Netley Gap Well. The southern boundary of the Anabama Granite is a clearly defined contact zone.
Type 13 zone is considered to be similar to type 5 and 4 zones, with the exception of non-linearity.

Faults

There are two main directions of faulting evident, the first being parallel to the major fold axial direction of the Adelaidean rocks i.e. 060^{o} and the second type can be considered as cross fault trending at 160^{o}.

The features F1 to F4 are possible faults, having small throws, and may be related to the Anabama Fault Zone. The faults F5 and F6 are parallel to the proposed Anabama Fault zone and probably represent either step faults associated with the Anabama Fault Zone or marked lithological changes within the 'basement' rocks.

Magnetic Basement Depth Contours of Anabama and Lilydale (1:63 360 sheet areas) (fig.14).

The source depths of the magnetic bodies below the detector level were obtained by several methods and the results were compared to construct the magnetic basement depth contours of Anabama and Lilydale.

The magnetic basement depth estimates were determined using the half-maximum slope technique as advocated by Peters' (1949) and extended by Moo (1965). Selected anomalies were interpreted using the method of Bean (1966) and the straight slope method of Vacquier et.al., (1951), for comparison of the basement depths.

The basement depths corrected for an assumed uniform ground clearance of 500 feet (152 m) were interpreted to represent two magnetic surfaces, one shallow, less than 1000 feet, and the other surface considerably deeper.

The deeper basement surface shown in fig.14 shows a relatively gentle gradient from surface Adelaidean rocks located in the north to a depth of approximately 7000 feet (2134 m) in the south. This gradient is 1 in 9.05, and probably represents either a very low angle fault dipping at 6°, or a 6° dipping surface between two geological rock systems.

The other magnetic surface is relatively shallow, shown in fig.14, generally not exceeding 1000 ft (305 m) below ground level, with a possible deepening to the south and east. This shallow magnetic surface probably correlates with the undefined basement reported from the seismic data, Seedsman and Kendall (1965). The material comprising this surface has a higher density than the Adelaidean rocks to the north, and probably represent metamorphics of either Willyama or Palaeozoic age.

3. SURVEY PROCEDURES

The geophysical traverses were located from the preliminary interpretation of the aeromagnetic charts and regional gravity contours. The traverses were orientated as far as possible to be at right angles to the known goelogical strike and to use pre-existing tracks.

The original programmed traverses had both magnetic and reconnaissance gravity data recorded.

The detailed survey was carried out between the 17th January 1972 to 11th February, 1972. The details of this survey's personnel and equipment are given in Appendix 1, and survey details and specifications in Appendix 2. The reduction procedures for both the magnetic and gravity data is given in Appendix 3.

4. INTERPRETATION OF THE GROUND GEOPHYSICAL TRAVERSES IN Anabama and Lilydale 1:63 360 SHEET AREAS

The locations of the ground magnetometer traverses and the station locations on the gravity traverses are shown in figures 15 and 16 respectively. A selected number of magnetic relevant bouguer gravity profiles are shown for each traverse in separate plans see figures 17 to 28 inclusive. The magnetic profiles of lines 22 and 24 are not included, as these traverses were more or less along the assumed strike, and are therefore not strictly relevant to this investigation.

The interpretation of the profile data can be divided into two parts: A. magnetic and B. bouguer gravity data.
In addition, a single magnetic traverse Number 12 was recorded across the Quondong Aeromagnetic Anomaly.

A. Details of the Interpretation of the Ground Magnetometer Traverses

All the magnetic traverses, with the exception of traverse 7 (fig.23) showed a general region of high frequency and high amplitude anomalies of comparatively shallow depths on the northern portion of each line. Traverse 7 was not extended far enough to accommodate these former anomalies, since no tracks exist in the area of very dense scrub.

The interpretation for these northern shallow sources, are based on an assumed model of a dipping tabular body. The parameters for selected anomalies on each line were calculated, using a depth conversion factor of 1.8, after the method of Moo (1965). The magnetic susceptibility contrast was estimated from the simplified formular given by Gay (1963); the results are shown in Table 1.

The sources of these anomalies were initially assumed to be produced by one rock type having a mean width of 1405 ± 480 feet and an overall mean magnetic susceptibility contrast of 9.301 ± 10.62 x 10^{-3} cgs units. The latter shows a large standard deviation. These values were then considered to represent two populations based on the magnetic susceptibility contrast.

Population Number	Number of Estimate	Magnetic Susceptibility Contrast (in x 10^{-3} cgs. units)	
		Mean	Standard Deviation
1	5	22.283	10.505
2	11	3.400	1.563

The magnetic susceptibility contrasts of these two populations, assuming that the surrounding country rocks are relatively non-magnetic; and comparable with the magnetic susceptibility values determined for the Braemar Ironstone Formation, as given in Appendix 6. Therefore, it is reasonable to assume that the sources of these anomalies are produced by two types of ironstone formations as advocated by Whitten (1970).

The sources of these anomalies, all appear to have a steep dip towards the north. This apparent dip direction, however may be due to the resultant polarization direction of the remanent components of the earth's past and present magnetic field.

Some of the relatively low amplitude anomalies, included within population 2 were interpreted as a possible fault models. Since some anomalies associated with the Redan Fault, in the Broken Hill area have a sharp negative

TABLE I

INTERPRETED PARAMETERS OF HIGH FREQUENCY, HIGH AMPLITUDE SOURCES
LOCATED ON THE NORTHERN PORTION OF EACH TRAVERSE

Traverse Number	Anomaly Number	Amplitude (in gammas)	Width (in feet)	Depth (in feet bgl.)	Magnetic Susceptibility Contrast (x 10^{-3} cgs. units)	Remarks
1	1	4384	1584	660	16.823	overall composite anomaly
	2	600	6336*	1490*	1.2995*	
2	1	8315	1980	1100+		
				600 (assumed)	23.085	
3	1	1380	1188	440	4.682	
4	1	490	1505	440	15.43	
	2	125	1190	440	3.11	
	3	430	1580	460	13.756	
5	1	2950	2570	390	4.042	
	3	470	1050	660	2.730	possible fault?
6	1	180	1000 (assumed)	935	1.541	
8	1	570	990	370	1.948	
9	1	1360	1390	660	5.933	
10	1	600	550	410	4.110	
	2	480	1290	630	2.177	

* Estimate of overall values of composite anomaly

\+ Considered too deep by comparison with other anomalies. Figures below show a near surface depth assumed.

anomaly associated with the positive, Prof. Boyd (pers. com).

A fault model interpretation, after Grant and West (1965) was used to interpret the magnetic anomaly 1 in line 8, (fig.25). The fault model used assumes that the fault can be represented by a thin semi-infinite slab. The estimates showed that the depth to the top of the fault was 627 ft. below ground level. Assuming a susceptibility contrast of 1.0 x 10^{-3} units, the throw of the fault would be 3545 feet. This throw would be reduced for a higher magnetic susceptibility contrast, e.g. 2 x 10^{-3} cgs. units gave a corresponding throw of 1773 ft. This latter throw is more realistic and fits in with the magnetic basement contours. The position of this fault are the interpreted structures shown in fig.13.

All of the magnetic traverses show an increase in magnetic field intensity towards the south, indicative of a higher magnetic susceptibility for the basement rocks beneath the concealed area of the North Murray Basin. There are two source types in this area, one deep seated and the other shallow in fig.14. This shallow surface correlates with the surface resolved by the refraction seismic data.

The deep seated sources were determined from a regional magnetic profile, which was extracted from the original data for each line as a 4th order polynomial profile. Selected magnetic traverse regional profiles were interpreted to estimate the order of the magnetic susceptibility contrast and their likely depth for two models. The first is a thick tabular body and the second a rectangular slab model. The results are given below:-

THICK TABULAR MODEL

Traverse Number	Amplitude (in gammas)	Width feet)	Depth (feet)	Magnetic Susceptibility Contrast (in x 10^{-3} cgs.units)
1	460	20600	9450 (½ max.slope) 6850 (st.slope)	1.933 1.401
2	600	47520	22600	2.616
6	800	10000 (assumed)	10040 (st.slope)	7.358

RECTANGULAR SLAB MODEL using simplified formular of Grant and West (1965)

Traverse Number	Amplitude (in gammas)	Width (feet)	Thickness of Block	Magnetic Susceptibility Contrast (in x 10^{-3}cgs.units)
1	460	7000	5000 (assumed)	5.952
			10000 (assumed)	2.976
3	600	9360	5000 (assumed)	10.326
			10000 (assumed)	5.163

The source which appears to have a minimum depth of approximately 7000 feet in line 1, (fig.17) deepens towards the east for both models. The magnetic susceptibilities are considerably higher than those expected for the surface Adelaidean rocks. It is suggested that this source is either due to Palaeozoic metamorphics or Pre-Adelaidean rocks at depth.

The high frequency and relatively low amplitude anomalies associated with shallow magnetic basement, are clearly seen on the residual magnetic profiles of the traverses. Selected anomalies of this shallower basement were interpreted assuming thin tabular bodies or ribbon models. The interpreted parameters for a number of anomalies in particular lines are tabulated in Table 2. The results confirm that the sources are shallow and that there are two possible source types i.e. northern and southern types based on the magnetic susceptibility contrasts. These two source types have the following interpreted parameters.

	Number of Anomalies	Width (feet)			Magnetic Susceptibility Contrast (in x 10^{-3} cgs.units)		
		Range	Mean	S.D.	Range	Mean	S.D.
Northern Source Type	7	595 to 1190	919	188	0.332 to 0.465	0.385	0.044
Southern Source Type	6	594 to 2770	1387	753	0.618 to 1.17	0.856	0.199

The northern source type consists of relatively thin sources having a relatively low magnetic susceptibility contrast. These values are comparable

TABLE 2

INTERPRETED PARAMETERS FOR SHALLOW SOURCE ON THE UPPER MAGNETIC HORIZON

Traverse Number	Anomaly Number	Amplitude (in gammas)	Width (in feet)	Depth (in feet bgl.)	Magnetic Susceptibility Contrast (x 10^{-3} cgs. units)	Remarks
1	3	100	1190	600	0.465	
2	2	120	990	390	0.427	
	3	105	990	350	0.34	
	4	75	600	330	0.381	
3	2	165	690	165	0.359	
4	4	105	5150*	836	5.95*	
5	2	170	990	250	0.393	
6	2	290	1290	413	0.852	
7	1	180	1900	800	0.694	
9	2	170	690	275	0.618	possible fault
	3	145	2770	1540	0.737	
21	1	80	990	450	0.332	possible fault is reduced
	2	320	590	220	1.066	

* The anomaly contains at least 5 unresolved sources, i.e. if the width is reduced by a factor of five, the magnetic susceptibility would be 1.17 x 10^{-3} cgs. units.

with those determined for the acid volcanics (Lower Cambrian or Ordovician age), given in Appendix 6. These results suggest that there is a possible thick zone of these rock type situated just south of the Adelaidean rocks, considerably larger than resolved by the geology.

The southern source type, located to the south of the northern type have magnetic susceptibilities comparable with those determined for the Nairne Pyrite Member (of the Kanmantoo Group) and associated rocks, see Appendix 6.

This should be verified with a further systematic study of the magnetic susceptibilities of the Kanmantoo Group from surface samples and diamond drill cores. Lower Cambrian basalts, equivalent to the Truro Volcanics, could also be the source rocks for these anomalies.

b. Magnetic Traverse 12 - Quondong Aeromagnetic Anomaly

The Quondong Aeromagnetic Anomaly is located between Beaver and Yabba Dams in Lilydale. The aeromagnetic contours of this anomaly and the location of vehicle magnetometer traverse 12 are shown in fig.29. This anomaly has a strike direction of 060 degrees, a strike length of 6 miles (9.7 km), and is classified as a zone type 6 in fig.13. It is considered to be produced by either iron rich metasediments or a basic intrusion associated with a fault. The northeastern and southwestern extremities of the anomaly appears to be determined by dislocations, probably cross faults.

The initial interpretation of two flight lines orientated north-south across this anomaly gave the following parameters for a tabular body model. A depth conversion factor of 1.75 was used, after the method of Moo (1965).

Flight Line Number	Amplitude (gammas)	Width of body (feet)	Depth (feet) (fig.1)	Magnetic Susceptibility Contrast (x 10^{-3} cgs.units)
44 (South)	800	3560	870	2.790
45 (North)	820	3375	655	2.555

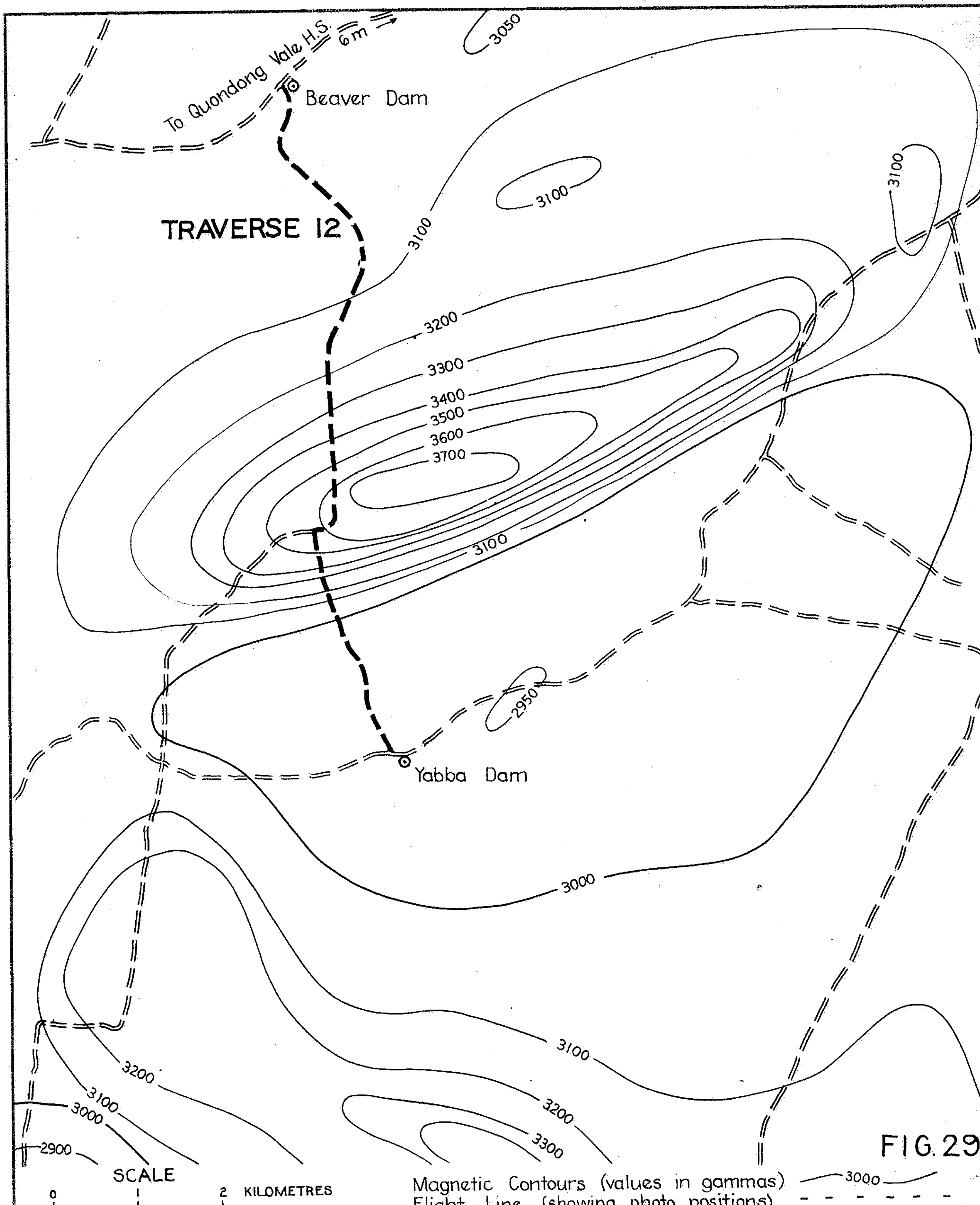


FIG. 29

	DEPARTMENT OF MINES — SOUTH AUSTRALIA	Scale: 1:63360 (orig.)
Compiled: R Gerdes	ANABAMA FAULT PROJECT	Date: 23 Oct 1972
Drn. TJE / Ckd. A.F.	QUONDONG AEROMAGNETIC ANOMALY	Drg. No. S10147 FG

300 1.72 C5552

The interpreted dip of the tabular body was 78^{o}N, assuming that no remanant component exists. The depth using the straight slope method of Vacquier et al (1951) for a finite prismatic body gave a depth of approximately 1000 feet, which is deeper than that given by the tabular body model.

GROUND MAGNETIC TRAVERSE 12

The original, filtered, assumed regional and residual total magnetic ground profiles fer traverse 12 are shown in fig.30. This anomaly appears to be comprised of two possible unresolved sources, a relatively thin source with an amplitude of approximately 1000 gammas and a low amplitude anomaly situated on the northern flank of the other anomaly.

Two possible models were assumed, for the main anomaly, the first being a dipping tabular body and the second model a fault. The details of these models are given as follows:

MODEL 1 A Dipping Tabular Body

The overall anomaly interpreted for a dipping tabular body gave the following source parameters:

Amplitude	Width of Body	Depth of Body	Dip of Body	Magnetic Suscept-ibility Contrast (x 10^{-3} cgs.units)
1106	3690	1025	71^{o}N	2.894

The tabular dipping model, assuming there as no remenant component, dips at 71^{o}N, which agrees with the former dip estimate from the aeromagnetic profile. If, a strong remenant component is present, the resultant polarization vector direction of the induced and remenant component, dips at an angle ranging between 71^{o} to 78^{o}N for a vertical tabular body.

The magnetic susceptibility contrast of this body ranges between 2.55 to 2.89 x 10^{-3} cgs. units. This susceptibility range is low compared with the measurements obtained for the Braemar Iron Formation, (see Appendix 6) and in addition the range appears to be higher than those measured for the Nairne Pyrite

Member, of the Kanmantoo Group. There are two possibilities for the source of these anomalies.

(i) A possible basic intrusion

(ii) If the source rocks are of the Nairne Pyrite type, the rocks would have to contain more magnetite in preference to pyrite.

MODEL 2. A Fault

The overall anomaly was interpreted as a thin horizontal step, for the fault model, after Grant and West (1965). The depth to the top of the semi-infinite slab is 2066 feet (630 m) and assuming the following magnetic susceptibilities the throw of the fault is as follows:

Assumed magnetic susceptibility Contrast (x 10^{-3} cgs units)	Throw of Fault (in feet)
2.5	8888 feet (2709 m)
5.0	4444 feet (1355 m)

The depth to the top of the slab is 2 times greater than the interpreted depths to basement, as defined by the seismic refraction data i.e. approximately 1000 ft.(fig.1). The estimated throw of this fault is unrealistic in this area, and can only be reduced by increasing the magnetic susceptibility contrast. In this area, faults are known to exist associated with the Canegrass Lobe. The more satisfactory interpretation is for a basic intrusion possibly intruded at the intersection of a major system of faults. As this intrusion lies on the main north south basement feature as defined from the 6th order surface, and at the intersection of major sub-surface faults trending 060^{o} and 160 degrees. These fractures and the presence of the basic intrusion at the intersection may be of considerable economic importance.

c. Details of the Interpretation of the Bouguer Gravity Traverses

All the bouguer gravity profiles show an increase in values towards the south see fig.17 to 24 inclusive. This gradient is considered to be independent of the strong negative effect of the Anabama Granite Bouguer Anomaly.

The interpretation of the anomalies on the bouguer gravity traverses can be divided into three sources types which are as follows:

(I) The near surface sources located on the northern portion of most of the gravity traverses. These sources are comparable with the high frequency high amplitude magnetic anomalies, and are interpreted for a vertical ribbon model, by the method given by Grant and West (1965).

(II) The interpretation of the regional gradient as shown in selected traverses. This assumed regional gradient was interpreted for firstly, a wedge shaped model, representing either a dipping interface or thrust model; and secondly a gradational density contrast model as developed by Gendzwill (1970). "This latter model assumes that there is a linear change of density between two adjacent slabs of constant density. This model is applicable where there exists a possible gradual horizontal change in density between two rock types, rather than a discrete density change across a single boundary," Gendzwill (1970).

(III) Located just south of the near surface sources of (II) is local gravity low, assumed to represent a zone of acid volcanics as delineated by the magnetic interpretation. On the southern edge of the acid volcanic belt is a near surface anomaly characteristic of a fault. Selected anomalies on the traverses were used to determine the likely throw and depth of this anomaly.

5(a) Interpretation of near surface located at the northern extremity of the traverses

The near surface sources are apparent in traverses 2 to 6 inclusive, and an interpretation was undertaken in line 1, (fig.17) as a representative sample. The shape of these anomalies indicate that the sources are vertical sheets. The model assumed for the estimate of depth, width and density contrast is vertical ribbon model, as outlined by Grant and West (1965).

The anomaly numbers for traverse 1 are given in fig.17 and the interpreted parameters for each anomaly are tabulated below.

Anomaly Number	Amplitude (in milligals)	Width (in feet)	Depth (in feet)	Length (in feet)	Dip (in degrees)	Density Contrast (in gm/cm^3)
1	0.95	2640	935	2338	90	0.059
2	0.775	1056	210	1173	10S	0.081
3	2.0	2500	590	2500	90	0.124
4	5.3	3564	535	360	90	1.46

Assuming a density of 2.65 gm/cc for the Adelaidean country rocks, then these anomalies would have densities ranging between 2.71 to 2.77 and one of 4.11 gm/cc, and are comparable with the range of densities determined for the Braemar Iron Formation, see Appendix 5.

The gravity lows in this area indicate the presence of low density rocks comparable in density with those obtained for the acid volcanics, see Appendix 5.

The other sources in the northern portion of each of the traverses are comparable with those interpreted on traverse 1.

(ii) Interpretation of the Regional Profiles

(a) Fault Model

The interpretation results for a fault model, representing a dipping wedge, based on the method advocated by Grant and West (1965), showed a low angle fault plane, dipping between 20° to 30°, at a depth greater than 3000 feet. The block has an estimated thickness of between 7000 to 20,000 feet, and the density contrast ranges between 0.08 to 0.14 gm/cc. This feature most probably represents a simple inclined lithological contact between two major rock units, such as a possible hinge.

(b) Gradational Density Contrast Model

The model assumes that there is a linear change of density (gm/cc/km) over a horizontal distance w (in km) between two density slabs having densities d_1 and d_2 respectively. The depth to the top of the slab is H_1 and the depth to the bottom of the slab is H_2, thereby defining the thickness of the slab to be $H_2 - H_1$. This model represents geologically a change in density for a steeply dipping sequences of beds, a change in regional metamorphism, or a wide complicated fault zone. It was assumed for the model that H_1 was small compared with w, i.e. $\frac{H1}{W} = 0$. The interpreted parameters for each traverse investigated are shown in Table 3.

The mean thickness of the slab, neglecting the estimate values for lines 1 and 5, is 3.8185 ± 2.11 km. There is a tentative increase in the slab thickness towards the east, and an increase in the thickness of the transition zone, from west to east. The mean thickness of the gradational density zone is 3.535 ± 3.736 km and the mean total change in density is 0.0718 ± 0.0395 gm/ce.

(iii) Interpretation of possible near surface faults, located in the southern edge of the assumed acid volcanic belt.

The anomaly 6 in line 1 (fig.17) was interpreted to be a near surface fault, using the method advocated by Grant and West (1965). The interpretational parameters are as follows:

Amplitude (in milligals)	Depth to top of fault (in feet)	Throw of fault (in feet)	Dip of fault plane (in degrees)	Density contrast (gm/cc)
3.95	93	2314	30^{o}S	0.71

These results indicate a wedge shaped mass of material, dipping south having a density contrast of 0.71 gm/cc. The density of the rocks on the southern side, assuming that the acid volcanics are present to the north, would give a density of 3.21 gm/cc, and conversely if the Adelaidean rocks are present, the corresponding density would be 3.38 gm/cc. These values are considerably higher than the density of the gneisses and greywacke of the Kanmantoo Group. These densities were estimated to be 2.77 and 2.68 gm/cc from core samples from the Berri South No.1 and Berri North No.1 drill holes recorded by the BMR (1964) and

TABLE 3

GRADATIONAL DENSITY CONTRAST MODEL

Line No.	Depth H_1 (in km)	Depth to Bottom of Slab H_2 (in km)	$H_2 - H_1$ (in km)	Distance of Density gradient (in km) w	Total Density Charge (gm/ce)	
1	0	11.542	11.542	0.1039	0.0569	H1/w = 0
2	0	0.8875	0.8875	1.065	0.1506	H1/w = 0
	0.0905	0.754		0.905	0.069	H1/w = 0.1
3	0	3.5292	3.5292	0.4235	0.0919	H1/w = 0
4	0	2.191	2.191	0.76695	0.0598	H1/w = 0
	0.07437	1.85925	2.191	0.7437	0.06948	H1/w = 0.1
5	0	12.93?		2.586	0.1038	Questionable H1/w = 0
6	Not done					
7	0	8.35	7.35	9.56	0.016569	H1/w = 0
	1.0158	7.936	6.92	10.1589	0.01841	H1/w = 0.1
9	0	2.2038	2.2038	7.71144	0.1019	H1/w = 0

Beach Petroleum (1967). Respectively the alternative is Cambrian limestone and dolomite which have a density range of 2.65 to 2.7 gm/cc, based on the Minlaton and Stansbury West Stratigraphic Drill Holes in the Shelf area. If metamorphosed as marble according to Dobrin (1960) is considered to have a maximum density of 2.88 gm/cc. This latter value should be verified by density determinations of surface and drill hole sampling of the metamorphosed Cambrian limestone and dolomite of the Kanmantoo Group.

This high density feature which is also present in lines 2 and 3 (figs. 18 and 19) appears to extend eastwards across the area. This feature is relatively non-magnetic, except for the type 3 zone which is located south of lines 7 and 9, and which may be a possible basic intrusion located on the northern side of high density feature. It could either be interpreted as a general lithological change in the shallow basement i.e. Limestone & Dolomite or a fault.

In addition to this deeper feature, a shallow fault feature was also interpreted in line 2, (fig.18), to have a throw of 540 ft. at a depth of 215 ft. and a dip of 60^{o}S with a density contrast of 0.017 gm/cc.

CONCLUSIONS AND RECOMMENDATIONS

The qualitative magnetic interpretation of the aeromagnetic contours indicate the existence of three possible magnetic provinces based on the order of the magnetic zone types and trend directions. These provinces are separated by probable magnetic lineaments. The magnetic province located beneath the Northern Murray Basin is considered distinct from those located in the Adelaide Geosynclinal Zone. It is characterised by rocks having generally higher magnetic susceptibilities and specific gravities than those recorded for the overall Adelaidean rocks, excluding the Braemar Iron Formation.

The residual gravity contours and regional magnetic zone types reflect the general trends of the Olary Arc, in the areas of outcropping Adelaidean rocks. Both types of data, however, indicate the presence of a relatively high density and a relatively higher magnetic feature to the south of magnetic lineament AA', which includes the Canopus Gravity High.

This area appears from the geophysical data to be a province showing lithological variations with a dominant northeast-southwest strike orientation. Fractures or discontinuities subparallel the general trend direction of this basement zone, and a secondary set of assumed fractures oriented north-south and northwest-southeast.

The dominant feature PP' located along the northwest edge of the Canopus Gravity High (fig.11) is outlined by a marked gravity gradient, a zone of basics resolved from the magnetic data are located along this line. This feature was interpreted to represent an overthrust from the south, emplacing denser and more magnetic rocks than the Adelaidean to the near surface. The rock types in this overthrust wedge are metamorphics of either Paleozoic or Willyama age, with basic igneous intrusions associated with this thrust. Binks (1970) outlined thrusts in the southeastern corner of ORROROO produced by compression from the southeast.

The Canegrass Permian Basin is outlined by the residual gravity contours, and three low magnitude gravity lows located north of the former may be correlated with either small sub-basins, perhaps containing Permian sediments or areas of granite intrusions.

Three distinct directions of dislocations or discontinuities were resolved from both the magnetic and bouguer gravity contoured data, which are grouped as follows:

Group No.	Trend Direction	Remarks
1	030 to 060 degrees	Dislocations Parallel to Adelaide Fold Belt and Hamley Fault.
2	140 to 150 degrees	Cross faults or Tear Faults.
3	North-South	Major Faults e.g. Morgan, Florienton and Chowilla faults.

The deep basement north-south structure resolved from the regional bouguer gravity contours, probably controlled the eastern edge of the Adelaide Geosyncline sedimentation. Some near surface structural features have this trend direction.

It is worthy of note, that the Anabama Granite occurs at the intersection of this deep seated north-south basement feature with near surface fractures orientated northwest-southeast and northeast-southwest. Similarly, the Quondong Aeromagnetic Anomaly, (figure 2 and 29) interpreted to be produced by a basic intrusion, is located on this north-south feature and has a similar surface fracture system, considered to control this basic body. It is recommended that the presence of the basic intrusion and the intersection of the fracture system may be of considerable importance as an area for possible economic mineralization.

The magnetic basement depth contours of Anabama and Lilydale (fig.14) indicate the existence of two magnetic basement surfaces. The deeper basement surface dips at approxiamtely 6 degrees north to a depth of 7000 feet below ground level. The shallower basement surface has a steep gradient in the north probably associated with small scale faults and to the south is generally less than 1000 feet below ground level.

This shallow basement surface correlates with the high velocity basement resolved by the refraction and reflection results of the Hyperna and Mannum-Radium Hill Power seismic lines; and can be considered to relate to the unweathered metasediments, below those intersected by the Mines Administration rotary drill holes.

The rock types encountered in these rotary drill holes are metasediments; consisting of phyllites, slates and hornfels. The metamorphic grade of this basement is higher than that recorded in the Adelaidean rocks situated to the north, which are green schist facies. This suggests, that this basement is either Kanmantoo type metamorphics (Paleozoic Metamorphics) as advocated by Thornton (1972) or Willyama Metamorphics. The age of this metamorphic horizon could only be reached by radiometric age determination, Thomson (pers. com).

The magnetic susceptibility contrasts interpreted from selected anomalies of this shallow basement suggests two source types. In the north, the susceptibility values are comparable with those obtained from the acid volcanics, whereas those located in the south are comparable with those determined from the Nairne Pyrite Member of the Kanmantoo Group.

These correlations are speculative as the latter should be verified with a more systematic study of the magnetic susceptibility and specific gravities of the whole Kanmantoo metasediments. Unfortunately, no magnetic susceptibility data is available for the Willyama Metamorphics.

A summary of the interpreted structure of Anabama and Lilydale compiled from the gravity and magnetic data is given in a composite plan as shown in fig.33. This shows the distribution of interpreted possible basic intrusions, the position of the thrust in Lilydale and the rather complex area located in the region of the magnetic lineament AA', i.e. Anabama Lineament in Anabama.

The correlation of both the gravity and magnetic profile data are good (see figs.31 and 32) and the interpreted results of this data confirm the existence of the two types of Braemer Iron Formation, as advocated by Whitten (1970).

A belt of shallow magnetic anomalies located to the south of the zone of Braemar Iron Formation have magnetic susceptibilities comparable with the acid volcanics, and probably include some basic intrusions; which may relate to local faults trending northeast-southwest.

Located between the belt of Braemer Iron Formation and the later zone of volcanics, is a region of lower density rocks, which correlate with a magnetic zone type 11. This zone shows that the rocks are both low in density and magnetic susceptibility. The significance of this zone is important as it may represent either a local thickness of unconsolidated Tertiary or Quaternary sediments, i.e. possible environment for sedimentary uranium or a zone of leaching producing the low density material, associated with faulting, diapirism or granite. It is recommended that further geophysical work, such as I.P., resistivity and perhaps seismic refraction traverses be undertaken across this zone, together with geochemical auger holes to verify the existence of economic mineralization.

The so called extension of the Redan Fault, the Anabama Fault as proposed by Thomson (1969), would be a major fault or lineament controlling the distribution of Adelaidean rocks and would effectively be the controlling edge of the Murray Basin sediment.

At the present state of knowledge a number of models were used to interpret this zone, as follows:-

(a) The overall gradient as defined by the magnetic basement depth contours indicate a surface dipping southwards at 6 degrees. This could simply represent a hinge zone, with secondary down faulting to the south in a series of steps.

(b) The interpretation cross sections of Traverse 1 based on dipping tabular and prismatic bodies for both the bouguer gravity and ground magnetic profile data are shown in fig.34. This illustrates a simple dipping surface of both magnetic and gravity models. At the control point E is a major dislocation. The interpretation of the magnetics indicates a deep fracture at a depth of 7000 feet below ground level with a susceptibility contrast of 2.976 x 10^{-3} cgs. units which extends to a depth of 17,000 feet b.g.l.Whereas the bouguer gravity model is a near surface wedge of higher density material having a density contrast of 0.71 gm/cc. i.e. density of 3.38 gm/ce if Adelaidean rocks are present.

The latter may represent either a wedge of high density and non magnetic material, such as Dolomites and Limestones. This is comparable with the hinge zone concept <u>or</u> a thrust wedge. The highly magnetic block can be considered as the deep seated contrast produced by a fault, controlling the mechanism of the hinge.

(c) A gradational boundary is possible between two major geological units, with a mean thickness of the gradational zone of 3.54 ± 3.74 km. This gives a total density change of 0.072 ± 0.04 gm/cc, representing the density of the rocks to the south as 2.74 gm/cc assuming a density of 2.67 gm/ce for the Adelaidean rocks.

Geologically the gradational boundary is not just a simple transitional change between two metamorphic lithological units, but inclues a complex zone of small scale faults, intruded and extruded by both acidic and basic igneous rocks.

The geophysical interpretation has shown that this zone is a complex region consisting of small scale faulting, with associated basic intrusion and further complicated by acid volcanic rocks. The geophysical complexity of this zone is shown in figures 33 and 34. Insufficient geological control exists in this concealed area. Extensive geological investigations including a number of stratigraphic holes are required before a satisfactory geophysical explanation can be given. In addition, it is considered worthwhile to interpret the detailed aeromagnetic data flown in Mutooroo and Oakvale by Geophysical Resources Development Co. Ltd. in 1969, McIntyre (1970) as more geological control becomes available for this Fault Project.

RAGerdes

RAG:MFV
19th March, 1973

R.A. GERDES
ASSISTANT SENIOR GEOPHYSICIST
EXPLORATION GEOPHYSICS SECTION

REFERENCES AND BIBLIOGRAPHY

Bean, R.J., 1966. A rapid graphical solution for the Aeromagnetic Anomaly of the Two-Dimensional Tabular body. Geophysics 31(5) pp.963-970.

Binks, P.J., 1971. The Geology of the ORROROO 1:250 000 map area. Rep. Invest. geol. Surv. S. Aust. No.36

Blumer, J.M. and Webb, J.E., 1965. Final Report on Gravity Survey of E.P.L.36. South Australia. S. Aust. Dept. Mines Env. 498 (open file).

Bryan, R. and Wecker, R., 1971. Exploration Report SML 282 (LILYDALE) Period 1/4/69 to 31/3/71 Mines Administration Pty. Ltd. S. Aust. Dept. Mines. Env. 1422 (open file).

Coats, R.P., 1964. Umberatana Group (new name). Quart. geol. Notes geol. Surv. S. Aust. No. 9 Jan.1964.

Compston, W., Crawford, A.R. and Bofinger, V.W., 1966. A Radiometric Estimate of the Duration of Sedimentation in the Adelaide Geosyncline, South Australia. J. geol. Soc. Aust. V1, 13 (1) pp.229-276.

Cooper, J.A., 1972. Isotopic age determinations and stratigraphic problems - a case history - in Stratigraphic Problems of the Late Precambrian and Early Cambrian pub. the Univ. of Adelaide. Centre of Precambrian Research. Special Paper No.1.

Currie, A.L., 1970. ANABAMA 1 MILE SHEET. PRELIMINARY GEOLOGY. S. Aust. Dept. Mines Plan 70-726 F1. (Unpublished). Report (not completed).

Dobrin, M.B., 1960. Introduction to Geophysical Prospecting. Mc.Graw Hill Book Co. Inc. New York 2nd Ed.

Drew, M.F., Paten R.J. and Gray, H.D., 1969. Final report in the Sunset Seismic Survey. P.E.L. 3 South Australia. P.E.P. 64, Victoria by Mines Administration Pty. Ltd. for Associated Australian Oilfield N.L. S. Aust. Dept. Mines Env. 1198 (open file).

Gendzwill, D.J., 1970. The Gradational Density Contrast as a Gravity Interpretation Model. Geophysics 1970 pp. 270-278.

Gerdes, R.A., Young, G.A., Cameron, B.F. and Beattie, R.D., 1970. Sandstone and Youanmi Airborne Magnetic and Youanmi Airborne Magnetic and Radiometric Survey, Western Australia, 1968. Bur. Miner Resour. Aust. Geol.Geophys. Rec. 1970/2 (Unpublished).

Gerdes, R.A., 1972. Ground Total Magnetic Intensity Reconnaissance Traverses in the East Bute Area. Blyth 1:63 360 sheet area. S. Aust. Dept. Mines Rep. Bk.No. 72/59.

Grant, F.I. and West F., 1965. Interpretation Theory in Applied Geophysics. Mc. Graw Hill Book Co. Inc. New York 1st. Ed.

Hosking, A.J., 1970. Anabama Hill. S.M.L. No.262 Progress Report to 31st May, 1970. Asarco (Aust.), Pty. Ltd. S. Aust. Mines Dept. Env.1096.

Jarre, G.A., 1971. Final Report S.M.L. 555 (Brady's Dam) Mines Administration Pty. Ltd. S. Aust. Dept. Mines Env. 1644 DM.385/71

Kendall, G.W., 1965. Report on a Seismic Refraction and Reflection Survey in the Northern Portion of the Murray Basin in South Australia 1965. S. Aust. Dept. Mines Rept. Bk.No. 61/112.

Mason, M.G., 1966. Report on Nairne Pyrite Deposit, Bruckunga. Hd. Kanmantoo. Client Nairne Pyrites Pty. Ltd. S. Aust. Dept. Mines Rept.No. 66/119 (4 parts).

Mawson, D., 1912. Geological investigations in the Broken Hill area. Mem. R. Soc. S. Aust. Vol. 4 (4) pp.211-319.

McIntyre, I.A.B., 1970. Preliminary Report on the Results of Interpretation of the Airborne Magnetometer and Spectrometer Survey carried out by G.R.D. on behalf of Longreach Minerals N.L. in the Radium Hill Area of South Australia. in Annual Report on S.M.L. 274 March 1969 to February, 1970, by Denholm L.S. of Longreach Metals No.

Liability. S. Aust. Dept. of Mines Env. 1178 (open file).

Mirams, R.C., 1961. Field Relationships of the Anabama Granite. Trans. R. Soc. S. Aust. Vol. 85, pp. 121-131.

Mirams, R.C., 1962. The Geology of the Manunda Military Sheet. (Explanation of the Geological Map). Rept. Invest. geol. Surv. S. Aust. No.19.

Moo, J.L., 1965. Analytical Aeromagnetic Interpretation. The Inclined Prism. Geophysical Prospecting 23(2).

Parker, Gay S. Jr., 1963. Standard Curves for Interpretation of Magnetic Anomalies of Long Tabular bodies. Geophysics 23 (2) pp. 161-200.

Peters, L.J., 1949. The direct approach to magnetic interpretation ends its practical application. Geophysics 14(3).

Pilkington, G., 1971. Report on the Anabama Hill induced Polarization Survey conducted during March and April, 1971. S. Aust. Dept. Mines Rept. Bk. No. 72/15.

Ramakrishna, B.N., 1972. Netley Hill Induced Polarization Survey. S. Aust. Dept. Mines Rept. Bk. No. 72/197.

Satkoski, J., 1970. Final Report of Special Mining Lease No. 263. Netley Hill; Asarco (Australia) Pty. Ltd. S. Aust. Dept. of Mines Env.1088.

Seedsman, K.R., 1963. Report on Reconnaissance Seismic Surveys in the Northern Portion of the Murray Basin in South Australia, 1963. S. Aust. Dept. Mines Rept. Bk. No. 58/83 (unpublished).

Stranton, R.L. and Russell, R.D., 1959. Anomalous leads and the Emplacement of Lead Sulphide Ores. Econ. Geol. Vol. 54, pp. 588-607.

Taylor, B.J., 1972. Progress Report of Geophysical Investigation of Netley Hill Prospect, S. Aust. Dept. Mines Rept.Bk.No. 72/130.

Thomson, B.P., 1966. The Lower Boundary of the Adelaide System and Older Basement Relationships in South Australia. J. Geol. Soc. Aust. Vol. 13 pt. 1 pp. 203-228.

Thomson, B.P., 1969. The Cambrian Crystaline Basement in Parkin, L.W. (Ed.) 1969. Handbook of South Australian Geology. Government Printer, Adelaide, Ch. 1. pp. 33-35.

Thornton, R.C.N., 1972. Hydrocarbon Potential of Western Murray Basin and Intrabasins. S. Aust. Dept. Mines Rept. Bk.No. 72/20 (unpublished).

Tucker, D., 1972. PhD. Thesis. ADELAIDE University (unpublished).

Vacquier, V., Steerland, N.C., Henderson, R.G. and Zeitz, I., 1951. Interpretation of Aeromagnetic Maps Geol. Soc. America Mem. 47, 151 p.

Webb, J.E., 1959a. Braemer 1 mile sheet, Aeromagnetic Map of Total Intensity. Geol. Surv. S. Aust.

Webb, J.E., 1959b. Manunda 1 mile sheet, Aeromagnetic Map of Total Intensity. Geol. Surv. S. Aust.

Webb, J.E., 1970. Report on Airborne Radiometric survey Cockburn and Lilydale Areas. South Australia for Mines Administration Pty. Ltd. by Austral Exploration Services Pty. Ltd. S. Aust. Dept. Mines Env. 1260.

Wecker, R., 1971a. Final Report S.M.L.569 (Pine Valley) Mines Administration Pty. Ltd. S. Aust. Dept. Mines Env. 1696/1.

Wecker, R., 1971b. Summary of Exploration S.M.L.416 (Postmark) Period 8/2/71 7/8/71. Mines Administration Pty. Ltd. S. Aust.Dept. Mines Env. 1403.

Wightman, W.E., 1972a. Anabama Hill Induced Polarization Survey No.3. S. Aust. Dept. Mines Rept. Bk. No. 72/133.

Wightman, W.E., 1972b. Netley Hill Induced Polarization Survey No.2. S. Aust. Dept. Mines Rept. Bk.No. 72/226.

Wilson, A.F., Compton, W., Jeffrey, P.M. and Riley, G.H., 1960. Radioactive Ages from the Pre-Cambrian Rocks in Australia. J. Geol. Soc.

Aust. 6 (2) pp. 179-195.

Whitten, G.F., 1962. Investigation of the Razorback Ridge Deposit. S. Aust. Dept. Mines (unpublished).

Whitten, G.F., 1966. The Geology of some South Australian iron deposits. M.Sc. Thesis Univ. Adelaide (unpublished).

Whitten, G.F., 1970. The Investigation and Exploitation of the Razorback Ridge Iron Deposits. Rept. Invest. geol. Surv. S. Aust. No.33

Young, G.A., 1963. CHOWILLA Airborne Magnetic and Radiometric Survey S.A., 1961. Bur. Miner. Resour. Aust. Geol. Geophys. Rec. 1963/25 (unpublished).

APPENDIX I

PERSONNEL AND GEOPHYSICAL EQUIPMENT

PERSONNEL

R.A. GERDES	Party Chief
R.S. TURNER	Senior Technical Officer
P.J. THOMAS	Field Assistant
S.N. SHEARD	Student Geophysicist (Flinders University)
S. CARR	Student Geologist (Adelaide University)
W. McCALLUM	Student Geophysicist (Adelaide University)
N. EDWARDS	Surveyor

VEHICLES

4 x 4 Land Rover DM 168 with magnetometer trailer

4 x 4 Land Rover DM 85

4 x 4 Land Rover Flat-top DM 25

Caravans Nos. 43, 44 and 66.

EQUIPMENT

MAGNETOMETERS

Elsec Proton Precession Total Force Magnetometer mounted on vehicle and trailer.

Base station, Elsec Proton Precession Magnetometer.

GRAVITIMETERS

Sharpe C.G.2. No.201

World Wide No. 101

Barometers

Two Aneroid microbarometers. Mechanisms Ltd. one of these used at the base station.

APPENDIX 2

SURVEY DETAILS AND SPECIFICATIONS

MAGNETICS

The Elsec Proton Precession Total Force Magnetometer was used to measure total magnetic intensity continuously along tracks. The detection bottle was located on a boom, which was mounted on a trailer. This trailer was towed at approximately 5 m.p.h. behind a landrover carrying the magnetometer, electronics, digital analogue converter, and recorder. The data was recorded directly onto a chart.

The magnetometer was generally used to measure the time of cycle time of 256 cycles, with the exception of line 3, with the time of 512 cycles.

The magnetometer traverse was located by recording the mileages, location of fences (gates), track intersections, dam sites and changes in track overall orientation. Most of these bush tracks had random variations in direction, due to trees and man made fences. The time was recorded for each traverse so that the daily diurnal variation correction could be applied to the data. This diurnal variation was recorded by a proton magnetometer at a base station, camp site at Cronjie Dam.

HEADING ERRORS FOR LANDROVER AND TRAILER

A test for the vehicle heading error was determined by orientating the vehicle angles with respect to magnetic north. This determination was undertaken in an area of relatively undisturbed magnetic field, located one mile south of Cronjie Dam on line 3.

The corrections for vehicles and trailers heading errors with orientation are given below for a total count rate of 10 278 for 256c/s.

Direction of Vehicle and Trailer (degree)	Heading Error (Gammas, with respect to the north direction)
358	0
22	10
41	30
87	-20
139	40
178	40
207	70
222	70
268	0
323	20
358	0

The diurnal variation over this period of time was assumed to be zero.

GRAVITY

The reconnaissance gravity stations were established at intervals of ½ mile along the traverses. The end points of each traverse were marked with a star dropper. Each traverse was composed of a number of loops, which were used to control instrumental drift. Detailed gravity stations were established at intervals of 1/10 mile along parts of the lines, and tied to the half-mile stations.

The elevations of the ½ mile stations were obtained barometrically and were recorded with the gravity values and then repeated on the return leg of the loop. The barometer readings were taken at all times on the front seat of the land-rover. The local air pressure variation was recorded at a base station.

The detailed gravity stations at a station interval of 1/10 mile were optically levelled by N. Edwards (Surveyor, South Australian Department of Mines).

The lines 4,5 and 6 are tied to Lands Department Bench Mark 39 (M.S.L.(1)) located on the Radium Hill-Mannum Power line. The other lines 1,2,3,7 and 9 are tied barometrically to the other three lines at station 1 of each lines, except line 1, where station 21 was used.

The observed gravities were tied to B.M.R. helicopter stations on Lands Department Bench marks, which are as follows:-

B.M.R. Station Numbers	Lands Department Bench Marks	Observed Gravity (milligals)	Elevation feet (M.S.L.(1))
7007.0035	BM.35	979 541.71	131.06
7007.0037	BM.37	979 531.11	148.16
7007.0039	BM.39	979 525.24	154.68

The gravity meters were calibrated before and after the survey. Gravitimeter No.101 were showing high drift gradients during the latter part of the survey. This drift was found to be due to a leak in the vacuum system of the gravitimeter.

The calibration was performed over the Bureau of Mineral Resources calibration range between stations ACS1 and ACS2 which has a gravity difference of 62.612 milligals. The calibration constants of each gravitimeter is given below:-

Calibration Constants

Model	Date	Calibration Constant
Sharpe Prospecter CGS2.	7/1/72	0.1054 mgnls/div.
Meter No.101	22/2/72	0.1054 mgnls/div.
World Wide	7/1/72	0.1080 mgnls/div.
Meter No.101	22/2/72	0.1082 mgnls/div.

DETAILS OF SURVEY TRAVERSES

Magnetics

Number of Magnetic Traverses 15

Mileage of Magnetic Data	138.1 miles (222 Km)
Sampling Interval	approximately 100 feet (30.48 m)

Gravity Data

Number of Gravity Traverses	8
Mileage of Gravity Data	97.85 miles (157.5 km)
Station Interval	
Reconnaissance	½ mile
Detail	1/10 mile
Number of Gravity Stations at ½ mile intervals	203
Number of Gravity Stations at 1/10 mile intervals	164
Number of gravity Stations at ¼ mile intervals	9
Number of Gravity stations at 300 foot intervals on line 7	10
Total Number of Gravity Stations	389

APPENDIX 3

REDUCTION OF DATA

A. MAGNETIC DATA

The magnetic traverses are topographically controlled by means of mileages measured with the vehicle speedometer to fixed points; such as fence intersections, tracks, dams, gates, changes in track orientation, and aerial photographically identified points at the beginning and end points of each traverse.

The magnetic data for each particular traverse was reduced by a computer programme called MOBMAG, which was developed by G. Pilkington (Mathematical Geophysicist) in Fortran IV from the BUTEMAG computer programme. The data was recorded in the same way as that used for BUTEMAG, Gerdes (1970), with the addition of the heading error and diurnal variation being incorporated within the programme. The heading error is defined as the angle between a section of the traverse and magnetic north, and is dependent on the direction that the vehicle was heading on the traverse. This direction was indicated by a predetermined notation on the computer cards.

The heading error angle was calculated from the distance between two points in the profile and the perpendicular distance from a reference datum, which was also used in the latitude correction, (9 gammas per mile assumed). The heading error was determined from the estimated orientation of the portion of the traverse. The value of the heading error for a particular angle was linearly extrapolated from the values obtained in the heading error test.

The reduced magnetic data in gammas showed considerable high frequency noise due mainly to the following:-

(1) The magnetic noise produced by variaitons in the track direction and distances from a fence line running parallel to the traverse.

(2) Gates.

(3) Water pipe lines.

(4) A number of tracks showed marked irregular fluctuations in local orientation, which was not corrected for by the sectional heading error. If the maximum misorientation of the track is assumed to be 45 degrees, then the maximum magnetic noise produced by the uncorrected heading error is 11 gammas.

This noise was removed by a Fourier Analysis filter, before a 4th Order Polynomial curve was fitted to selective portions of the filtered data. The Polynomial curve was obtained using a least squares technique. The data for the profiles was computer plotted by a sub-routine called MAGPLOT, which G. Pilkington had incorporated in the program MOBMAG.

B. GRAVIMETRIC DATA

The observed gravity and barometric elevation data was tied to S.A. Lands Department, Bench Mark 39, elevation datum M.S.L. (1), and B.M.R. Helicopter Station 7007.0039. The accuracy of the observed gravity and barometric elevation ties between stations on the traverse are approximately 0.05 milligals and 2.09 feet respectively.

The mean error of observed gravity of the half mile and detailed gravity stations is considered to be 0.075 milligals. The maximum probable error (defined as the sum of the mean error and mean standard deviation) is 0.154 milligals. Since the gravity traverses are not controlled at their southern extremity, a possible accumulative error of 0.03 milligals per mile, was estimated from the ties to the known observed gravity values for B.M.R. stations.

The elevations of each of the barometric stations (½ mile stations) were obtained from the mean value of a number of repeat readings at each station in each traverse. The mean probable elevation error for barometric stations is less than 7 feet. These elevations were compared wherever possible with the optical levelled data of the half mile stations, and the mean probable error of the difference was 5 feet. This indicates that the maximum probable error in the barometric elevations is 11 feet.

The elevation correction factor used for computing the bouguer gravity values was 0.066 milligals per foot. A density of 2.2 gm/cm was assumed for the surface Quaternary and Tertiary rocks.

It is assumed that the stations are located within 180 feet, so that the latitude error is 0.02 milligals.

The total relative accuracy of the survey in terms of Bouguer values is given by the formula below:

$$Et = ((\text{Error in Gravity})^2 + (\text{Error in Elevation})^2 + (\text{Error in Latitude})^2)^{\frac{1}{2}}$$

$$Et = ((0.075)^2 + (4.19 \times 0.066)^2 + (0.02)^2)^{\frac{1}{2}} = 0.155 \underline{\text{milligals}}.$$

and the maximum probable error determined in the same was 0.271 milligals.

APPENDIX 4

Magnetic Zone Type Classification

Tabulated below are the zone-types and a brief description of their magnetic character. The anomaly range quoted for each zone-type includes most, but not necessarily all, of the anomalies on any zones of that type.

Zone Type	Anomaly Range	Magnetic linearilty
1	less than 50 gammas	good
2	50 to 100 gammas	good
3	100 to 200 gammas	good
4	200 to 300 gammas	good
5	300 to 500 gammas	good
6	500 to 1 000 gammas	good
7	1 000 to 2 000 gammas	good
8	2 000 to 5 000 gammas	good
9	greater than 5 000 gammas	good
11	less than 100 gammas	poor
12	100 to 250 gammas	poor
13	250 to 500 gammas	poor
14	500 to 1 000 gammas	poor
15	greater than 1 000 gammas	poor

APPENDIX 5

Specific Gravity Determinations on the ANABAMA GRANITE, BRAEMAR IRON FORMATION and KANMANTOO GROUP (Nairne Pyrite Member .)

ANABAMA GRANITE

D.H. Tucker of the University of Adelaide determined the specific gravity by Archimedes Method, on regular samples (every 10 ft.) of the split core of Asarco (Aust.) Pty. Ltd., diamond drill holes AN1, AN2 and AN3. The following table shows the specific gravities of each drill hole.

Diamond Drill Hole No.	Number of Samples	Specific Gravity (gm/cc)		
		Range	Mean	Standard Deviation
AN1	37	2.29 to 2.79	2.6546	0.0943
AN2	89	2.52 to 3.23	2.6606	0.0883
AN3	43	2.41 to 2.85	2.6135	0.0927

Samples above 100 feet were considered as weathered and too oxidised for a representative sample. The histogram showing the frequency and specific gravity is shown in drawing No. S10007 after Tucker, (1972).

The mean specific gravity and standard deviation of 169 samples from all the drill holes was 2.647 and 0.092 gm/cc respectively.

The specific gravity logs for each of the drill holes will be in a B.M.R. report by Tucker, see plan SA/B2-15A. (Not shown in this report).

BRAEMAR IRON FORMATION

The specific gravities of the Braemar Iron Formation (Yudnamutana Sub-Group) were determined at 5 foot intervals from the Razorback Range diamond drill holes RB1, 2 and 3 by the female computers of the Exploration Geophysics Section. Whitten (1970) considered that two types of iron deposits were present, the tillitic iron formation and bedded iron formations. The histograms for all three diamond drill hole core sampled showed three probable distributions. The first distribution was for the specific gravities above 100 feet (30 metres), see Fig.1.

of drawing No. 72-892. This population was considered to be a zone of secondary enrichment due to oxidation of the iron formations. The other two populations were considered as populations A and B based on the skew distribution curves. These populations can be separated at 3.15 gm/cc, based on a cummulative probability plot. The mean, standard deviation and 95% confidence limits per each population are tabulated below.

Population	Number of Samples	Range	Specific Gravities (gm/cc) Mean	Standard	95% Confidence Limits
Above (30 m)	61	3.2 to 4.2	3.554	0.168	3.386 to 3.722
Population A	55	2.9 to 3.3	3.12	0.132	3.088 to 3.252
Population B	20	3.8 to 5.0	4.095	0.250	3.846 to 4.344

The population A correlates with the tillitic iron formation and the population B correlates with the bedded iron formation.

KANMANTOO GROUP

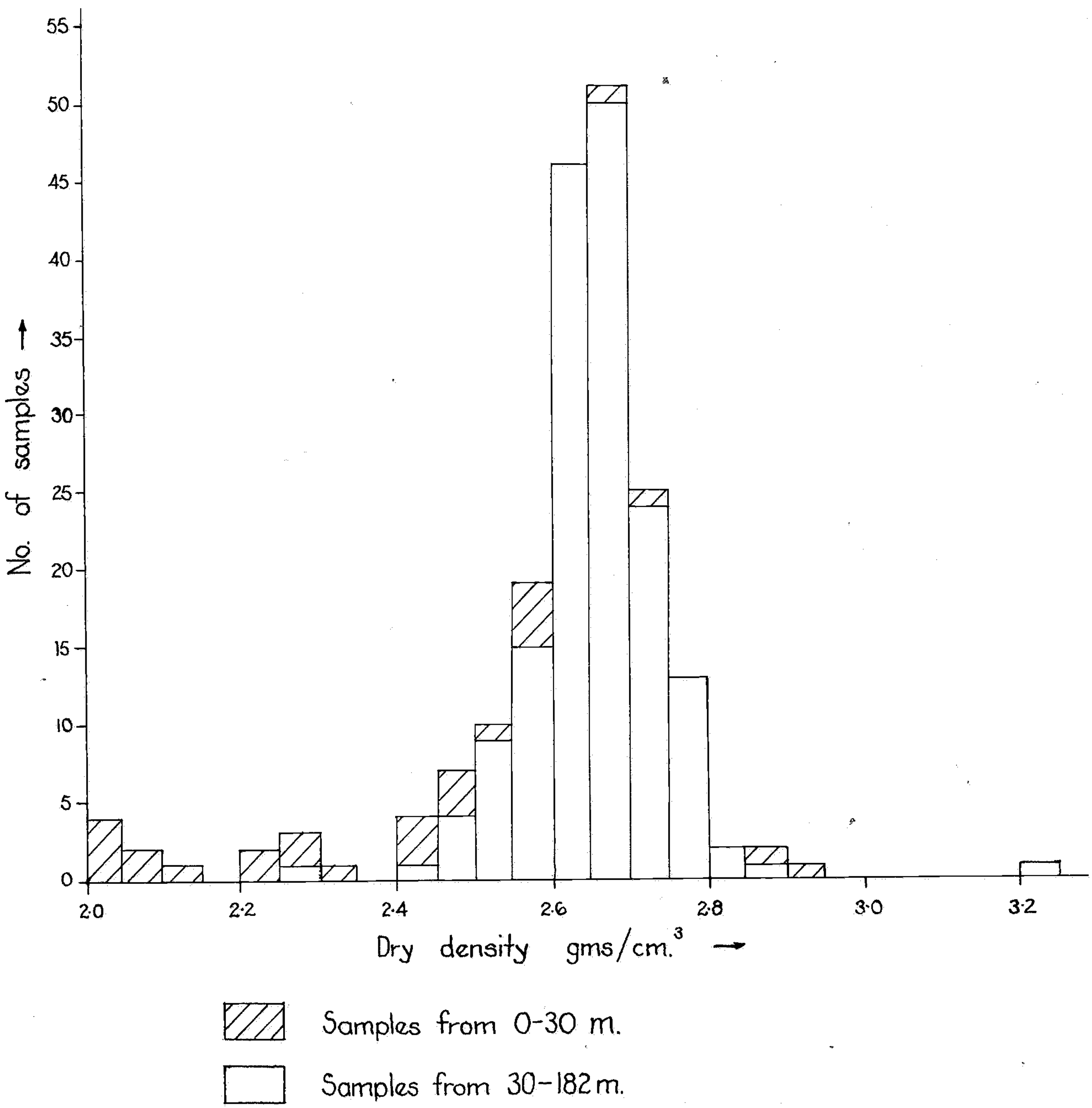
Previous specific gravity results of the Kanmantoo Group are based in oil diamond drill holes into the Middle Cambrian in the Murray Basin area. Core analysis on metamorphics (gneiss) of the Kanmantoo Group in Berri South No.1, drill hole B.M.R. 1964 at a depth of 2 172 feet had a dry bulk and apparent grain density of 2.77 and 2.78 gm/cc respectively. W.R.C. Beach Petroleum N.L. 1967 measured the dry bulk and apparent grain density from a metagreywacke at 3 092 feet in Berri North No.1 Well, which were 2.68 and 2.68 gm/cc respectively.

The South Australian Department of Mines in 1966 undertook an extensive drilling program of the Nairne Pyrite Member in the Kanmantoo Group. Recently the female computers of the Exploration Geophysics Section determined the specific gravities of diamond drill holes RD11, 12, 13 and 15 in connection with the ANABAMA FAULT PROJECT. These drill holes were samples below 100 feet at 10 foot intervals, and the histogram is shown in drawing No. S10008. The specific gravities less than 2.5 gm/cc are considered to be non-pyritic members of the Nairne Pyrite Member (Muscovite-Garnet-Quartz-Pyrite-Schist).

As a representative sample all the drill holes data was considered to determine the specific gravity of this rock unit, which are given below:

Number of Samples	Specific Gravity (gm/cc) Range	Mean	Standard Deviation
178	1.85 to 3.66	2.82	0.24

It is considered that the 95% Confidence Limit, the S.G. of this rock unit lies between 2.34 to 3.32 gm/cc. This range shows an increase in pyrite and probably an increase in metamorphic grades.



Based on ASCARCO diamond drillholes AN 1, 2 & 3

after D. Tucker 1972

EXPLORATION GEOPHYSICS SECTION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: Graphical
Compiled: R Gerdes	ANABAMA FAULT PROJECT	Date: 10 Oct. 1972
Drn. TJE	Ckd. A.F.	HISTOGRAM OF SPECIFIC GRAVITIES OF THE ANABAMA GRANITE	Drg. No. S 10007 FR

300—6,72 C5552

DEPARTMENT OF MINES – SOUTH AUSTRALIA

EXPLORATION GEOPHYSICS SECTION

Compiled: R. Gerdes

Drn. TJE | Ckd. A.F.

ANABAMA FAULT PROJECT

HISTOGRAM OF SPECIFIC GRAVITIES OF THE NAIRNE PYRITE

KANMANTOO GROUP, KANMANTOO MINES

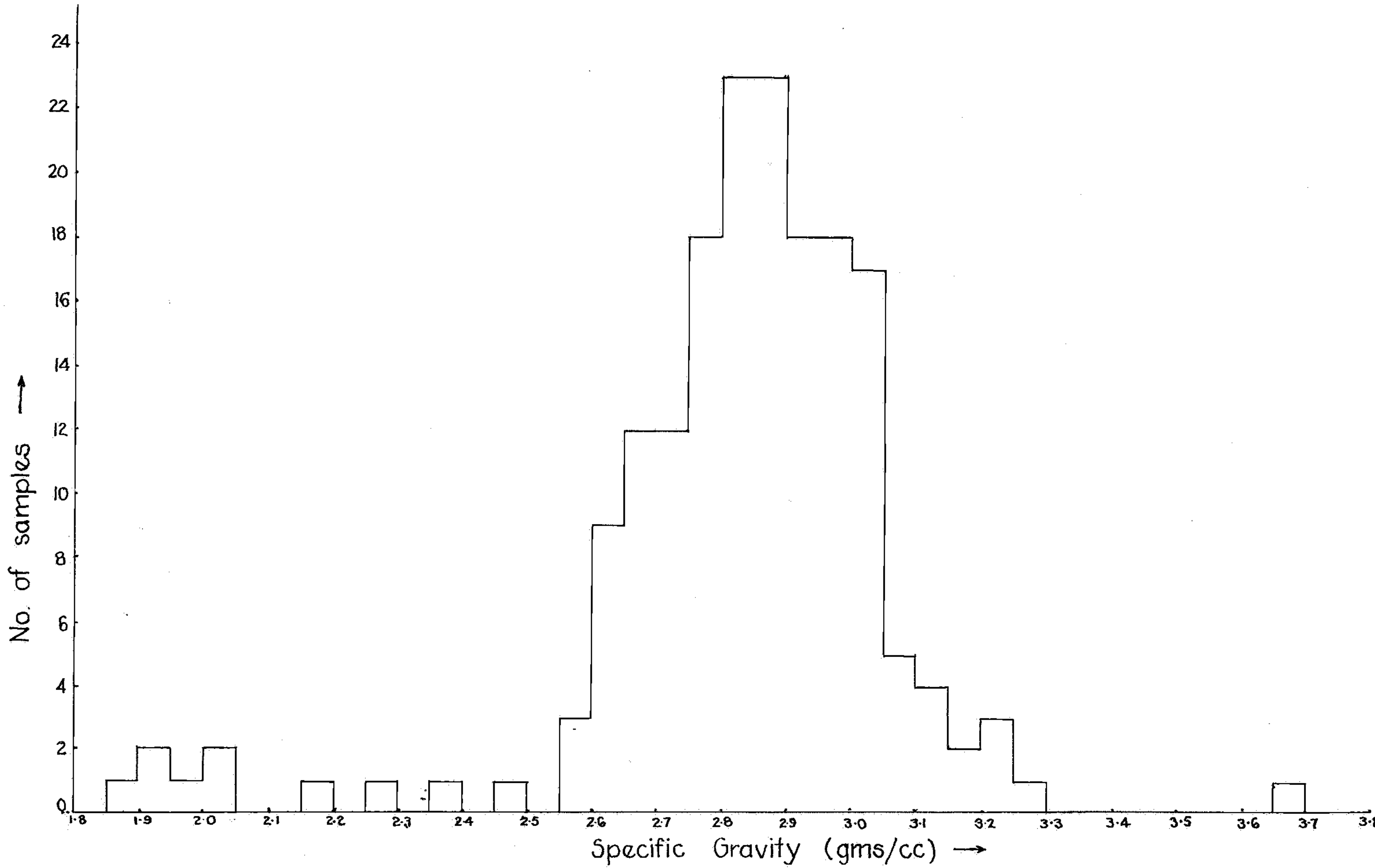
Scale: Graphical

Date: 6 Oct. 1972

Drg. No.

S 10008 FR

Based on Kanmantoo Mines, Nairne Diamond Drill Holes 11, 12, 13 and 15.



Sampling Interval of 10 feet from :– 100 feet below ground level

No. of readings 178

Mean specific gravity 2·82 gm/sec

Standard deviation 0·24 gm/sec

95% Confidence Limits 2·34 to 3·32 gm/sec

(Determined by Female Computors, Exploration Geophysics Section)

360–6.72 C5552

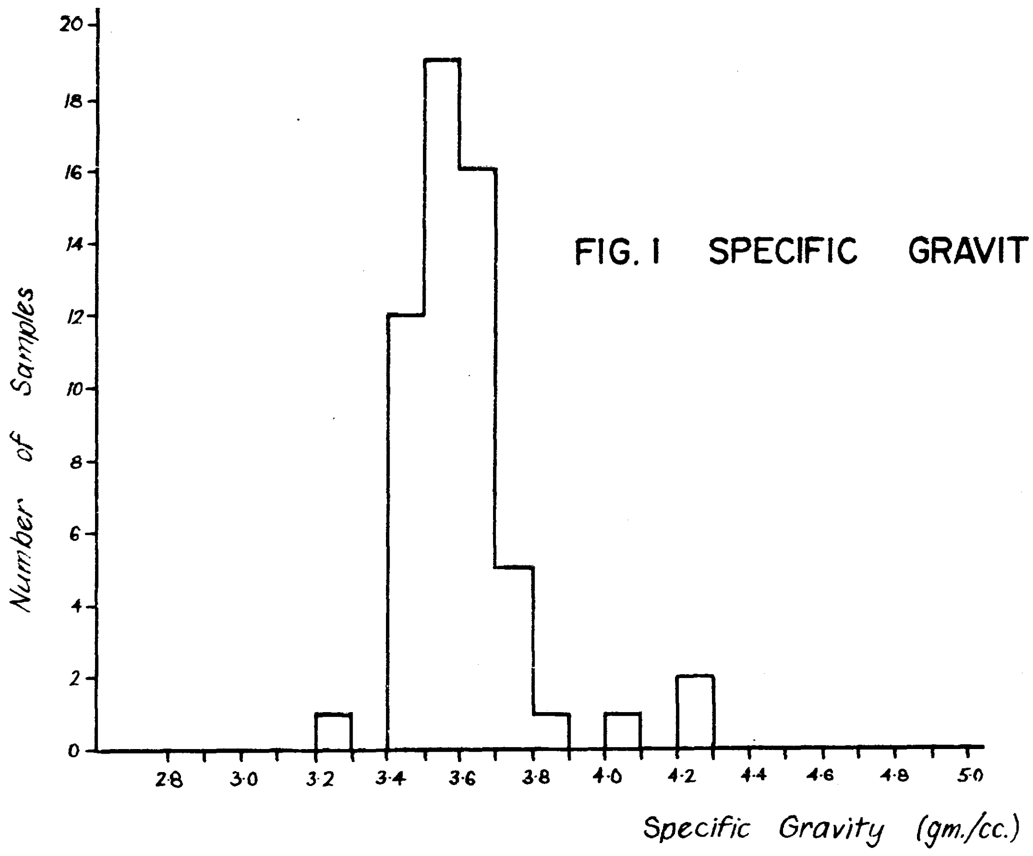


FIG. 1 SPECIFIC GRAVITIES ABOVE 30 metres (100 ft.)

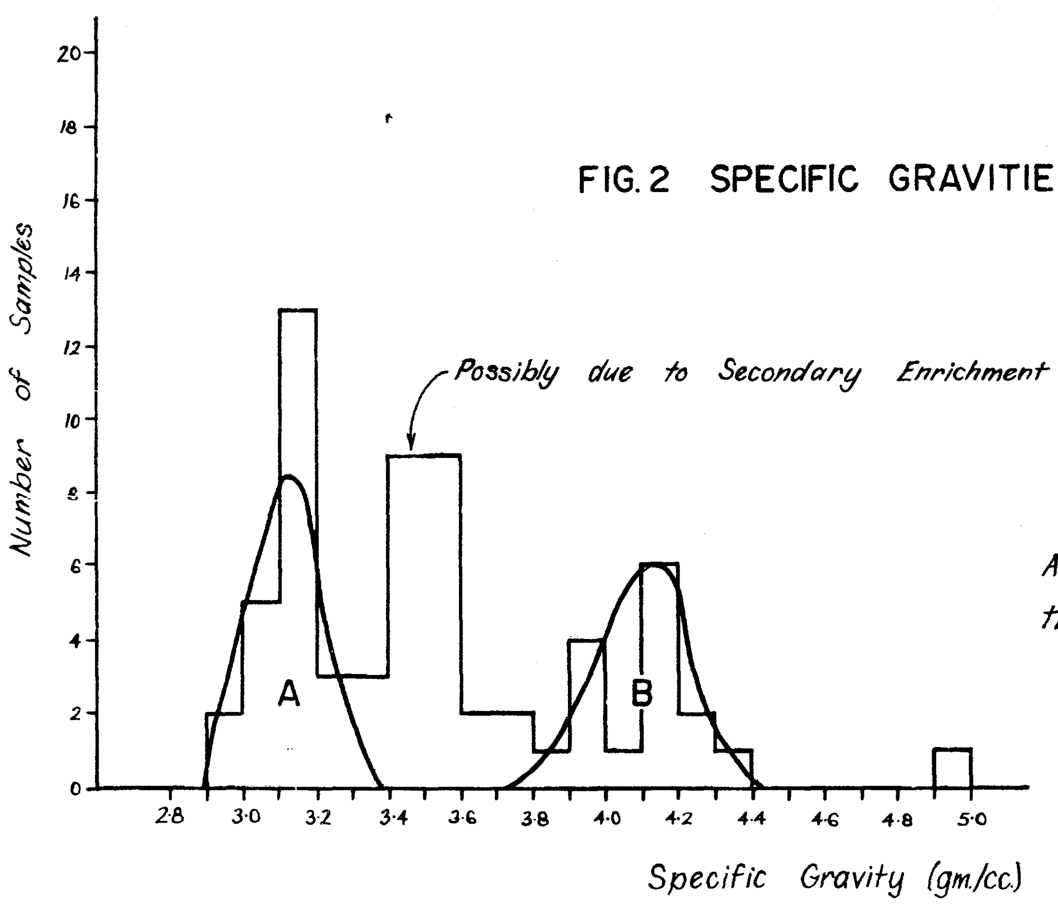


FIG. 2 SPECIFIC GRAVITIES BELOW 30 metres (100 ft.)

A and B considered to be two different populations

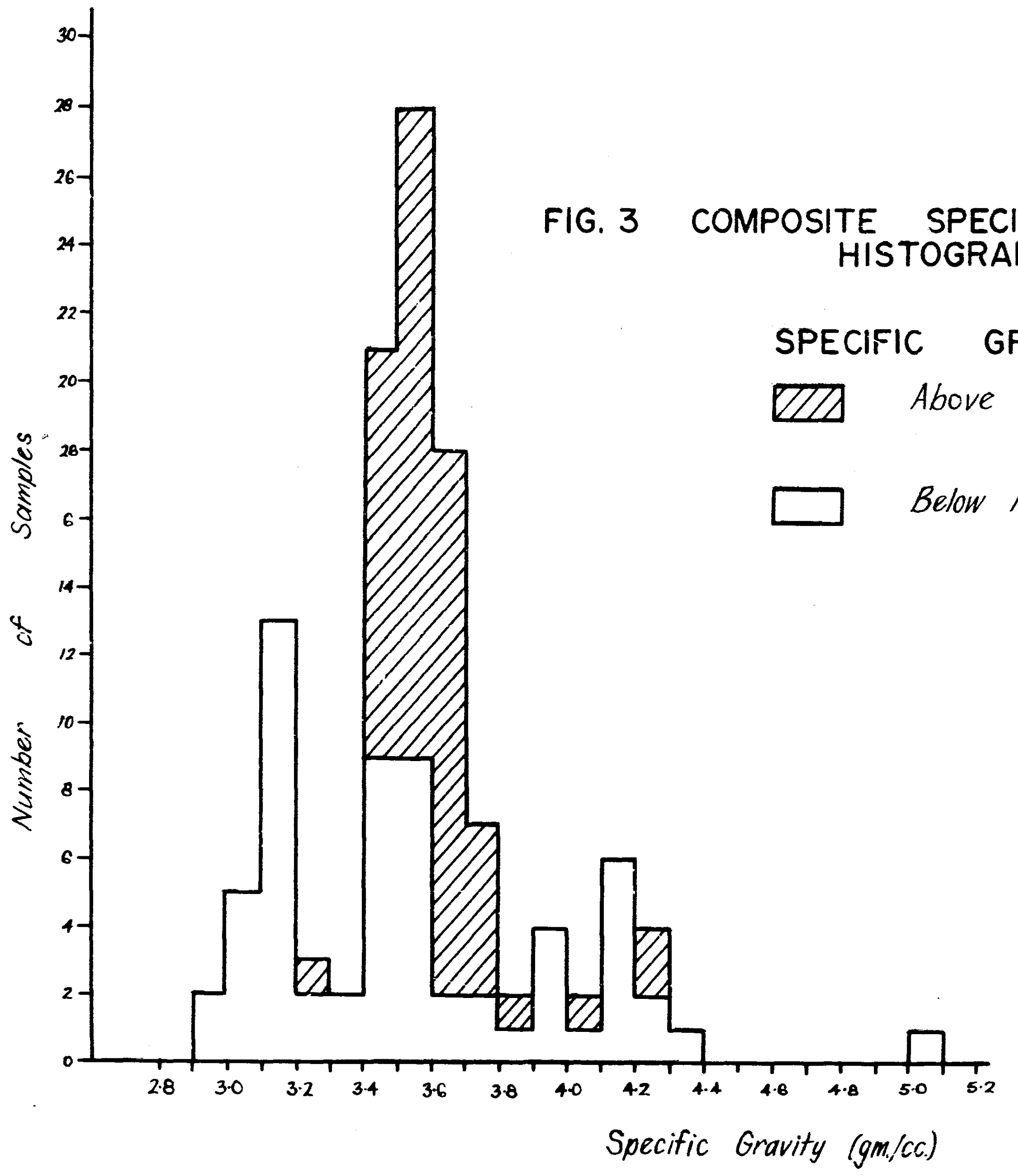


FIG. 3 COMPOSITE SPECIFIC GRAVITIES HISTOGRAM

Razorback Range Iron Formation

EXPLORATION GEOPHYSICS SECTION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: graphical
Compiled: R. Gerdes	ANABAMA FAULT PROJECT	Date: 6 OCT. 1972
Drn. DJM / Ckd A.F.	HISTOGRAMS OF SPECIFIC GRAVITIES OF BRAEMAR IRON FORMATIONS - BASED ON DIAMOND DRILL HOLES R.D. 1, 2 & 3	Drg. No. 72-892 F6

APPENDIX 6

Magnetic Susceptibilities of the Braemar Iron Formation, Kanmantoo Group (Nairne Pyrite Member), Anabama Granite and Acid Volcanics (L. Cambrian age ?)

BRAEMAR IRON FORMATION

The magnetic susceptibilities of the Braemar Iron Formation were measured by the female computers of the Exploration Geophysics Section from the Razorback Range diamond drill holes RD1, 2 and 3. The core was samples systematically at 5 foot intervals throughout the whole core. It was found that 31 samples out of 67 were non-magnetic.

It was considered necessary to subdivide the sampling into two portions based on the probable oxidation to a depth of 100 feet (30 m). The histograms for the magnetic susceptibilities above and below this artificial mark are shown in drawing No. 72-891.

The histogram for magnetic susceptibilities for samples above 100 feet (30 m) fig. 1 showed a normal type distribution and had a mean and standard deviation of 3.14 and 2.55 x 10^{-3} cgs. units respectively.

The histogram for the magnetic susceptibilities for samples below 100 feet (30 m) shown in fig.2, drawing No.72-891 showed an asymmetrical distribution. The cummulative frequency plot on probability graph showed a probable two population distribution separated by a magnetic susceptibility value of 28 x 10^{-3} cgs. units, which corresponds to the gap in the histogram fig.2. The range, mean, standard deviation and confidence limit for these two populations are given below:

Population	Number of Samples	Magnetic Susceptibility (x 10^{-3} cgs.units) Range	Mean	Standard Deviation	95% Confidence Limit
A	58	0 to 26	8.138	4.085	4.053 to 12.223
B	6	34 to 54	43.636	3.636	39.696 to 46.968

Three magnetic susceptibility samples were recorded having values of 132, 240 and 240 x 10^{-3} cgs. units respectively. These samples probably represent a very magnetite rich band within the overall ironstone formation. The mean and standard deviation including these samples with population II was 79.0 and 33.86 x 10^{-3} cgs. units.

KANMANTOO GROUP - NAIRNE PYRITE MEMBER

Magnetic susceptibility determinations were made by the female computers of the Exploration Geophysics Section in 1972, on fragments and split core from the Brukunga Formation (Nairne Pyrite Member). Considerable drilling was undertaken by the Mines Department on behalf of the Nairne Pyrites Pty. Ltd., and diamond drill holes DDH11, 12, 13 and 15 to obtain a range of susceptibility values for these rocks. The histogram for all the determinations are shown in drawing No.72-893. This plot showed a range of susceptibilities from 0 to 2.1 x 10^{-3} cgs. units. The mean value of this frequency distribution would be meaningless.

It was considered necessary to use the geological logs of the drill holes after Mason (1966), and determine their distribution. These histograms are shown in drawing No.72-894 and the means, standard deviation etc. shown in Table 4.

The amphibolites, schists and geniss have the greater susceptibilities of the order of 1.0 x 10^{-3} cgs. units.

REFERENCE

Mason, M., 1966. Nairne Pyrite Deposit. Parts 1,2 and 3. S. Australian Dept. of Mines, Rept.Bk.No. 66/119.

TABLE 4

Rock Type	Number of Samples	Magnetic Susceptibility ($x10^{-3}$ cgs. units) Range	Mean	Standard Deviation	95% C.L.
Overall Amphibolite	24	0 to 2.54	0.600	0.384	0.216 to 0.984
Grenofels Amphibolite	8	0.686 to 2.54	1.594	0.259	1.335 to 1.853
Amphibolite	15	0 to 0.296	0.109	0.049	0.0596 to 0.158
Schist	27	0.062 to 1.27	0.5912	0.1769	0.4143 to 0.7681
Gneiss-Metasiltstone	33	0 to 1.054	0.363	0.1299	0.233 to 0.493
Gneiss (a) with zeros	56	0 to 1.672	0.3044	0.2226	0.0818 to 0.5270
(b) neglecting zeros	26	0.1934 to 1.672	0.6559	0.2217	0.4342 to 0.8776

ANABAMA GRANITE

The magnetic susceptibilities of the Anabama Granite were obtained by W. McCallum, Student Geophysicist, of the Exploration Geophysics Section on the Asarco (Australia) Pty. Ltd. diamond drill hoel DDH, AN1 at 5 foot intervals between 350 to 465 feet. The histogram is shown in drawing No. S10007.

The population characteristics are given below:

Number of Samples	Range	Magnetic Susceptibility ($x10^{-3}$ cgs.units) Mean	Standard Deviation	95% C.L.
18	0 to 12.24	4.836	3.772	1.064 to 8.608

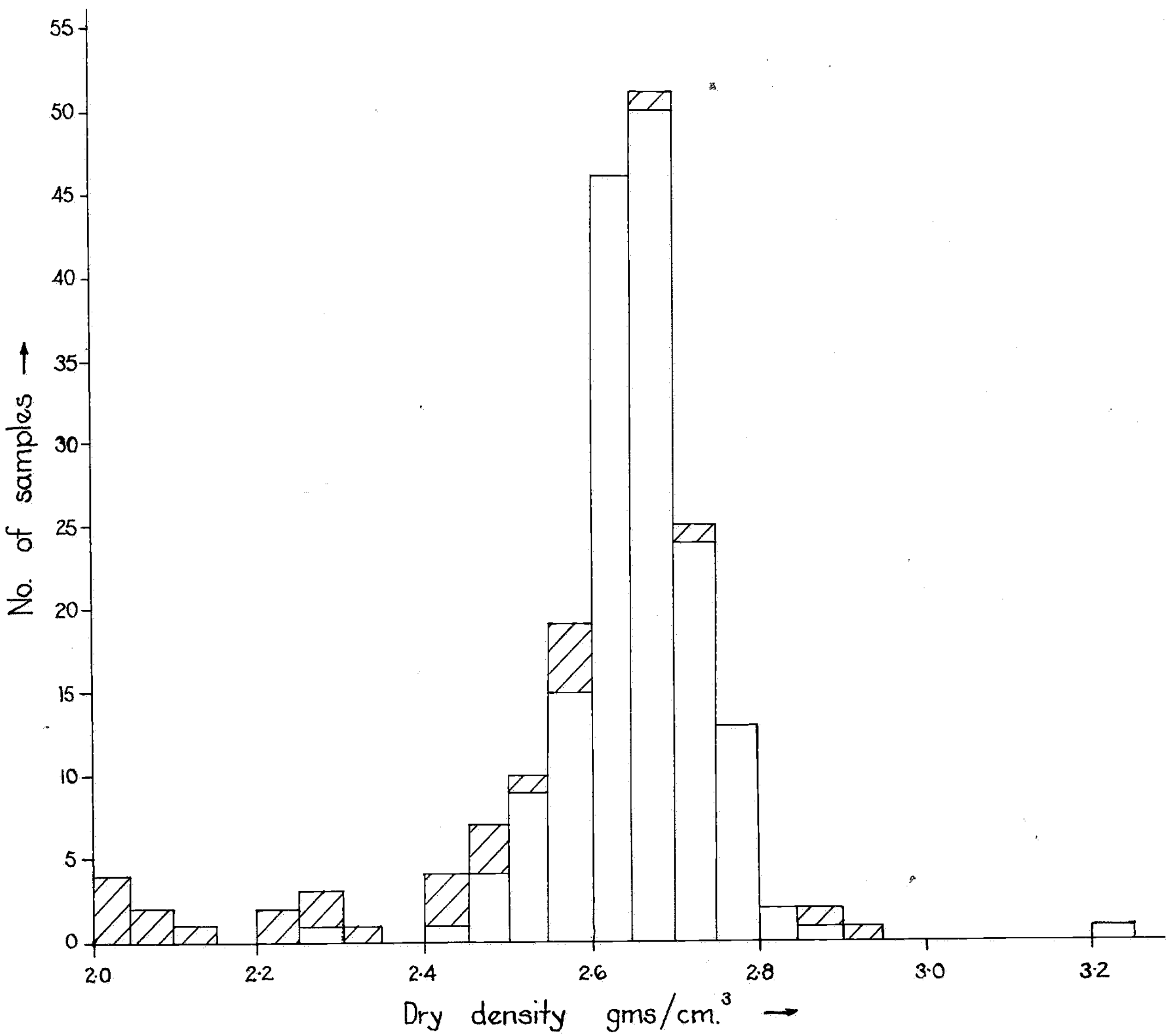
These results show that the Anabama Granite is generally non-magnetic.

Acid Volcanics (L. Cambrian or Ordovician age?)

The rhyolite mapped in the Anabama were sampled by B. Forbes of the Regional Mapping Section. These rocks, specimen numbers P235/70, P243/70 and P250/70 were called acid volcanic rocks and the range, mean and standard deviation of the magnetic susceptibility are as follows:

Magnetic Susceptibility ($x10^{-3}$ cgs. units) Range	Mean	Standard Deviation
0.025 to 0.871	0.313	0.395

These rocks are only slightly magnetic.



Samples from 0-30 m.

Samples from 30-182 m.

Based on ASCARCO diamond drillholes AN 1, 2 & 3

after D. Tucker 1972

EXPLORATION GEOPHYSICS SECTION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: Graphical
Compiled: R Gerdes	ANABAMA FAULT PROJECT	Date: 10 Oct. 1972
Drn. TJE / Ckd. A.F.	HISTOGRAM OF SPECIFIC GRAVITIES OF THE ANABAMA GRANITE	Drg. No. S 10007 FR

300-6.72 C5552

Fig. 1 Magnetic Susceptibilities of Core Sampled above 100 feet (30 m.)

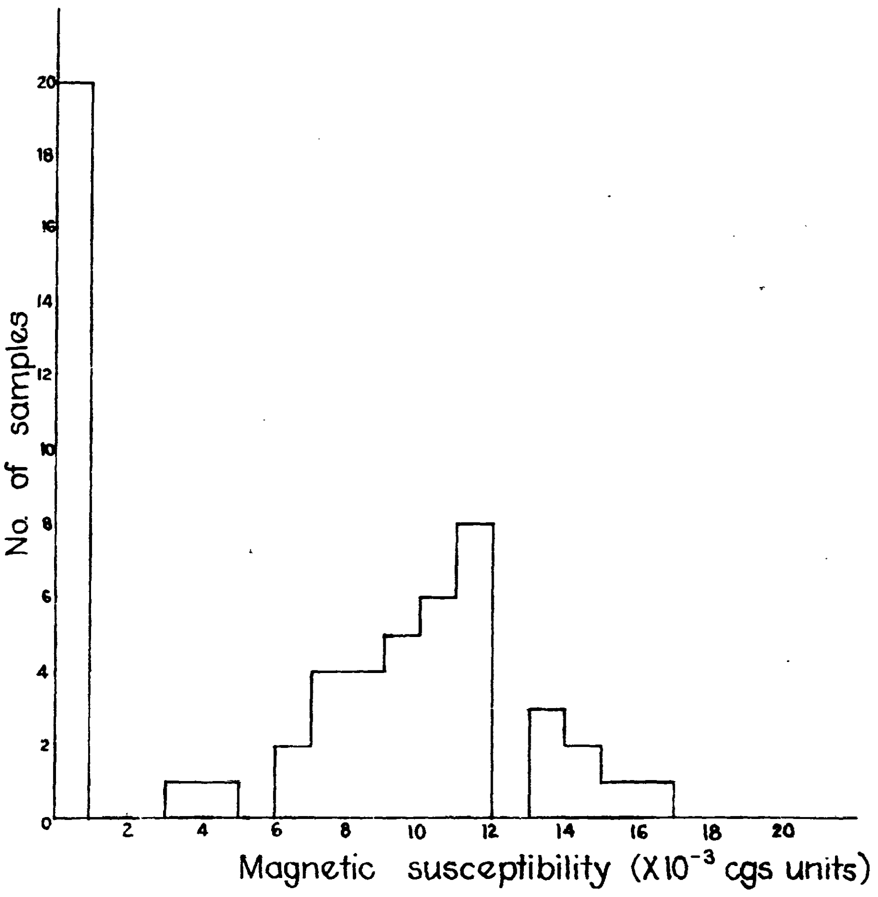
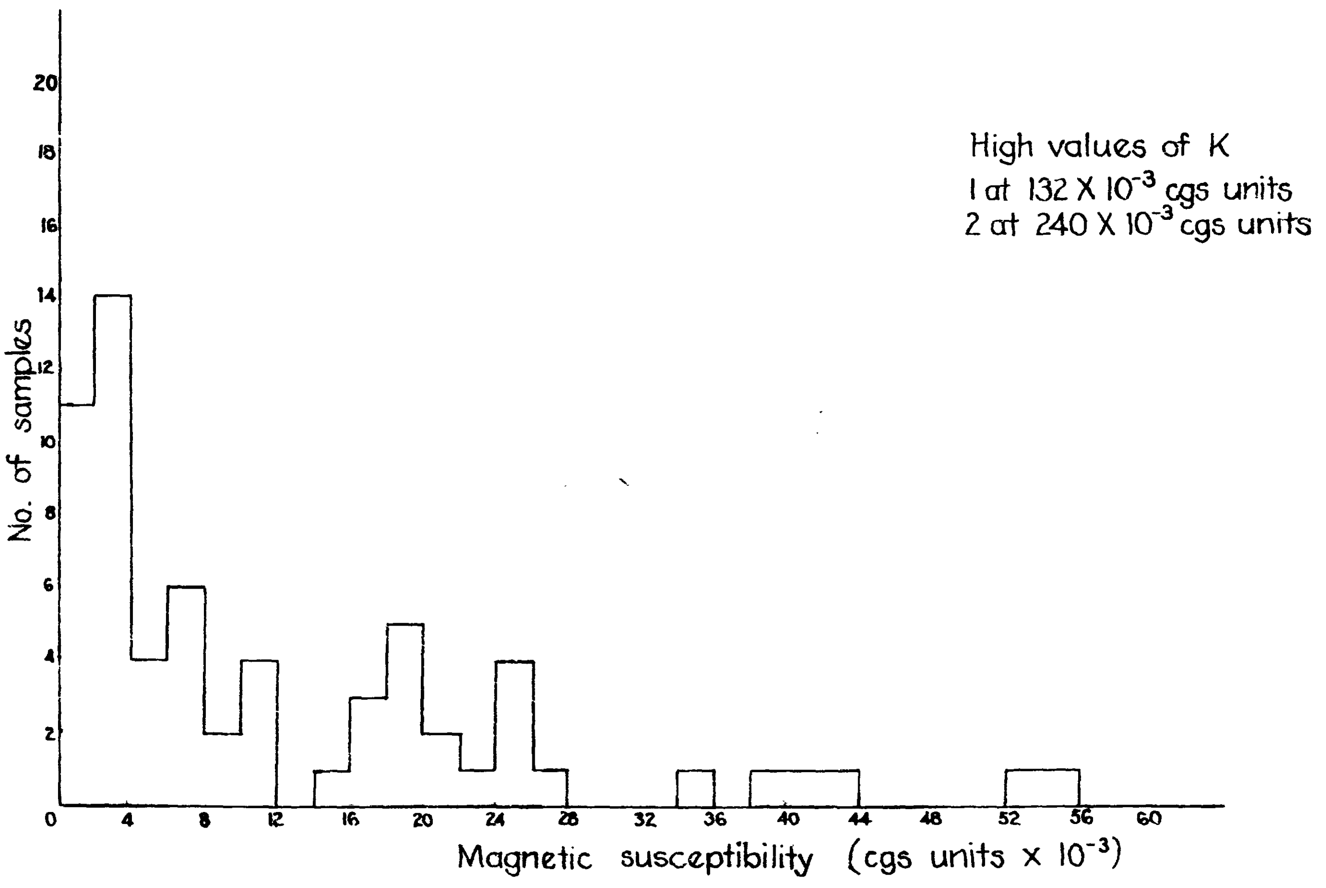


Fig. 2 Magnetic Susceptibilities of Core Sampled below 100 feet (30 m.)



Based on Razorback Range Iron Formation drillholes RD. 1,2 & 3

EXPLORATION GEOPHYSICS SECTION

Compiled: R. Gerdes

Drn. TJE | Ckd. A.F.

DEPARTMENT OF MINES – SOUTH AUSTRALIA

ANABAMA FAULT PROJECT

BRAEMAR IRON FORMATION

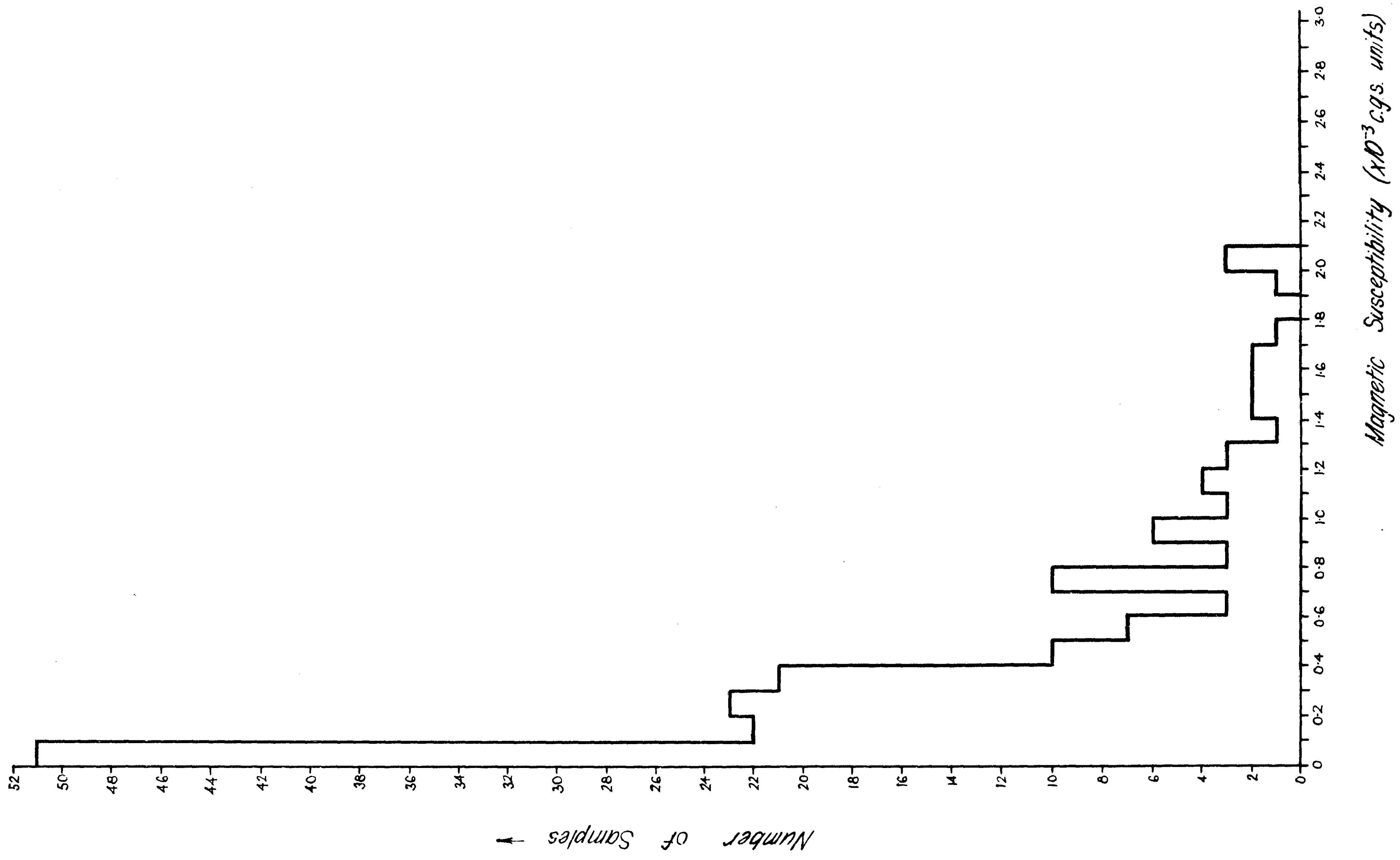
HISTOGRAMS OF MAGNETIC SUSCEPTIBILITY

Scale: Graphical

Date: 10 Oct 1972

Drg. No. 72-891

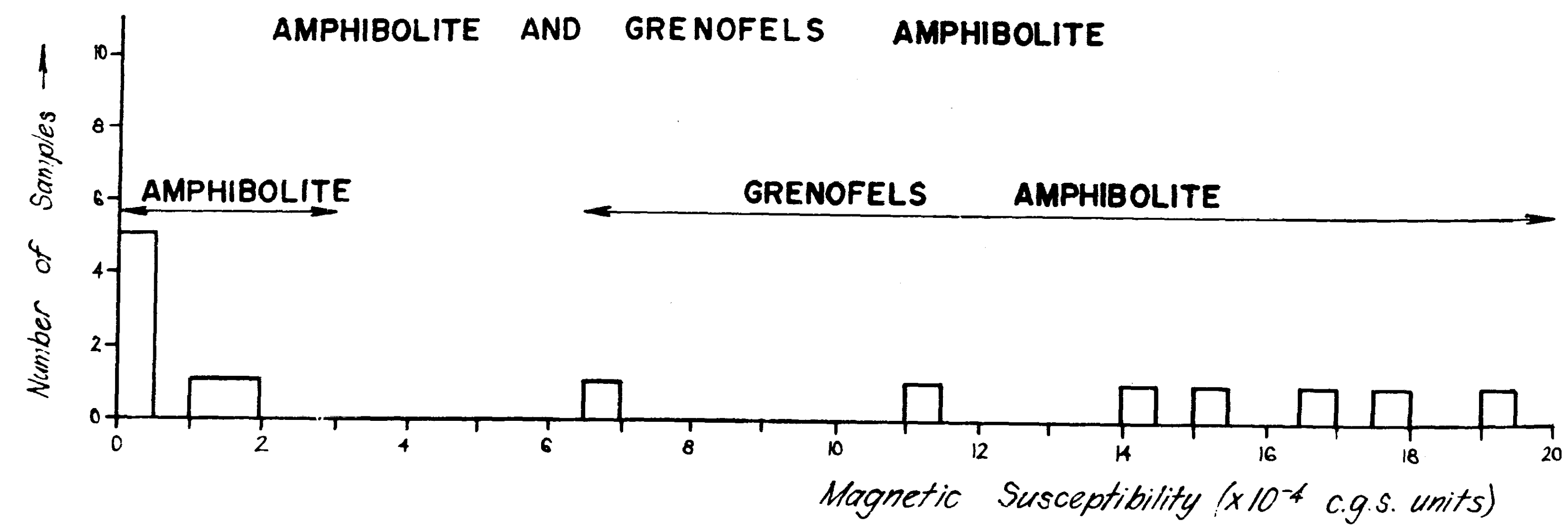
FR

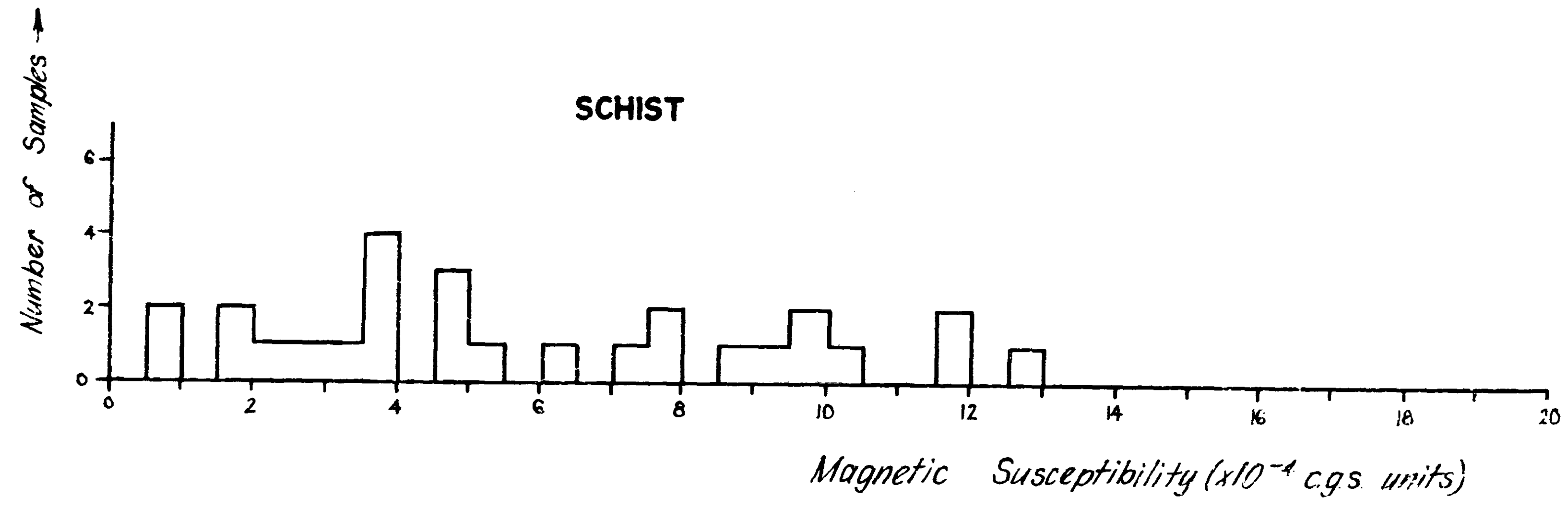


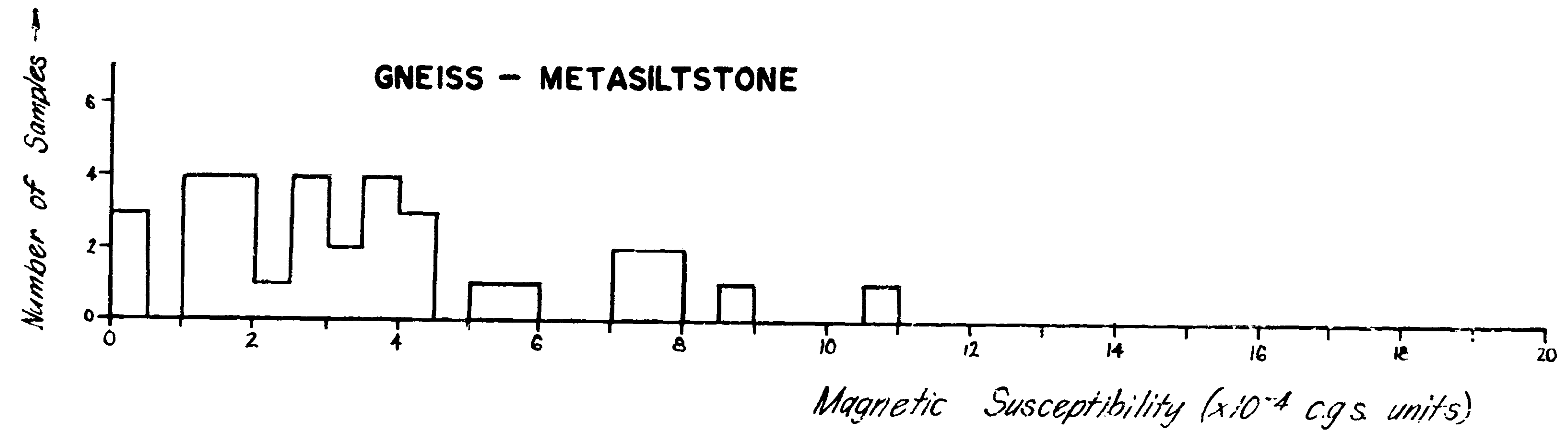
Based on Kanmantoo Mines, Nairne Diamond Drill Holes 11,12,13 & 15.

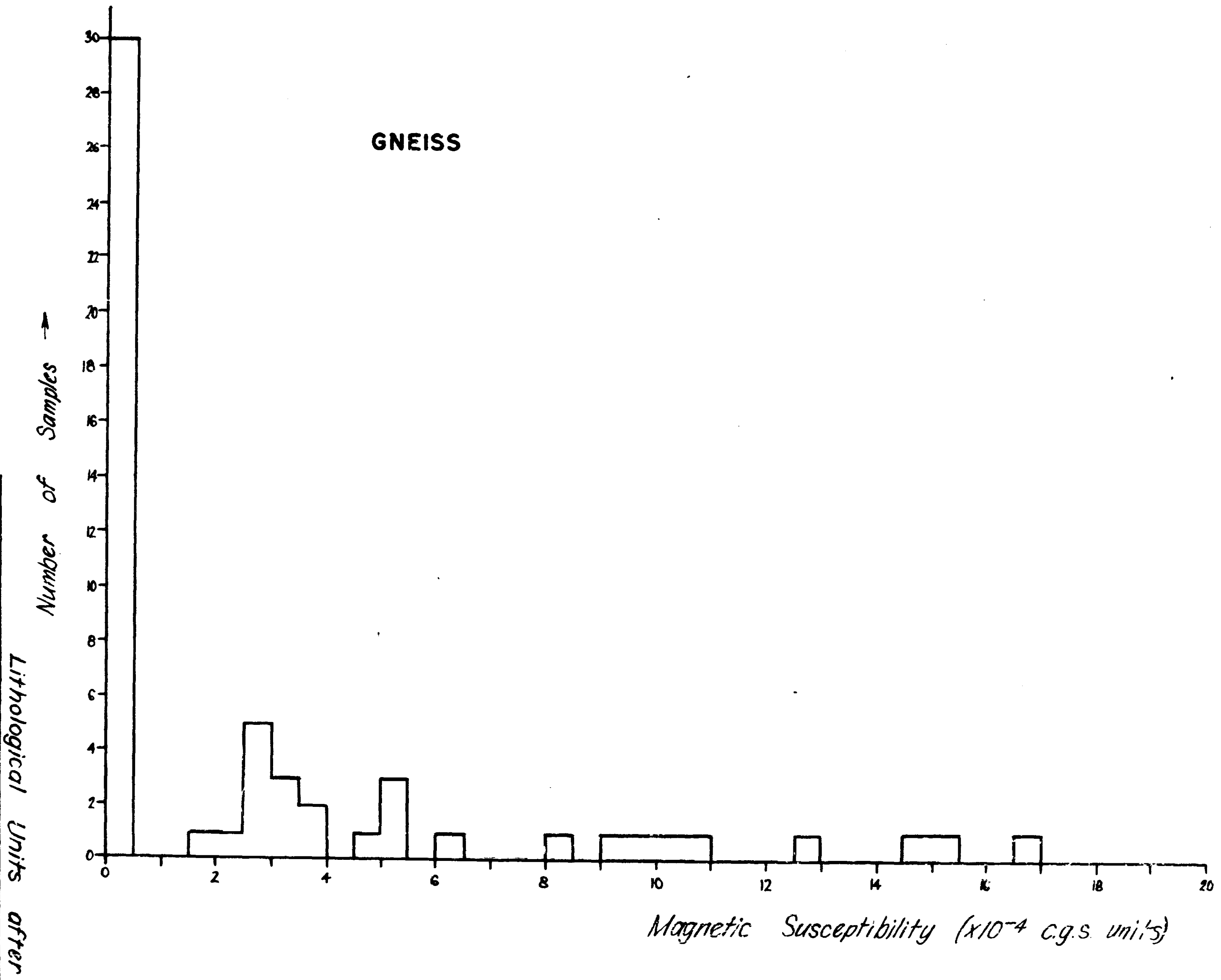
EXPLORATION GEOPHYSICS SECTION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: graphical
Compiled: R. Gerdes	ANABAMA FAULT PROJECT KANMANTOO GROUP, BRUKUNGA FORMATION NAIRNE PYRITE MEMBER HISTOGRAM OF MAGNETIC SUSCEPTIBILITY	Date: 10 OCT 1972
Drn. D.J.M. Ckd. A.F.		Drg. No. 72-893 Fl

1M–2,70 A1811









Lithological Units after Mason (1966)

EXPLORATION GEOPHYSICS SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	Scale: graphical
Compiled: R. Gerdes	ANABAMA FAULT PROJECT KANMANTOO GROUP BRUKUNGA FORMATION NAIRNE PYRITE MEMBER - HISTOGRAMS OF MAGNETIC SUSCEPTIBILITY OF ROCK TYPES FOUND IN DRILL HOLES R.D. 11, 12 & 13	Date: 10 OCT 1972
Drn. D.J.W. Ckd. A.F.		Drg. No. 72-894

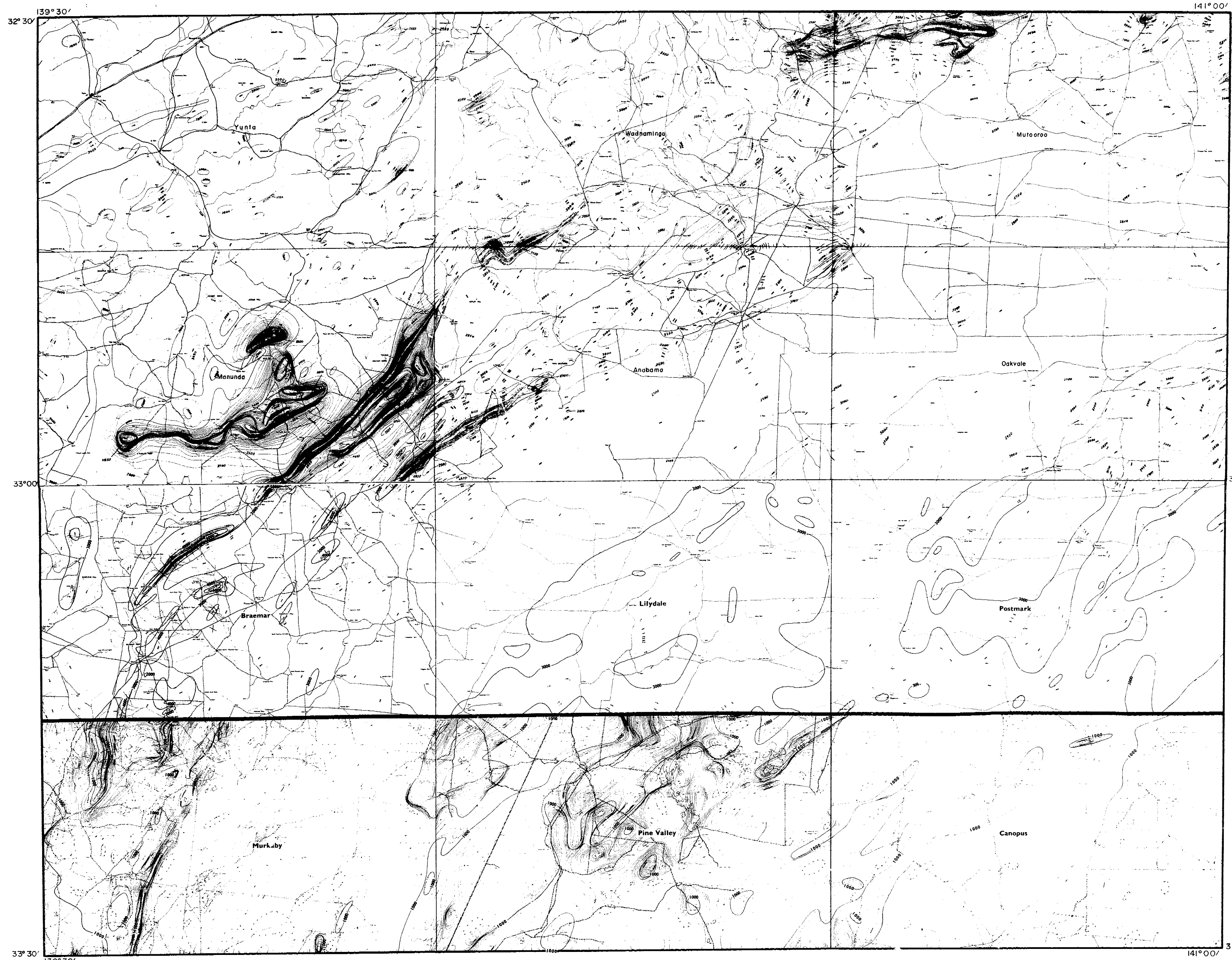
APPENDIX 7

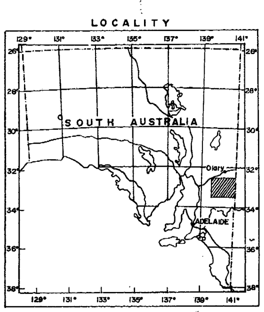
TABLE 5

SPECIFIC GRAVITIES OF SURFACE SAMPLES IN AREA

Age	Formation	Lithology	Location	Number of Specimen	SPECIFIC GRAVITY (DRY) gm/cc			SPECIFIC GRAVITY (WET) gm/cc		
					Range	Mean	Standard Deviation	Range	Mean	Standard Deviation
Ordovician	-	Rhyolite (Tuff)	Brothers Hill	5	2.246-2.532	2.420	0.104	2.353-2.500	2.433	0.062
	-	Acid Volcanics	Specimen P250/70	7	2.40 - 2.52	2.464	0.04	-		
			P235/70	10	2.50 - 2.68	2.580	0.586	-	-	-
			P243/70	4	2.58 - 2.60	2.593	0.008	-	-	
			P251/70	3	2.63 - 2.64	2.636	0.005			
			OVERALL	24	2.40 - 2.68	2.555	0.074	-	-	
Adelaidean	Appila Tillite	Quartzite	Anabama Hill	2	2.579-2.592	2.586	0.0065	2.567-2.591	2.579	0.012
"	Yudnam-utana	Quartzite	Gorge Well	3	2.685-2.702	2.694	0.0072	2.680-2.699	2.688	0.0084
		Quartzite	White Rock Hill	1	-	2.622	-	-	2.607	-
		Quartz reef	"	2	2.624-2.628	2.626	0.002	2.586-2.613	2.5995	0.0135
		Quartz-Hematite rock	"	3	3.565-4.922	4.131	0.576	3.551-4.821	4.086	0.537
Willyama		Quartzite	Cronje Hill	2	2.530-2.564	2.547	0.017	2.511-2.547	2.529	0.018
		Quartz-mica schist	"	4	2.469-2.647	2.532	0.069	2.453-2.614	2.512	0.061

PORTIONS OF
CHOWILLA AND OLARY





SCALE

1 : 250,000

MILES 4 2 0 4 8 12 16 20

KILOMETRES 5 0 5 10 15 20 25 30

COMPILED 1972

AEROMAGNETIC MAP OF TOTAL INTENSITY

NOTE

This map compiled from airborne magnetometer surveys conducted on behalf of the S.A. Dept. of Mines. The total magnetic intensity at 500 feet above ground level was recorded continuously. The contours are corrected for regional gradient.
Uncontrolled photomosaic assemblies were used to navigate flight lines and controlled or semi-controlled base maps indicate the aircrafts actual course.
Results reduced by S.A. Dept. of Mines Geophysical Section.

LEGEND

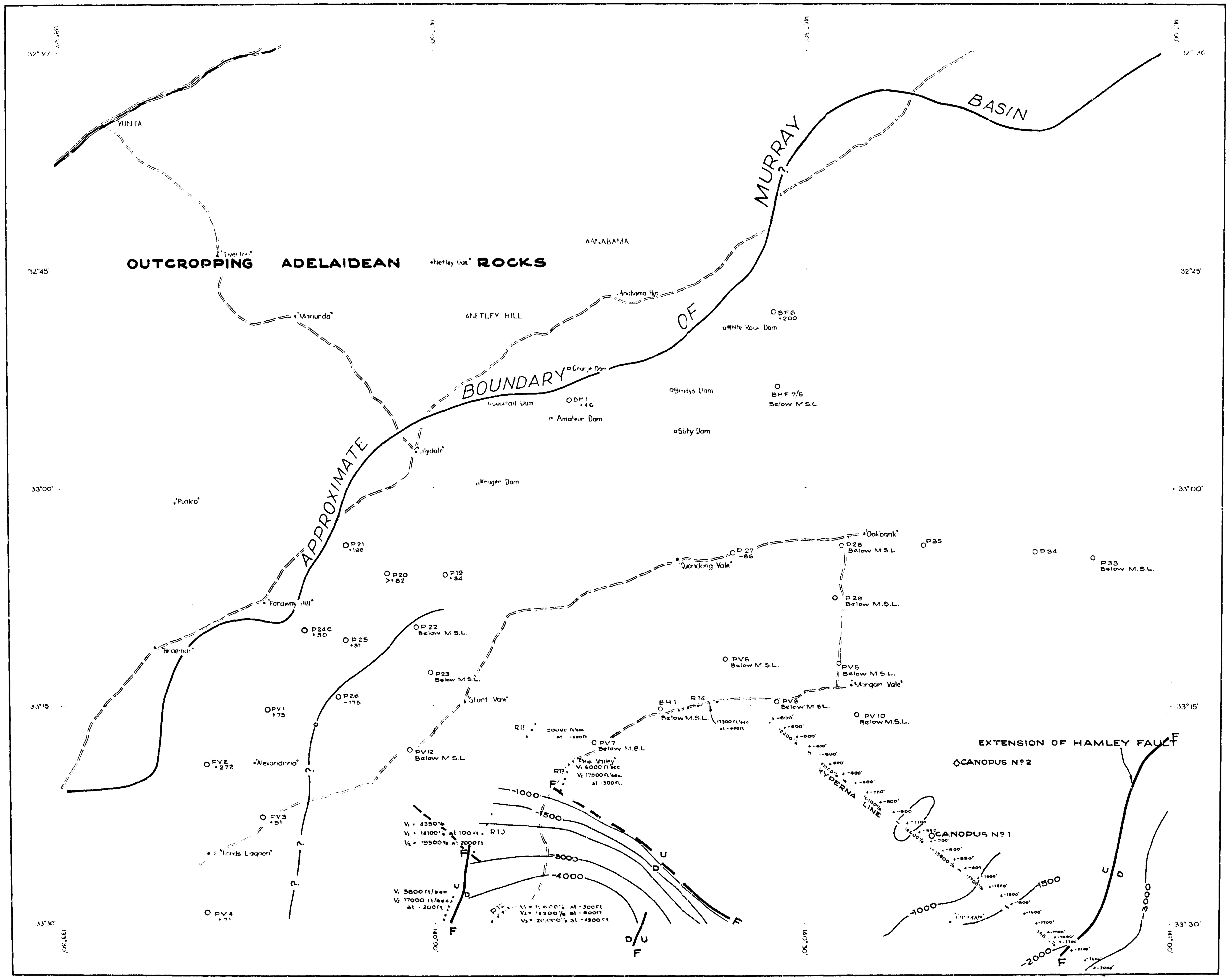
MAGNETIC CONTOURS (VALUES IN GAMMAS) 2000

FLIGHT LINE

MAGNETIC LOW

ROADS

72-801 GF



LEGEND

- PV2 Rotary Drill Hole
- +272 Elevation above M.S.L. (in feet)
- -172 Elevation below M.S.L. (in feet)
- Oil diamond drill hole
- Seismic Traverses
  - Velocity V_1 6000 ft/sec
  - V_2 17900 ft/sec at 500 ft below M.S.L.
- F Interpreted fault
  - U - Upside
  - D - Downside
- -3000 Basement Contours (datum M.S.L.) (Feet below sea level)

Scale in Kilometres
5 0 5 10 15 20 25 30
4 0 4 8 12 16 20
Scale in Miles

PORTION OF CHOWILLA AND OLARY 1:250,000 FIG.3

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT BASEMENT CONTOURS BASED ON SEISMIC AND DRILLHOLE DATA			
EXPLORATION GEOPHYSICS SECTION	R.A. Gerdes Geophysicist	Drn. RAG	SCALE: 1:250 000 (ORIG)
		Tcd. G.M.	73-69
		Ckd. A.F.	FG
Director of Mines	Sup. Geophysicist	Exd.	DATE: 6TH OCTOBER 1972

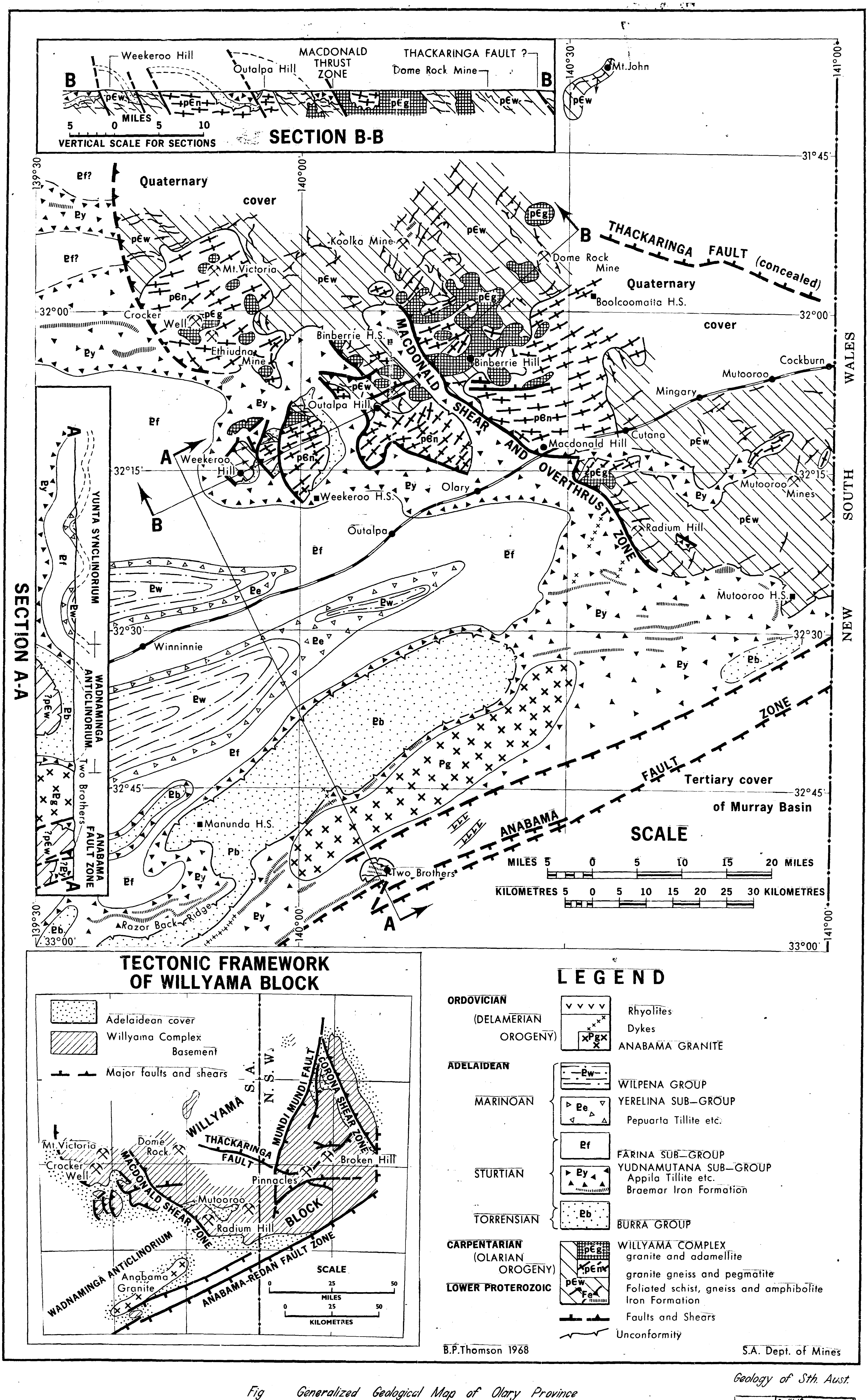
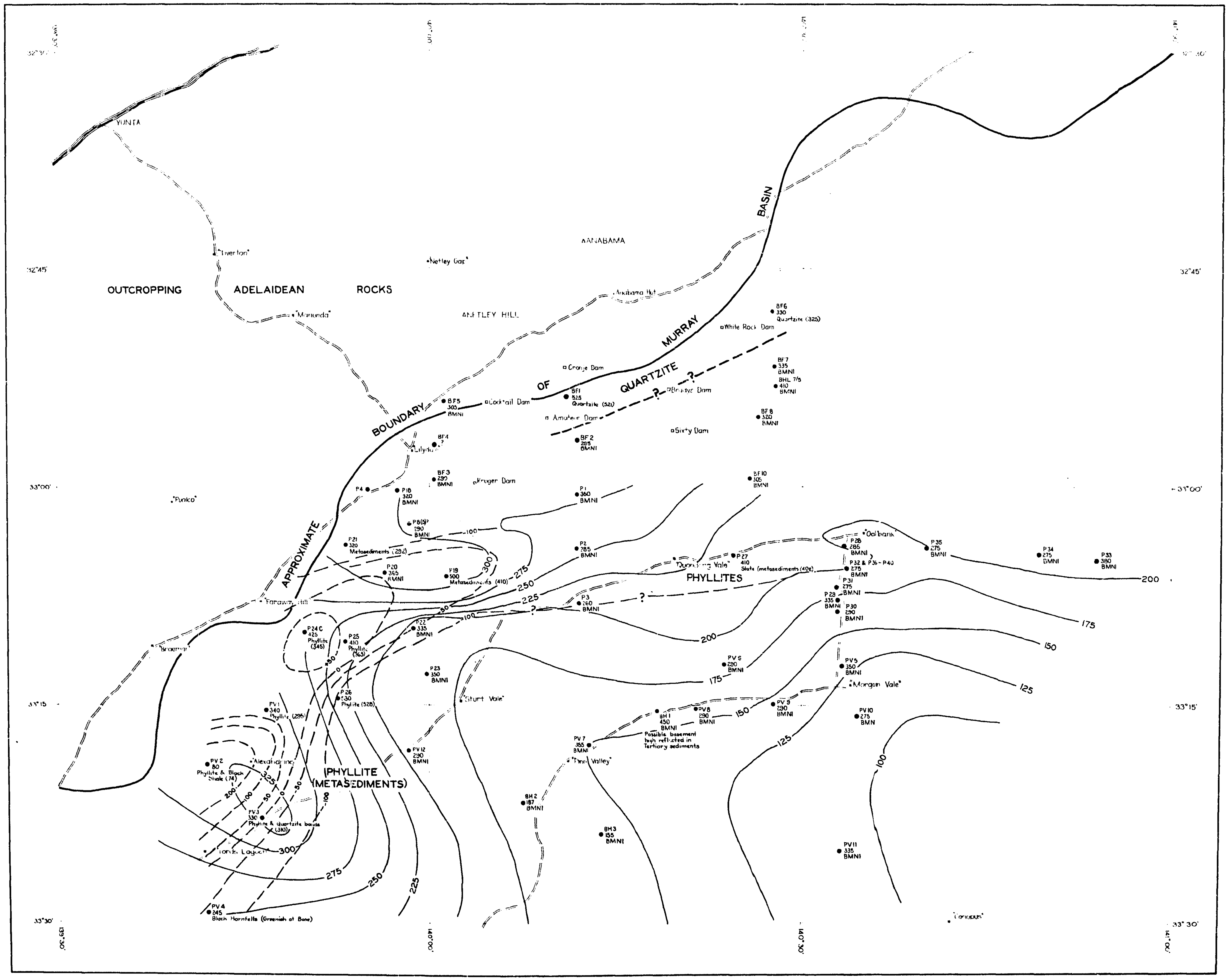


Fig Generalized Geological Map of Olary Province

Geology of Sth. Aust.

69-179/4



LEGEND.

PV 8 — Rotary holes drilled by Mines Administration Pty. Ltd.
370 — Depth drilled from surface (feet)
Phyllite (295) — Lithology and depth below ground surface
or
BMNI — Basement (metamorphic) not intersected

—50— Phyllite basement surface, based on drill hole logs (in feet)

—125— Structural contours on the Pliocene - Eocene unconformity after Wecker (1971) Min Ad.

Datum: Mean Sea Level

Note: Interpreted concealed geology based on rotary drilling data situated south of the approximate boundary of the Murray Basin (Adelaidean Outcrop Boundary) showing metamorphic basement and Pliocene-Eocene unconformity contours

Scale in Kilometres

5 0 5 10 15 20 25 30

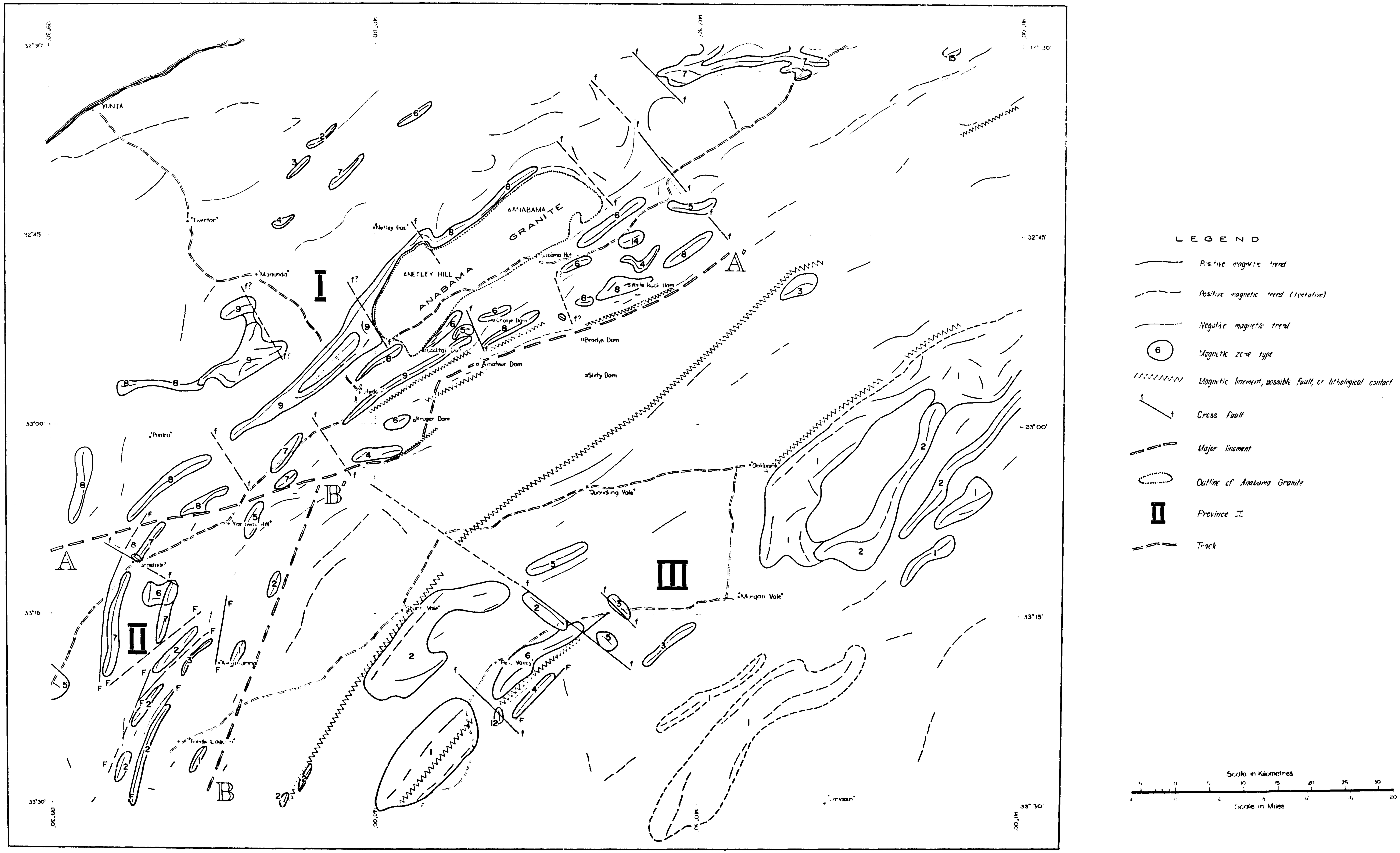
4 0 4 8 12 16 20

Scale in Miles

Portions of Chowilla & Olary 1:250000 sheets

FIG. 5

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT INTERPRETED CONCEALED GEOLOGY			
EXPLORATION GEOPHYSICS SECTION	R. GERDES GEOPHYSICIST	Drn. RAO	SCALE: 1 250 000 (ORIG)
		Tcd. TJE	73 - 70
		Ckd. A F	FG
Director of Mines		Exd.	DATE: 4 OCT 1972



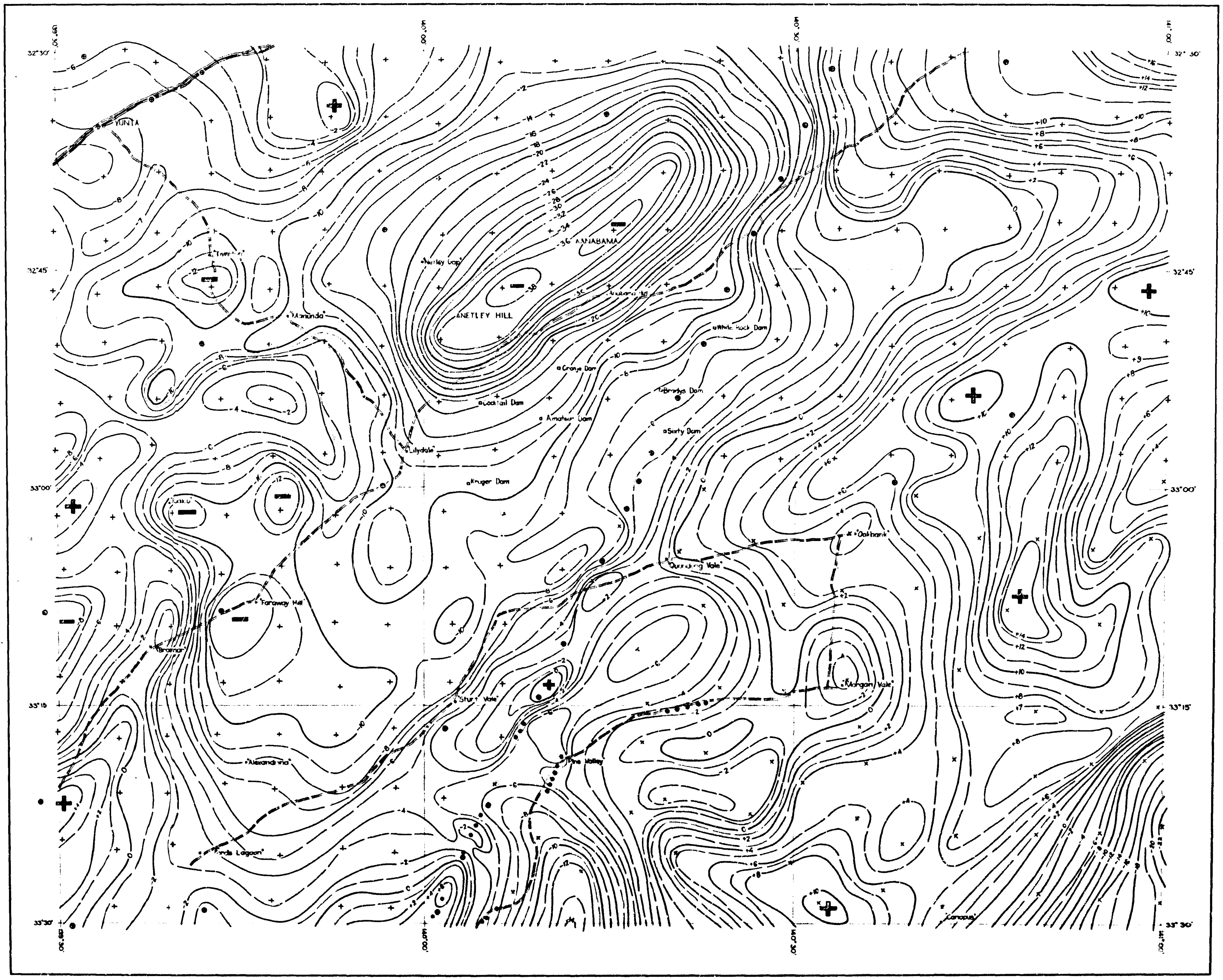
Portions of Chowilla and Olary 1:250,000 sheets

FIG. 6

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ANABAMA FAULT PROJECT
REGIONAL INTERPRETATION OF MAGNETIC TRENDS AND ZONES
(BASED ON AEROMAGNETIC CONTOURS)

EXPLORATION GEOPHYSICS SECTION	R A Gerdes GEOPHYSICIST	Drn. RAG	SCALE: 1:250,000 (ORIG)
		Tcd. DJW	73-71
		Chd. A F	FG
Director of Mines	SEN. GEOPHYSICIST	Exd.	DATE: 3 OCT 1972



LEGEND

B.M.R. Helicopter Survey 1911 Gravity Station	+
" " " " Control Station	⊕
Gravity Station after Hackathorn Oils Ltd.	×
S.A. Department of Mines Station	•
Bouguer Gravity Contour (contour interval 1 milligal)	-6
Positive Bouguer Anomaly	✚
Negative Bouguer Anomaly	▬

Elevation correction factor used 0·066 milligals/foot
(density 2·2 gm/cc.)

Scale in kilometres
5 0 5 10 15 20 25 30
4 0 4 8 12 16 20
Scale in Miles

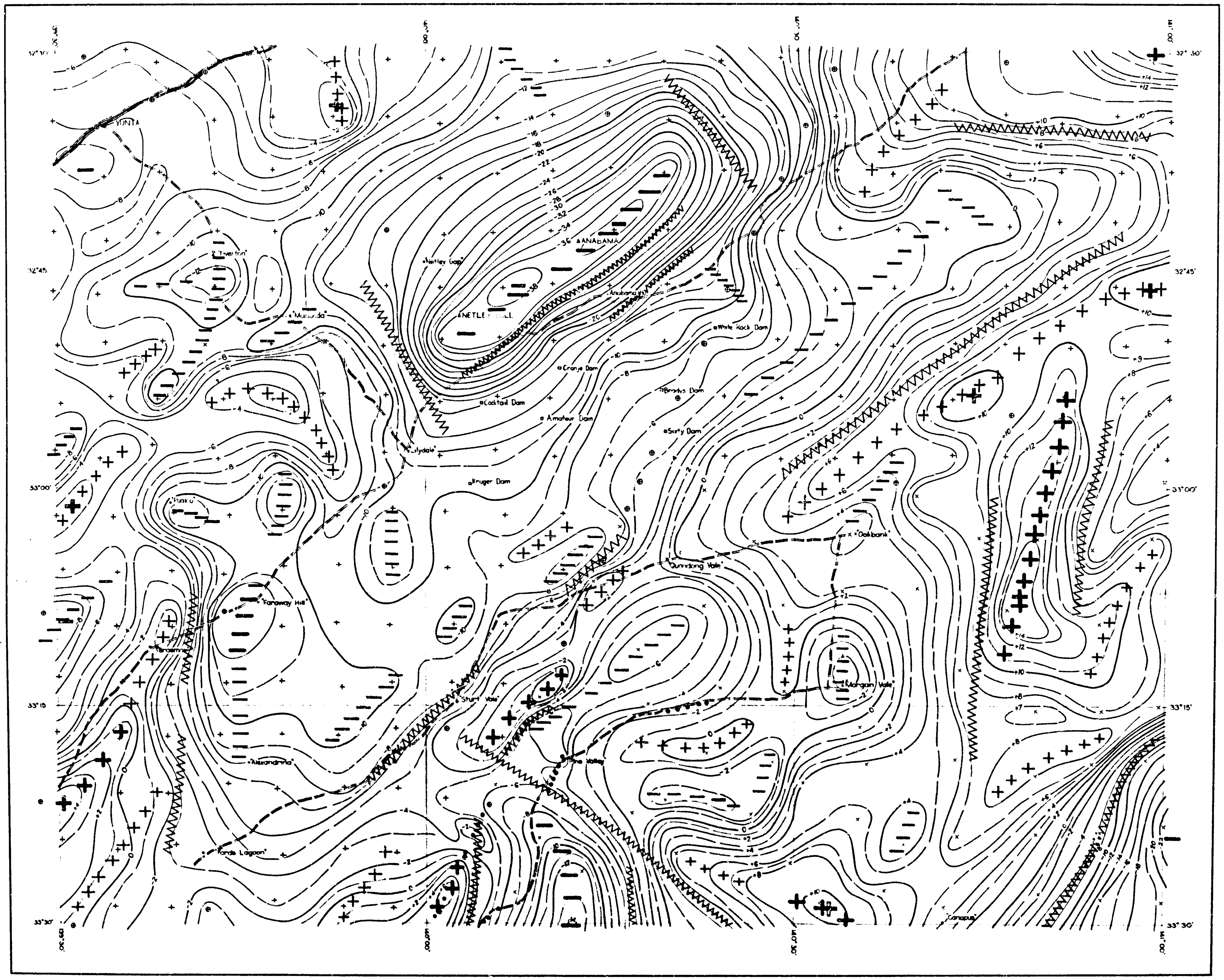
Portions of Chowilla & Olary 1:250000 Sheets

FIG. 7

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ANABAMA FAULT PROJECT
BOUGUER GRAVITY CONTOURS OF THE SOUTHERN HALF OF OLARY AND THE NORTHERN HALF OF CHOWILLA

EXPLORATION GEOPHYSICS SECTION	GEOPHYSICIST	Drn. R.A.G.	SCALE: 1:250 000 (ORIG)
		Trd. D.J.M.	73-72
		Chd. A.F.	FG
Director of Mines	SUP. GEOPHYSICIST	Exd.	DATE: 19 OCTOBER 1972



LEGEND

B.M.R. Helicopter Survey 1971 Gravity Station	+
" " " " Control Station	⊕
Gravity Station after Hackathorn Oils Ltd	×
S.A. Department of Mines Station	•
Bouguer Gravity Contour (contour interval 2 milligals)	
Negative Bouguer Anomaly – Major	
" " " " Minor	
Positive Bouguer Anomaly – Major	
" " " " Minor	
Steep gradients	

Elevation correction factor used 0·066 milligals/foot (density 2·2 gm/cc)

Scale in Kilometres
5 0 5 10 15 20 25 30
4 0 4 8 12 16 20
Scale in Miles

SCALE IN MILES
4 2 0 4 8 12 16 20
5 0 5 10 15 20 25 30
SCALE IN KILOMETRES

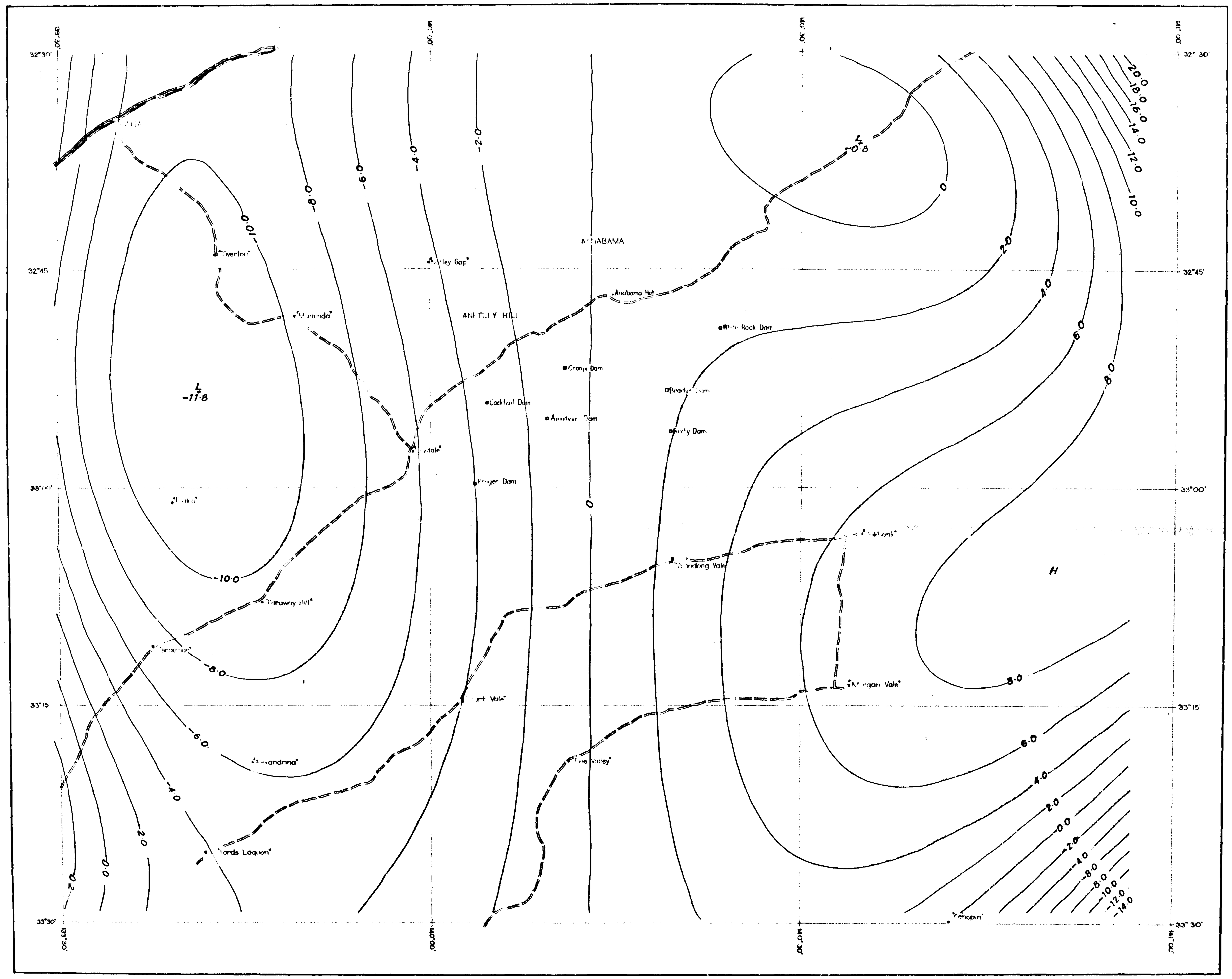
FIG. 8

Southern portion of Olary and northern half of Chowilla

DEPARTMENT OF MINES – SOUTH AUSTRALIA

ANABAMA FAULT PROJECT
BOUGUER GRAVITY CONTOURS AND
BOUGUER GRAVITY ANOMALY TRENDS

EXPLORATION GEOPHYSICS SECTION	GEOPHYSICIST	Drn. RAG	SCALE: 1:250 000 (ORIG)
		Tcd. DJM	73-73
		Ckd. A F	FG
Director of Mines	SUP. GEOPHYSICIST	Exd.	DATE: 19 OCTOBER 1972



LEGEND

Regional bouguer gravity contour
Contour interval 2 miligals

$\frac{L}{-0·8}$ Bouguer gravity low

H Bouguer gravity high

Scale in Kilometres

5 0 5 10 15 20 25 30

Scale in Miles

Portion of Chowilla & Olary

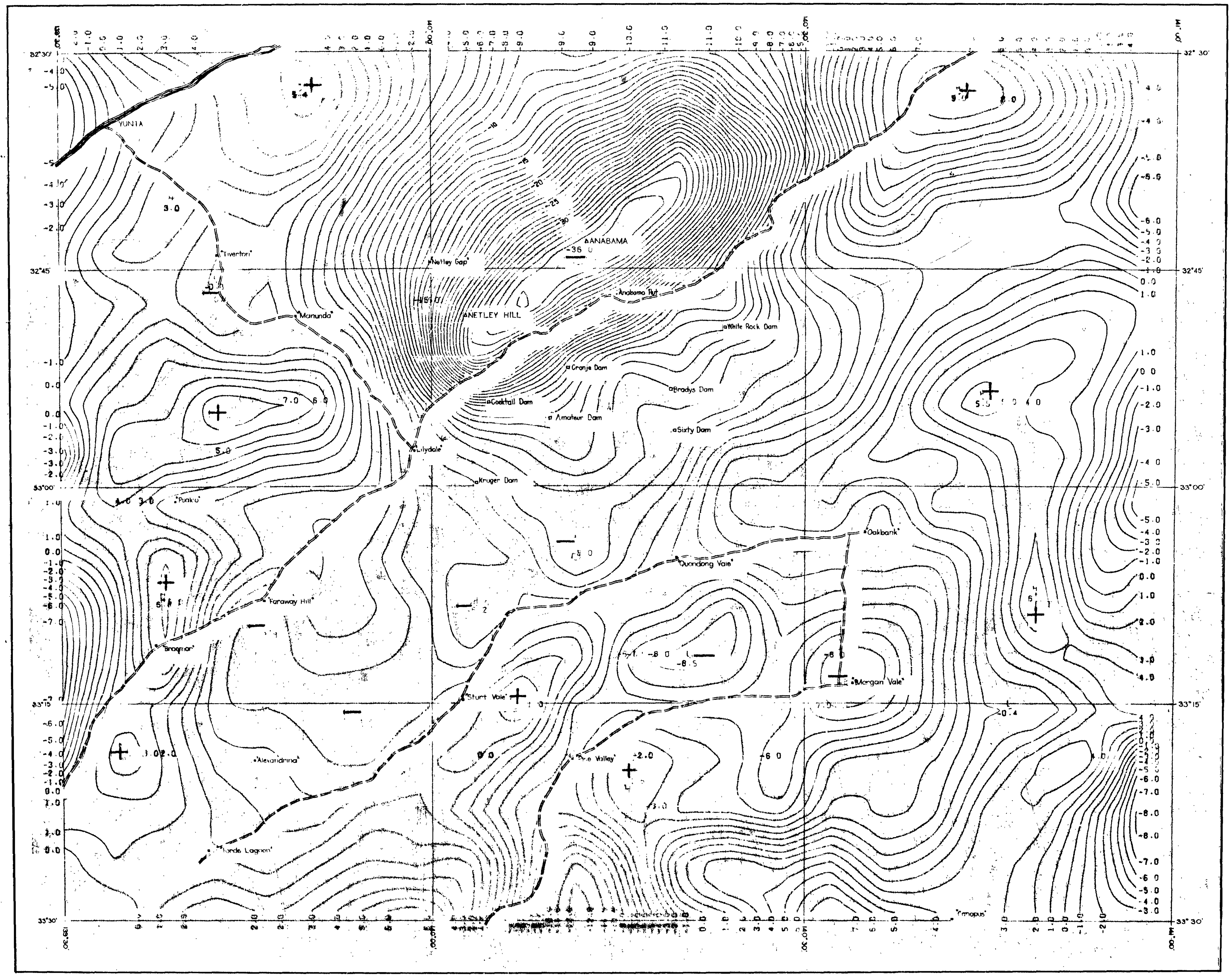
FIG.9

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ANABAMA FAULT PROJECT

6TH ORDER REGIONAL POLYNOMIAL SURFACE (FROM COMPUTER)

		Drn.	SCALE: 250 000 (ORIG)
		Tcd. G.M	73-74
		Ckd. AF	FG
Director of Mines		Exd.	DATE: 24 OCT 1972



LEGEND

-6.0 Residual gravity contour from computer contour interval 1 milligal

+ Positive gravity anomaly

— Negative gravity anomaly

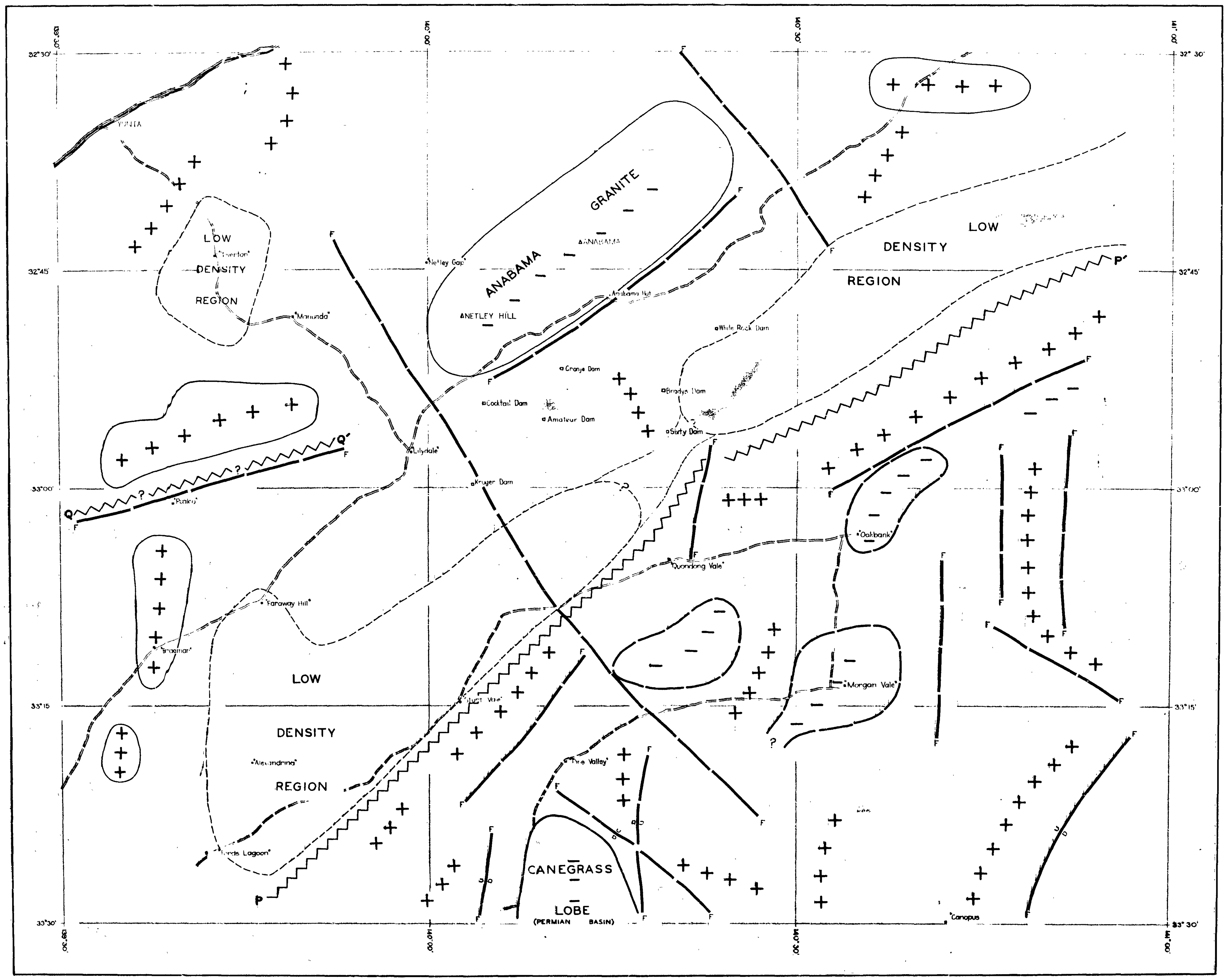
Scale in Kilometres

5 0 5 10 15 20 25 30

Scale in Miles

Portions of Chowilla and Olary 1:250000 Sheets FIG. 10

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT 6TH ORDER POLYNOMIAL RESIDUAL COMPUTER GRAVITY CONTOURS			
EXPLORATION GEOPHYSICS SECTION	GEOPHYSICIST	Drn. RAO	SCALE 1:250000 (ORIG)
		Tcd. A.F.	73-75
		Ckd.	FG
Director of Mines		Exd.	DATE: Oct. 1972



LEGEND

- Tentative Sedimentary Basins or Granites
- + Positive Residual Trend
- Areas of Ironstone Formation
- − Negative Residual Trend
- P/\/\/\P' Major Discontinuites
- Fault
- Tentative fault

Scale in Kilometres

5 0 5 10 15 20 25 30

Scale in Miles

FIG.11

DEPARTMENT OF MINES – SOUTH AUSTRALIA

ANABAMA FAULT PROJECT
PORTIONS OF CHOWILLA AND OLARY
STRUCTURAL INTERPRETATION
BASED ON RESIDUAL GRAVITY CONTOURS

EXPLORATION GEOPHYSICS SECTION	R A Gerdes GEOPHYSICIST	Drn.	SCALE: 1:250 000 (ORIG)
		Tcd. AGR	73-76
		Chd. A F	FG
Director of Mines	GEOPHYSICIST	Exd.	DATE: 13th NOV 1972

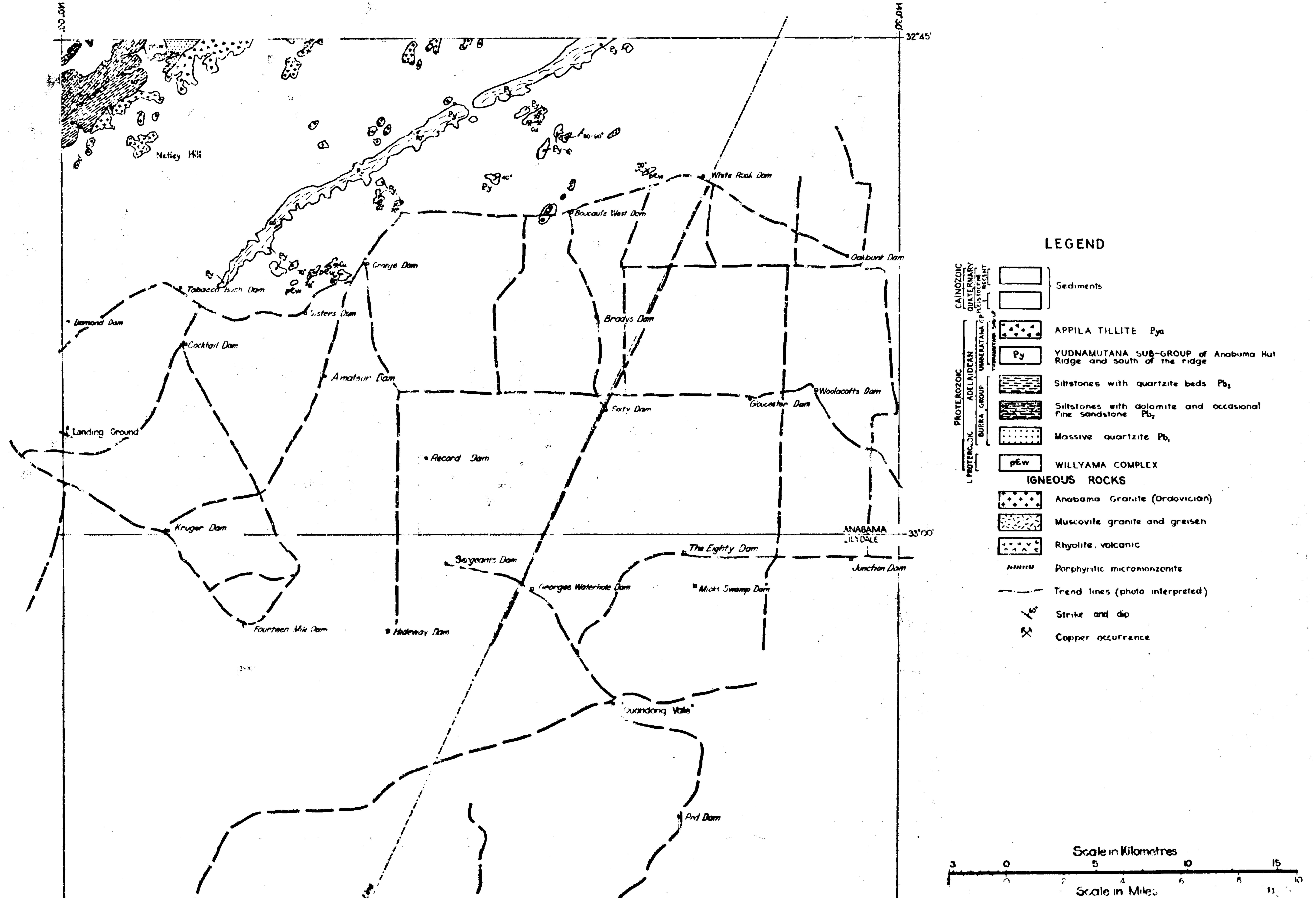
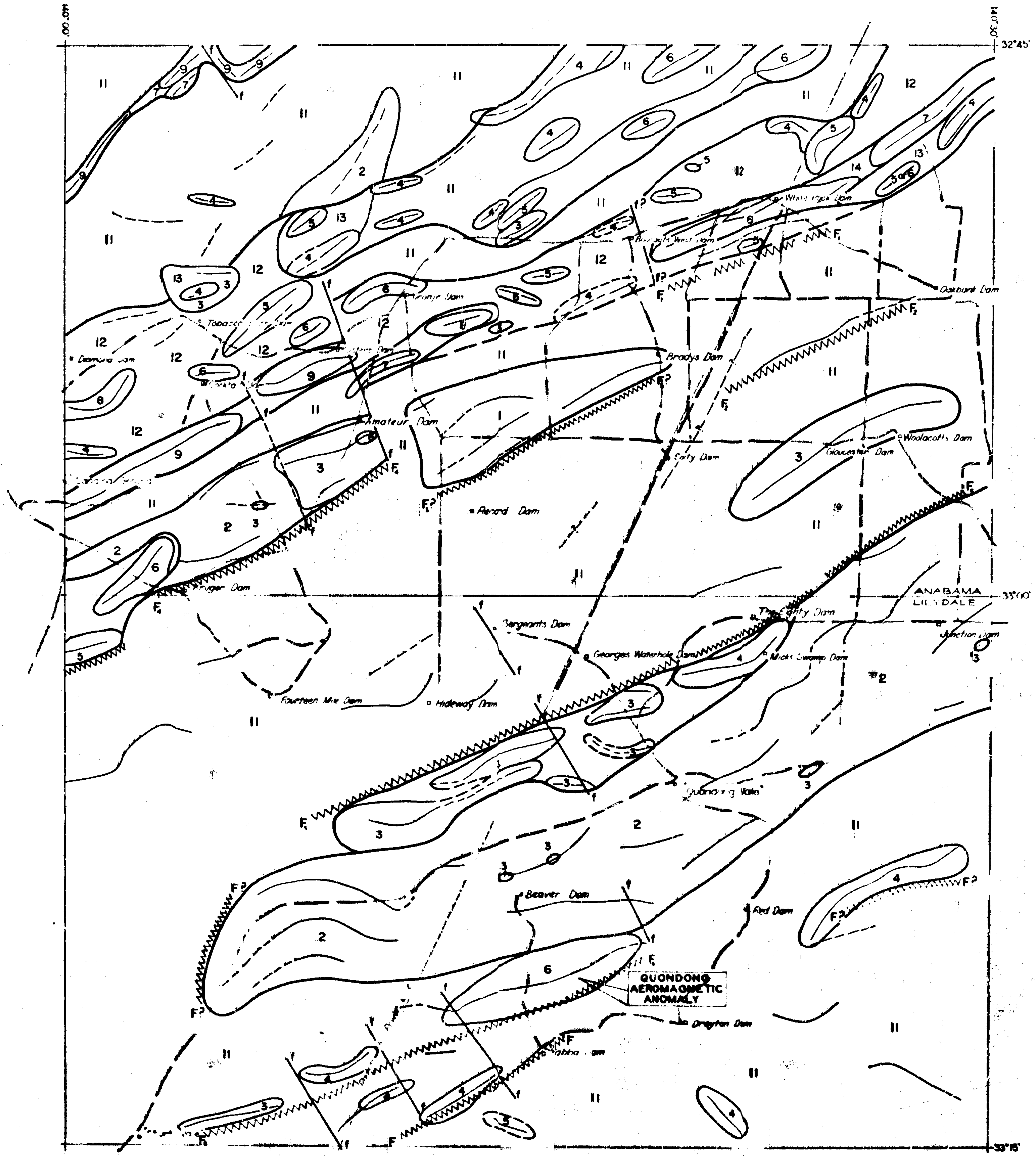


FIG.12

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ANABAMA FAULT PROJECT
SOLID GEOLOGY
OF ANABAMA & LILYDALE

EXPLORATION GEOPHYSICS SECTION	R GERDES GEOPHYSICIST	Drn.	SCALE (ORIG)
		Trd. TJE	73-77
		Ckd. AF	FG
Director of Mines		Exd.	DATE: 23 OCT 1972



LEGEND

- Positive Magnetic Trend
- Negative Magnetic Trend
- Magnetic Zone – type 9
- Major Magnetic Zone (Lithological Type)
- Magnetic Lineament, Possible Fault, or Lithological Contact — F F
- Cross Fault — f f
- Track

Scale in Kilometres

2 0 5 10 15

Scale in Miles

2 0 2 4 6 8 10

FIG. 13

Based on Magnetic Charts

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT INTERPRETATION OF MAGNETIC TRENDS AND ZONES OF ANABAMA AND LILYDALE 1:63 360 SHEET AREAS			
EXPLORATION GEOPHYSICS SECTION	GEOPHYSICIST	Drn. RAG	SCALE 1:125 000 (ORIG)
		Tcd. DJM	73-78
		Ckd. AF	FG
Director of Mines		Exd.	DATE: 23 OCT 1973

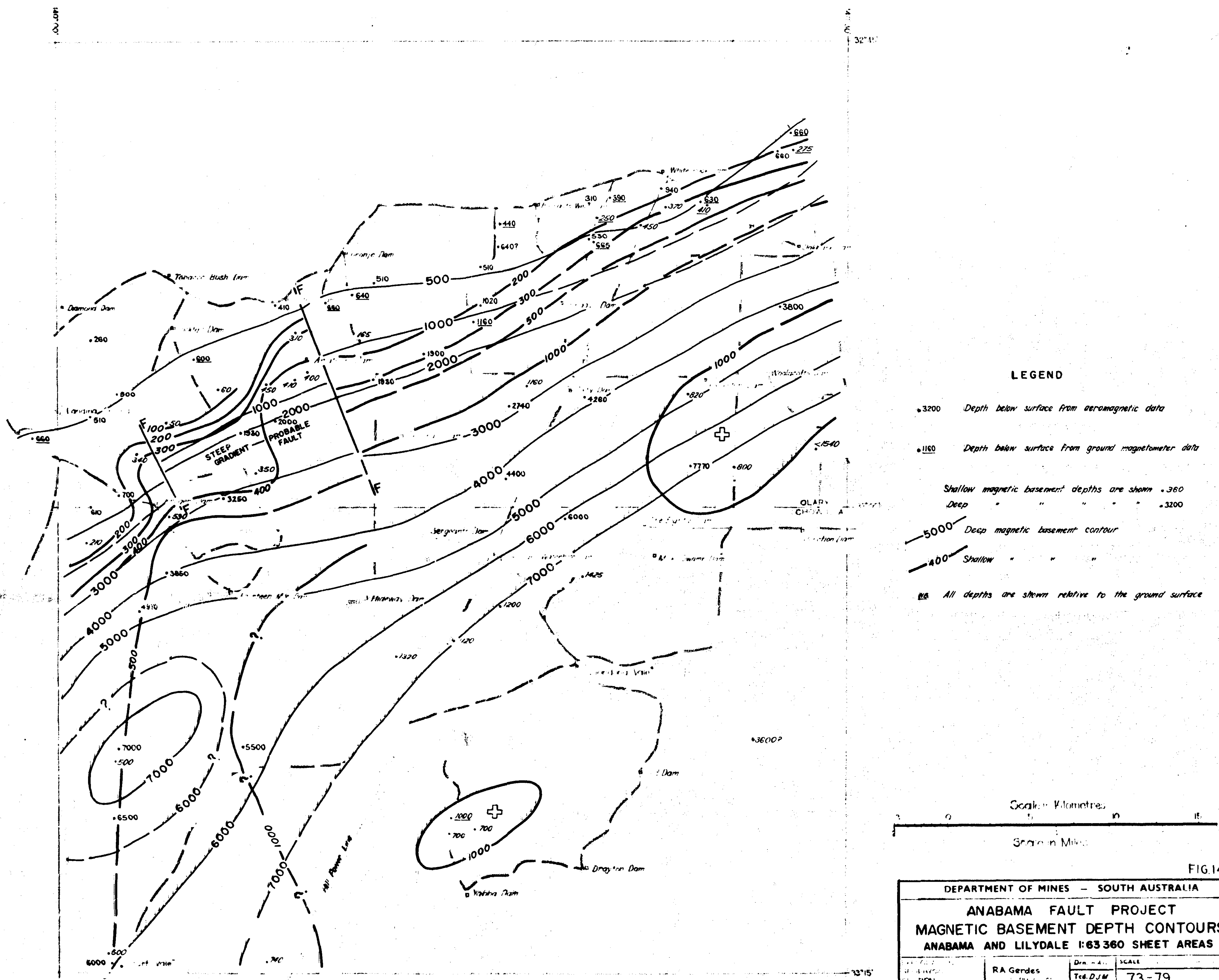
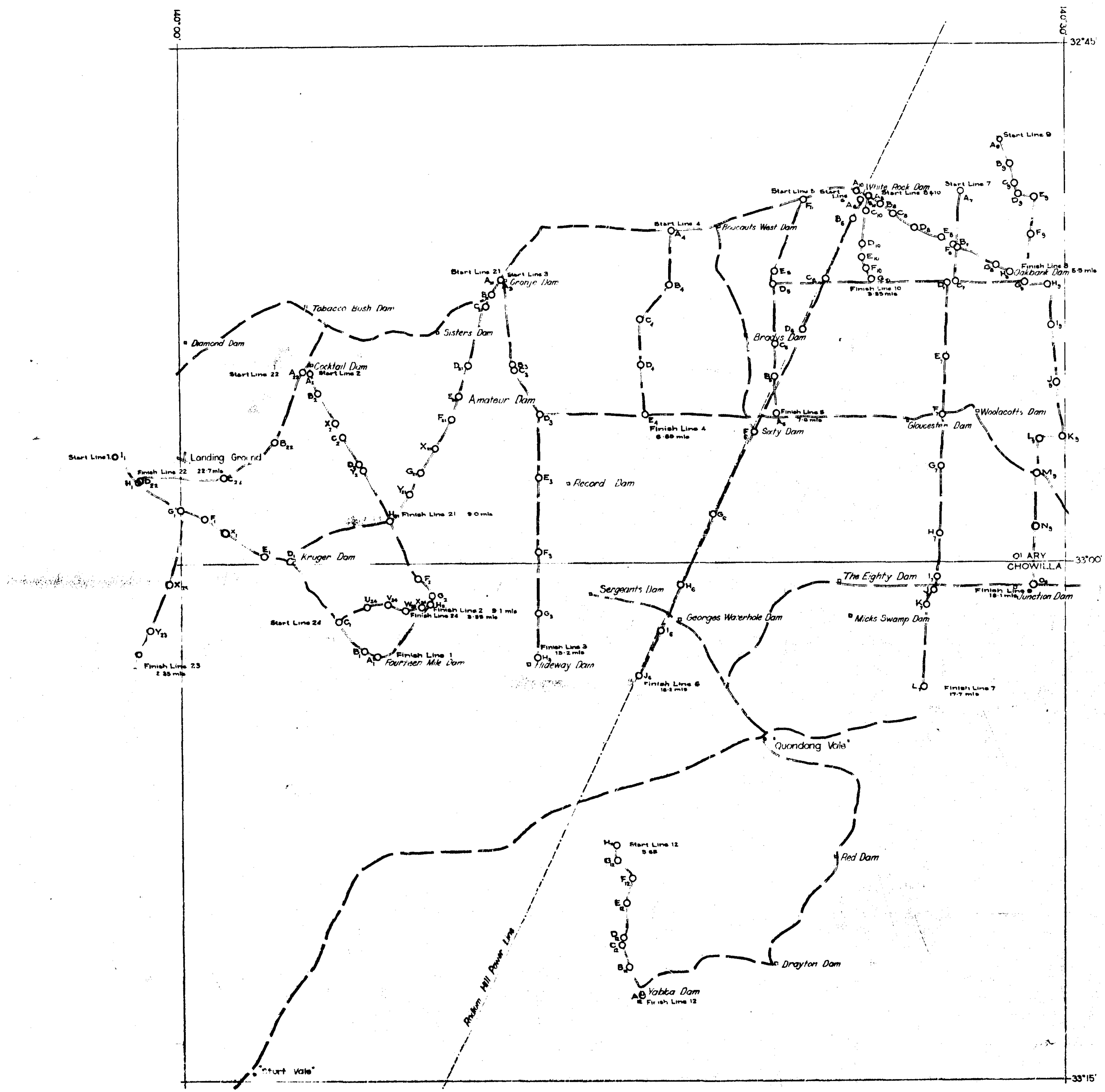


FIG.14

DEPARTMENT OF MINES – SOUTH AUSTRALIA
ANABAMA FAULT PROJECT
MAGNETIC BASEMENT DEPTH CONTOURS
ANABAMA AND LILYDALE 1:63 360 SHEET AREAS

Director of Mines	R A Gerdes	Drn.	SCALE
		Tcd. D J M	73-79
		Chd A F	FG
		Exd.	DATE 26 JAN 1973



LEGEND

Mileage control points on Magnetometer Traverse 7

Scale in Kilometres

Scale in Miles

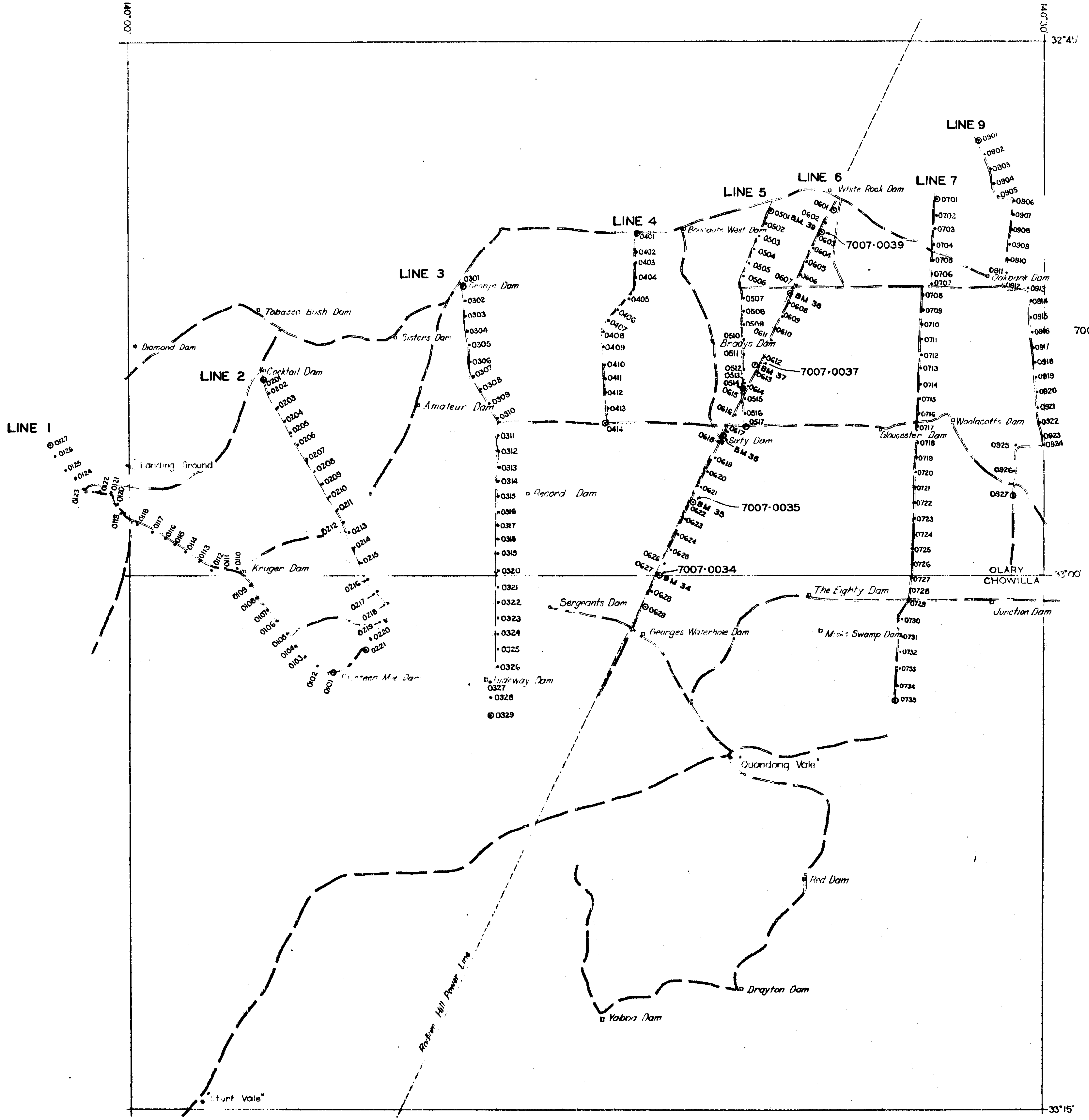
FIG. 15

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ANABAMA FAULT PROJECT

LOCATIONS OF VEHICLE MAGNETOMETER TRAVERSES AND CONTROL POINT POSITIONS

EXPLORATION GEOPHYSICS SECTION	R.A. GERDES GEOPHYSICIST	Drn. RAG	SCALE: 1:125000 (ORIG)
		Tcd. O.M.	73-80
		Ckd. A.F.	FG
Director of Mines		Exd.	DATE: 10th Oct 1972



LEGEND

- ⊙ Permanent stations
- 0324 • DM Station 24 on traverse line 3 (all stations 72 Al.xxxx)
- 7007·0034 (BM 34) Bureau of Mineral Resources permanent stations

Scale in Kilometres

5 0 5 10 15

0 2 4 6 8 10

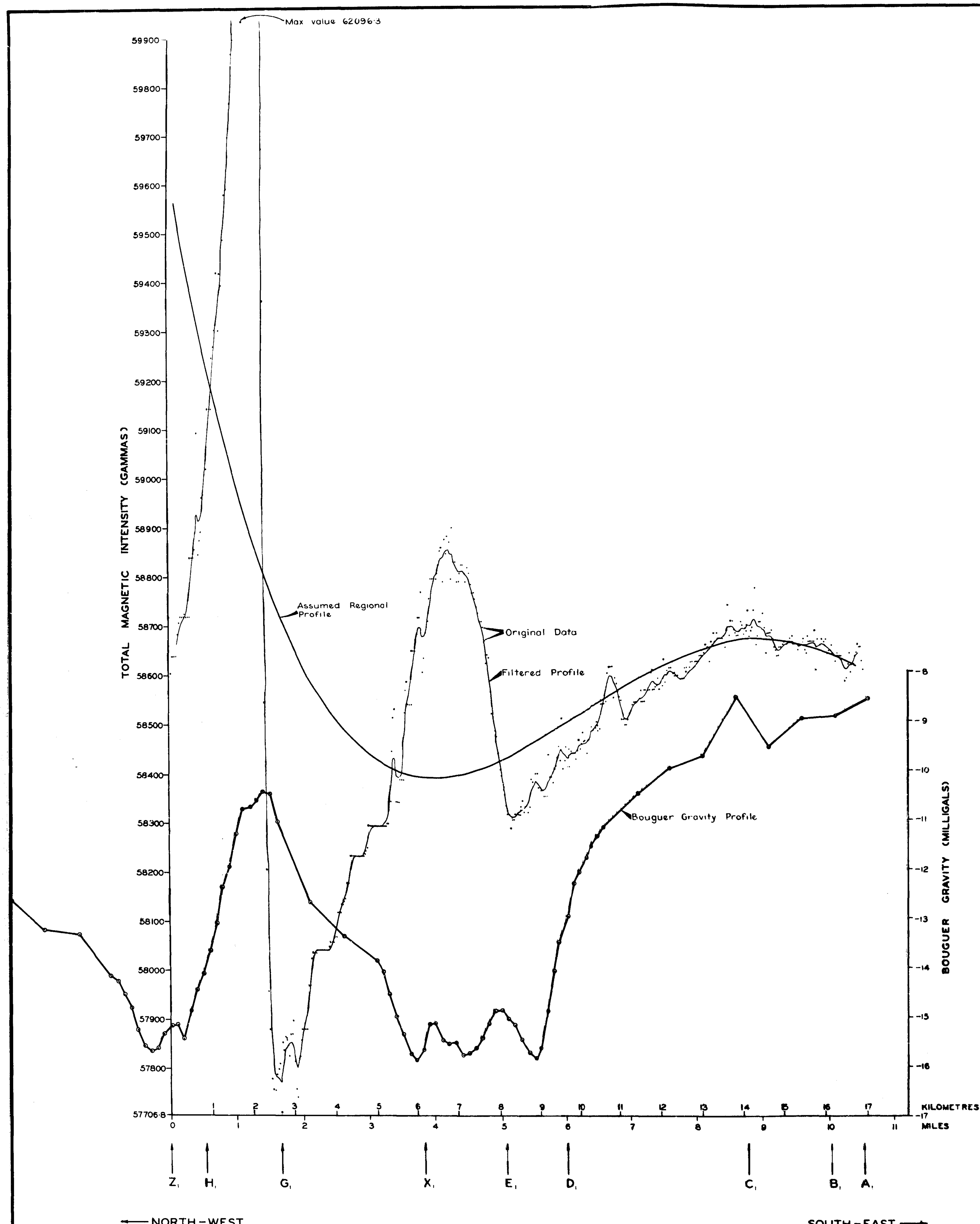
Scale in Miles

FIG.16

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ANABAMA FAULT PROJECT
LOCATION OF GRAVITY TRAVERSES
& STATION POINTS

EXPLORATION GEOPHYSICS SECTION	R GERDES GEOPHYSICIST	Drn. RAG	SCALE 1:125 000 (ORIG)
		Tcd. TJE	73-81
		Ckd. A.F	FG
Director of Mines		Exd.	DATE: 13 OCT 1972



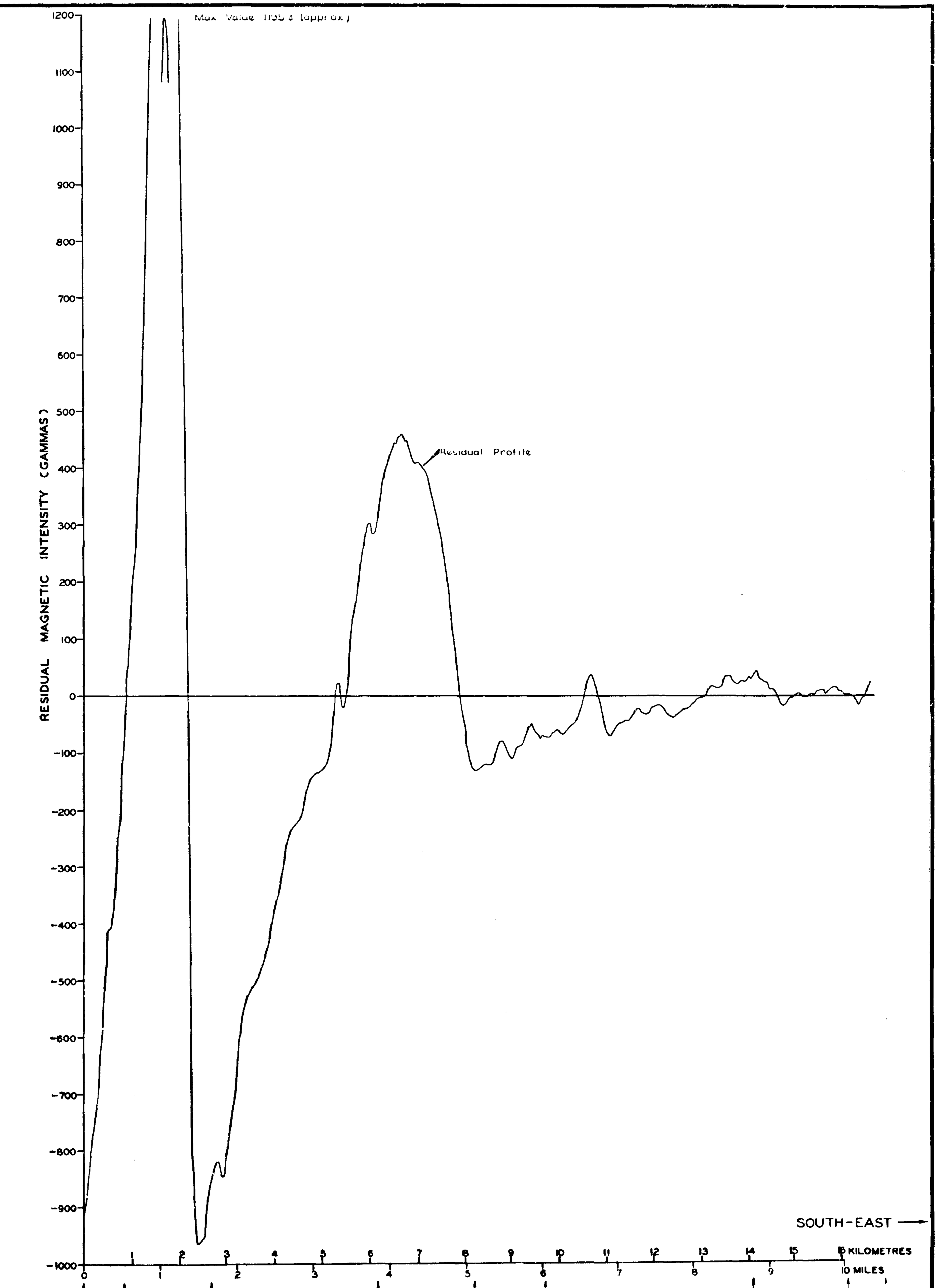
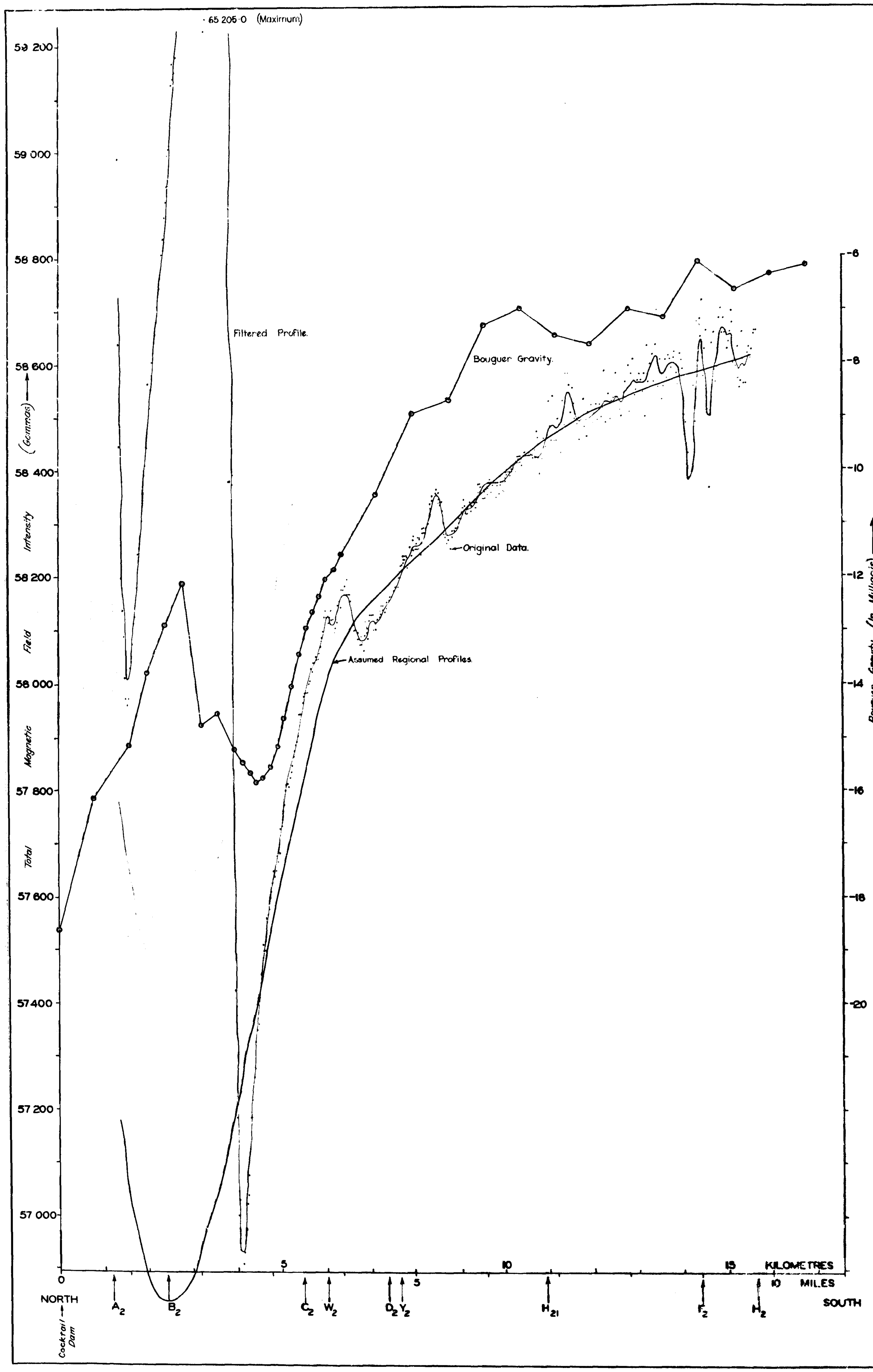


FIG.17

NB: A₁ .... Control Point on Traverse 1 at Station A

DEPARTMENT OF MINES – SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT GROUND MAGNETIC AND BOUGUER GRAVITY TRAVERSE 1			
EXPLORATION GEOPHYSICS SECTION	R. GERDES GEOPHYSICIST	Drn. RAG	SCALE: 1 IN – 0·75 MILES
		Tcd. MAS	73-82
		Ckd. AF	FG
Director of Mines		Exd.	DATE: 18 JANUARY 1973



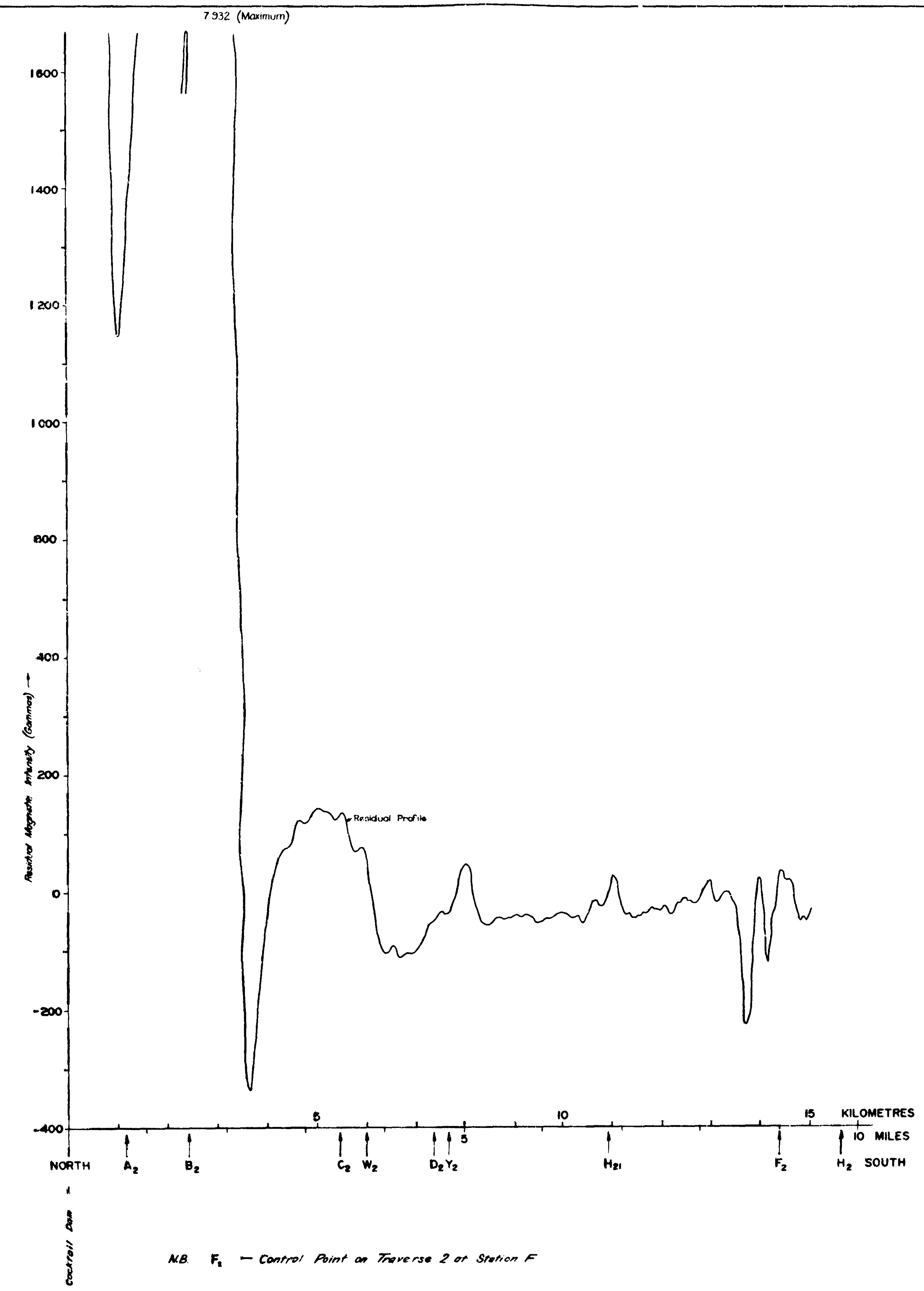


FIG. 18

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT			
GROUND MAGNETIC AND BOUGUER GRAVITY TRAVERSE 2			
EXPLORATION GEOPHYSICS SECTION	R A Gerdes GEOPHYSICIST	Drn. R.A.G.	SCALE 1 in = 0.75 miles
		Trd. S.J.C.	73 — 83
		Ckd. A.F.	FG
Director of Mines	SUP GEOPHYSICIST	Exd.	DATE: 15 DEC 1972

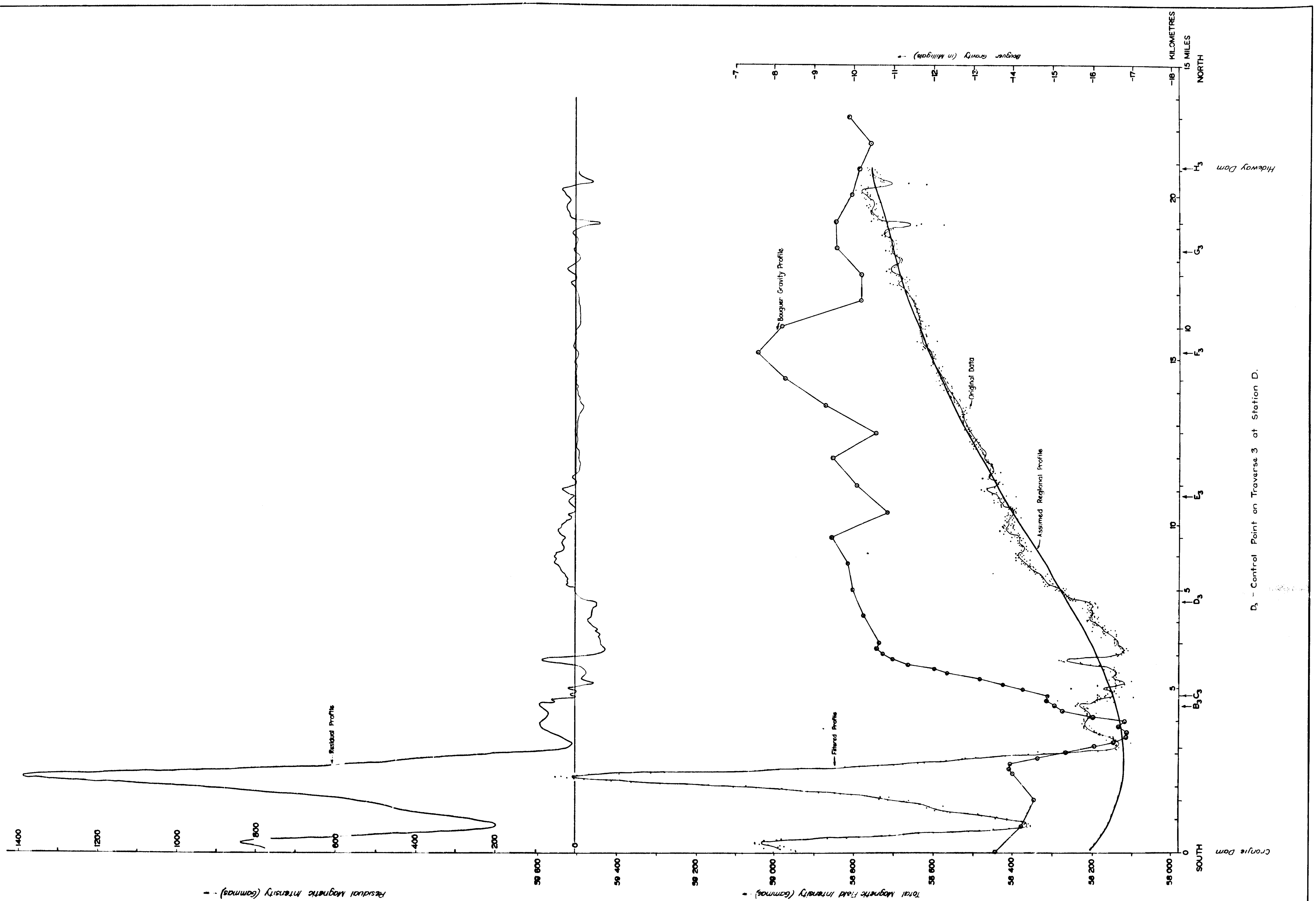


FIG.19

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT			
GROUND MAGNETIC AND BOUGUER GRAVITY TRAVERSE 3			
EXPLORATION GEOPHYSICS SECTION	R. GERDES GEOPHYSICIST	Drn. R.A.G.	SCALE: AS SHOWN
		Tcd. S.J.C.	73-84
		Ckd. A.F.	FG
Director of Mines	SUP. GEOPHYSICIST	Exd.	DATE: 7.12.1972

FIG.20

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT GROUND MAGNETIC AND BOUGER GRAVITY TRAVERSE 4			
EXPLORATION GEOPHYSICS SECTION	R. GERDES	Drn. RAG	SCALE: 1 IN = 0·75 MILES
	GEOPHYSICIST	Tcd. TJE	73-85
		Ckd. A.F.	FG
Director of Mines		Exd.	DATE: 8 DEC. 1972

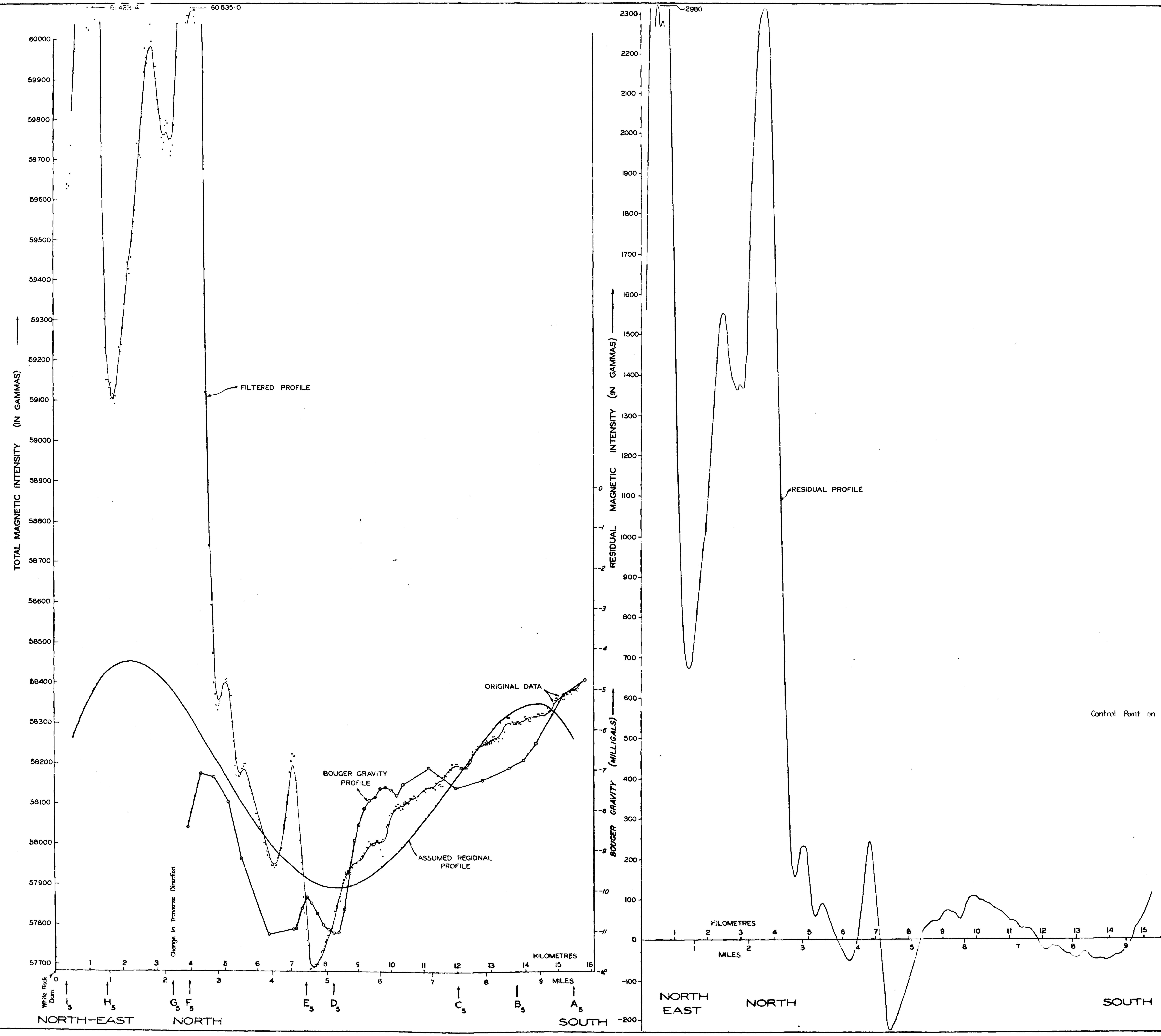
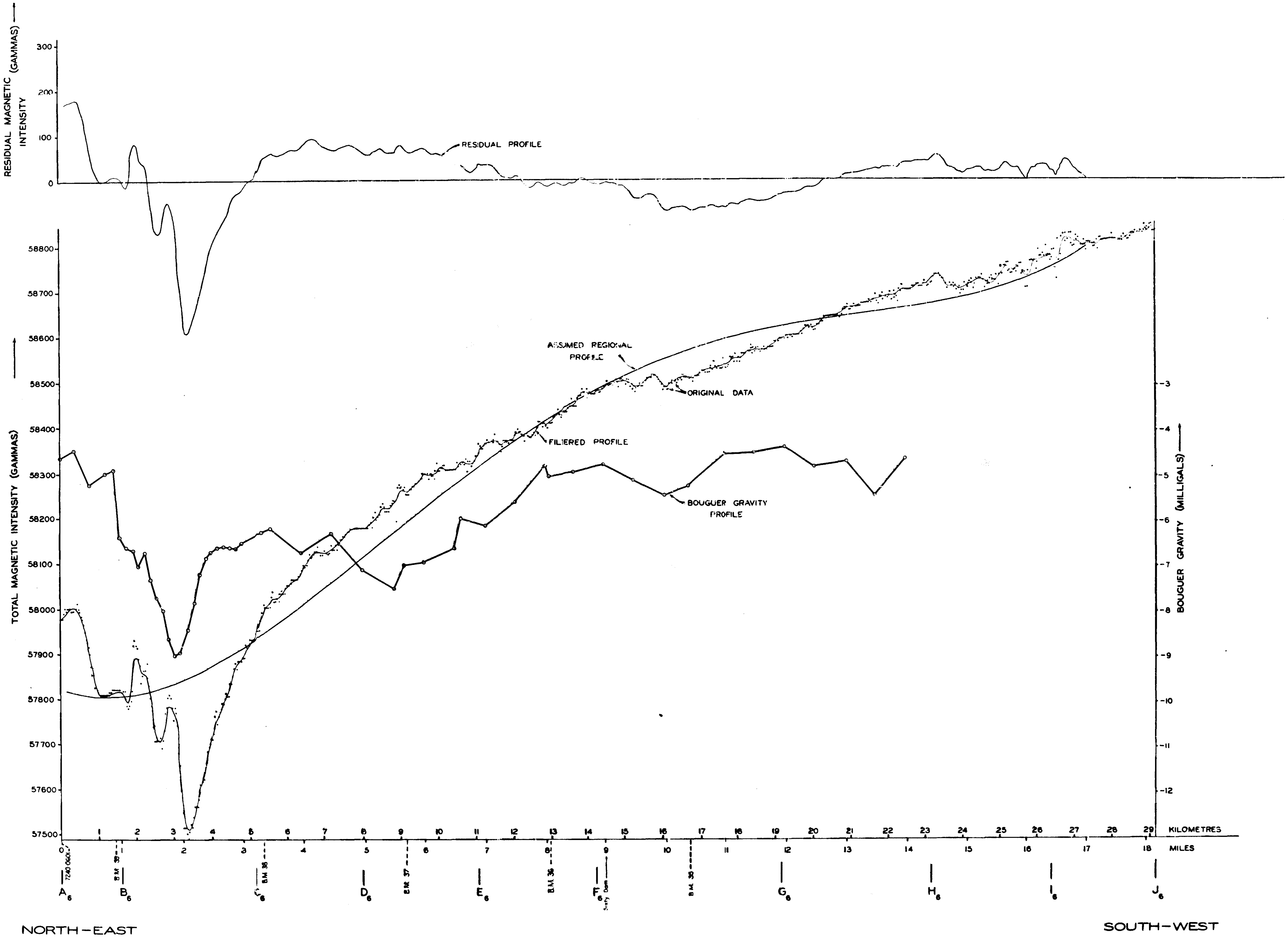


FIG. 21

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT GROUND MAGNETIC AND BOUGUER GRAVITY TRAVERSE 5			
EXPLORATION GEOPHYSICS SECTION	R. GERDES GEOLOGIST	Drn. RAG	SCALE: 1 IN. = 0·75 MLS.
		Tcd. TJE	73-86
		Ckd. A.F.	FG
Director of Mines		Exd.	DATE: 12 DEC. 1972



Control Point on Traverse 6 at Stn. A.........A_6

FIG 22

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT GROUND MAGNETIC AND BOUGUER GRAVITY TRAVERSE 6			
EXPLORATION GEOPHYSICS SECTION	R. GERDES GEOLOGIST	Drn. RAG Trd. TJE Ckd. A.F. Exd.	SCALE: 1 IN = 0.75 MILES 73-87 FG DATE: 14 DEC. 1972
Director of Mines			

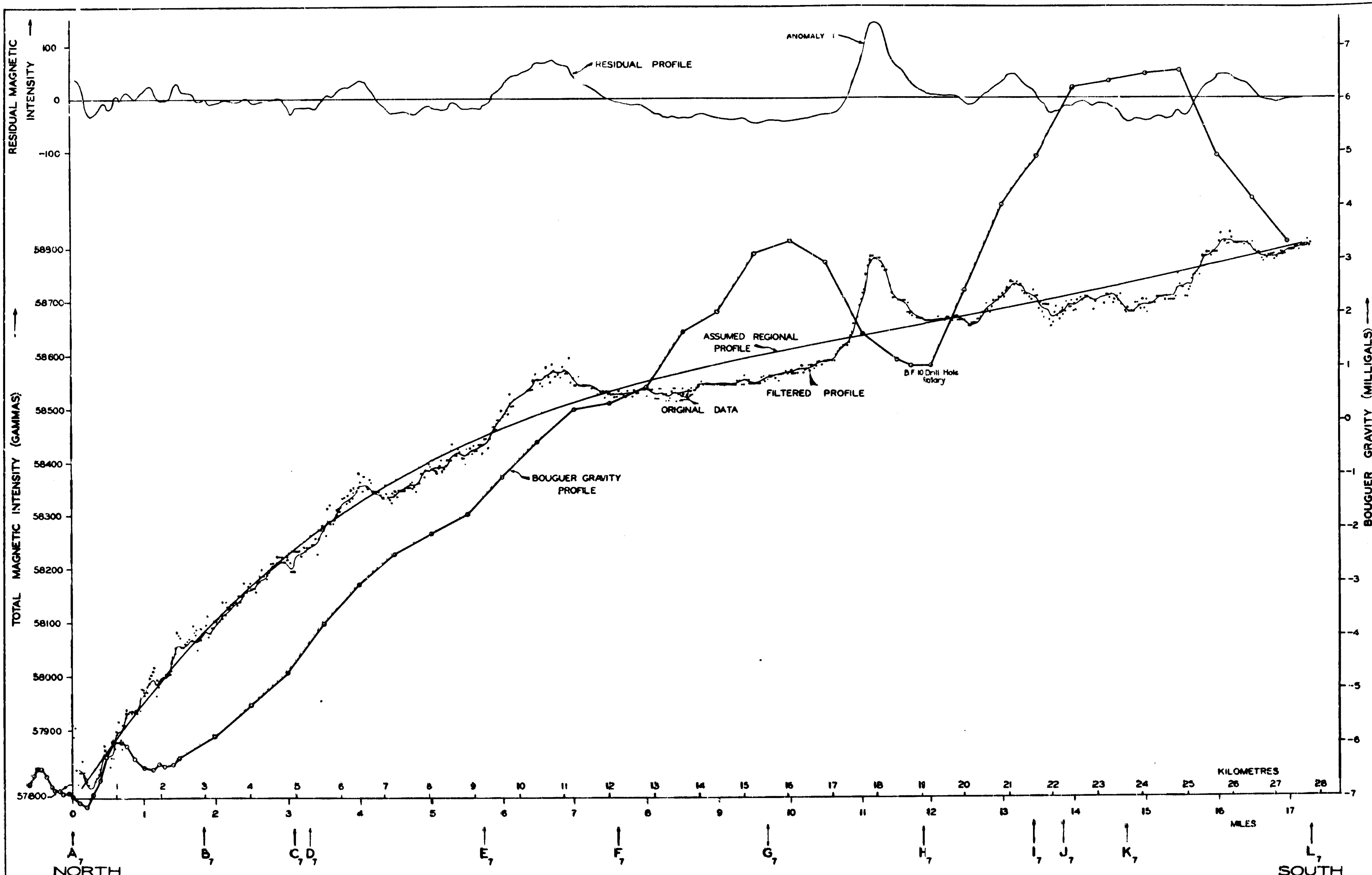


FIG 23

Control Point on Traverse 7, at Station A A_7

DEPARTMENT OF MINES – SOUTH AUSTRALIA

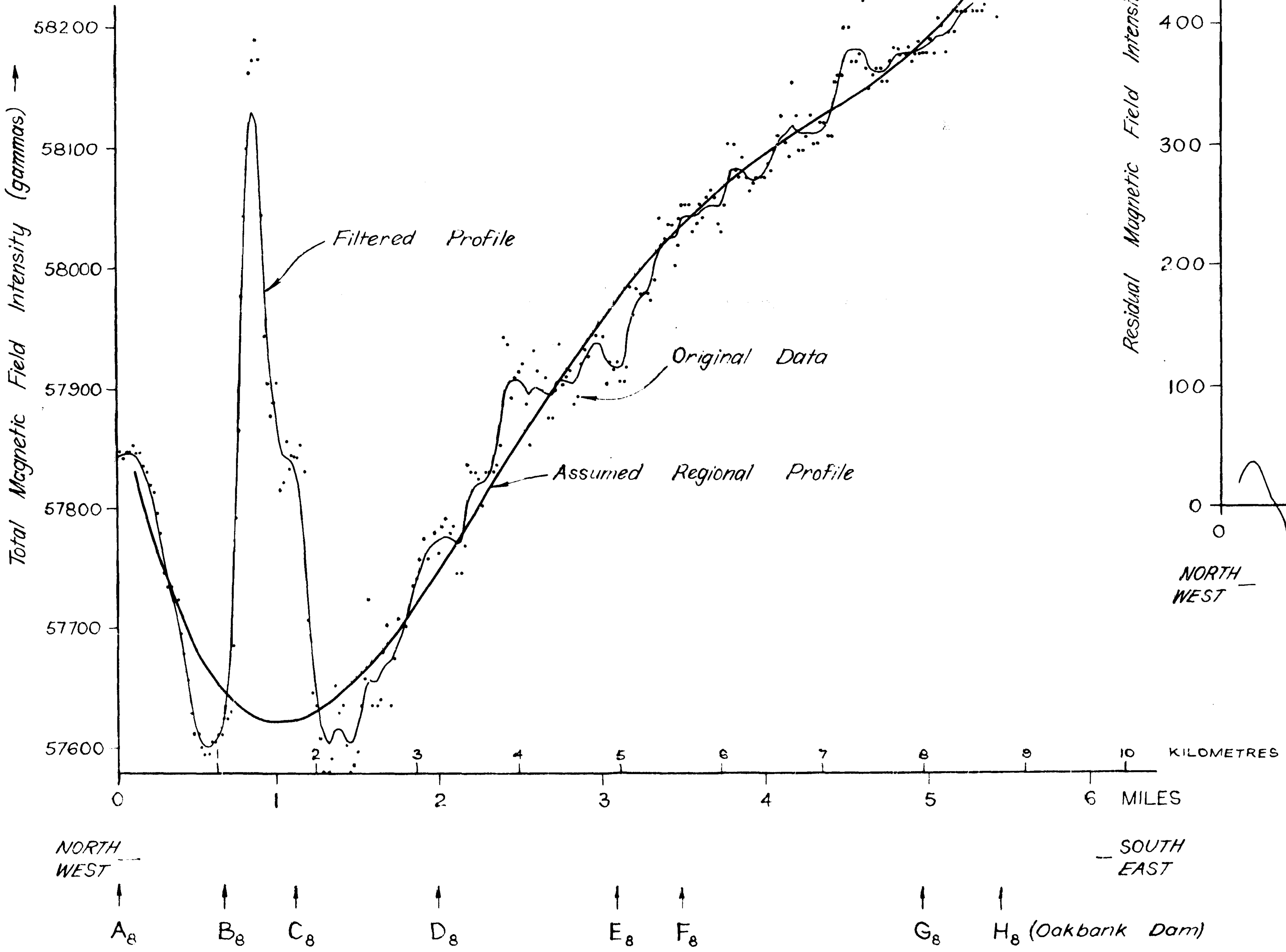
ANABAMA FAULT PROJECT
GROUND MAGNETIC & BOUGUER GRAVITY

TRAVERSE 7

EXPLORATION GEOPHYSICS SECTION	R. GERDES	Drn. RAG	SCALE 1 IN = 0·75 MLS
	GEOLOGIST	Trd. TJE	73-88
		Chd. A F	FG
Director of Mines		Exd.	DATE: 20 DEC 1972

FIG 24

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT GROUND MAGNETIC AND BOUGUER GRAVITY TRAVERSE 9			
EXPLORATION GEOPHYSICS SECTION	R. GERDES GEOLOGIST	Drn. RAG	SCALE: 1 IN = 0·75 MILES
		Trd. TJE	73-89
		Ckd. A.F.	FG
Director of Mines		Exd.	DATE: 8 JAN 1973



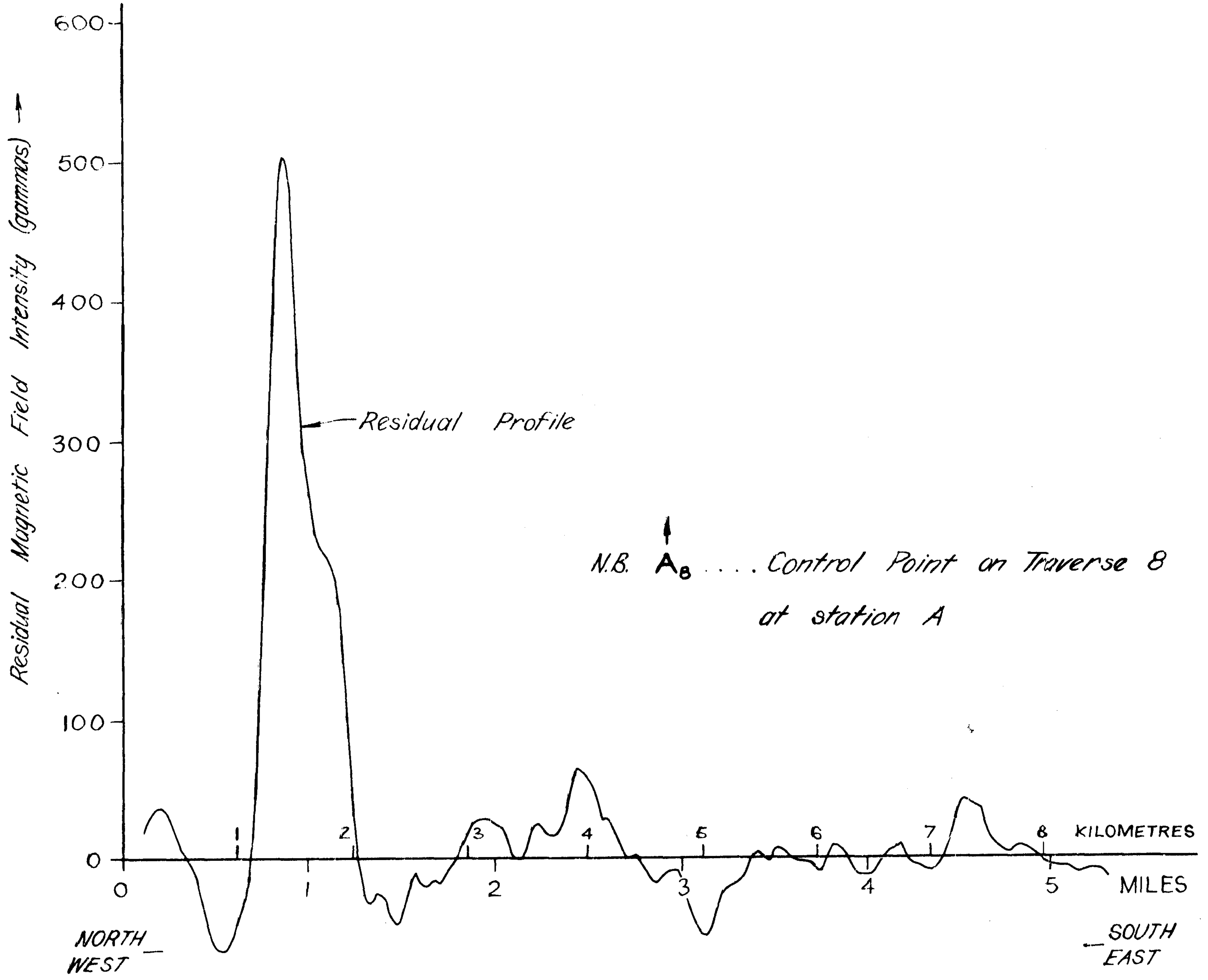
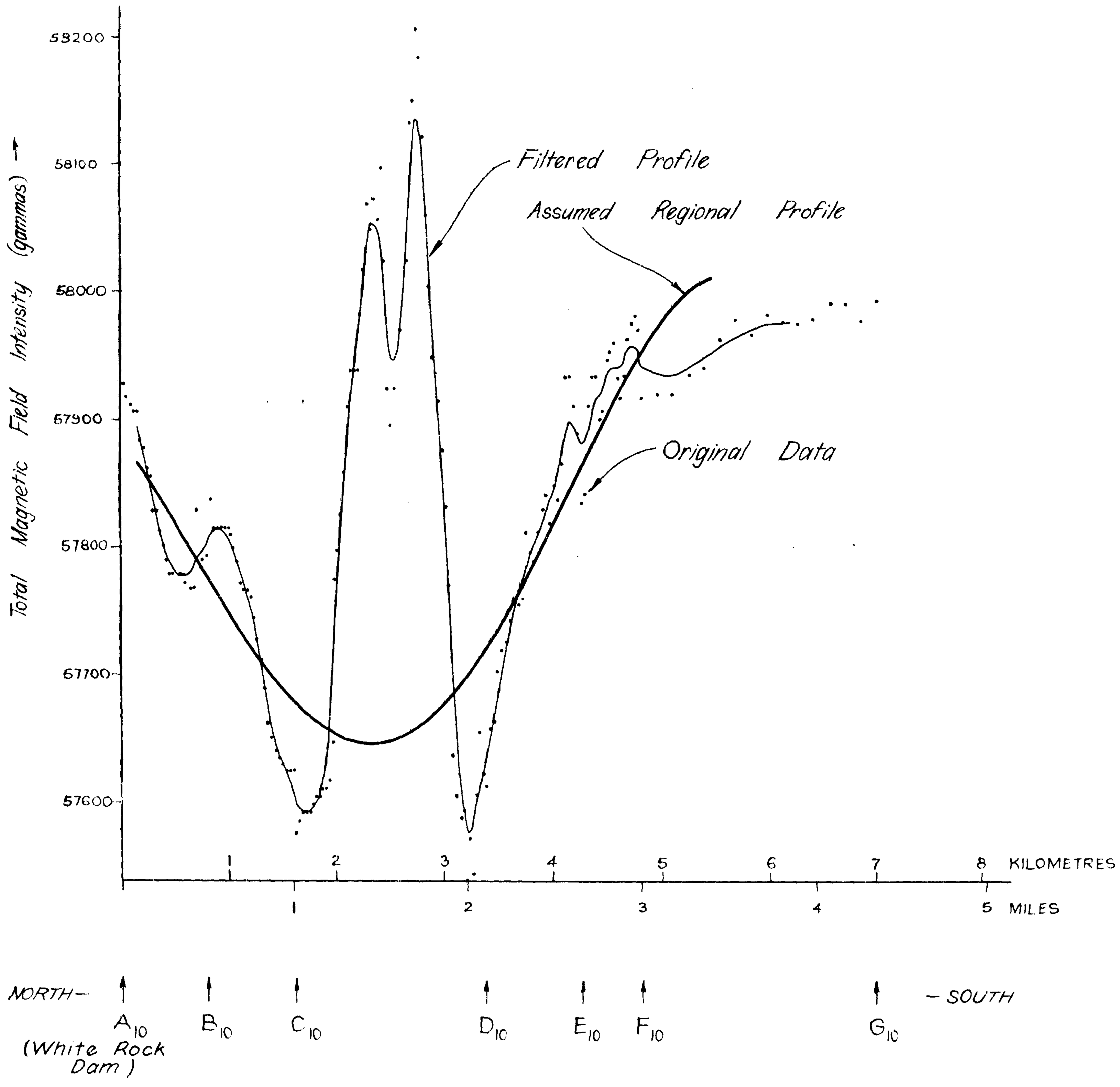


FIG. 25

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT GROUND MAGNETIC TRAVERSE 8			
EXPLORATION GEOPHYSICS SECTION	R.A. Gerdes GEOPHYSICIST	Drn. R.A.G.	SCALE: 1 INCH = 0·75 MILES
		Tcd. D.J.M.	73-90
		Ckd. A.F.	FG
Director of Mines	SUP. GEOPHYSICIST	Exd.	DATE: 27 OCTOBER 1972



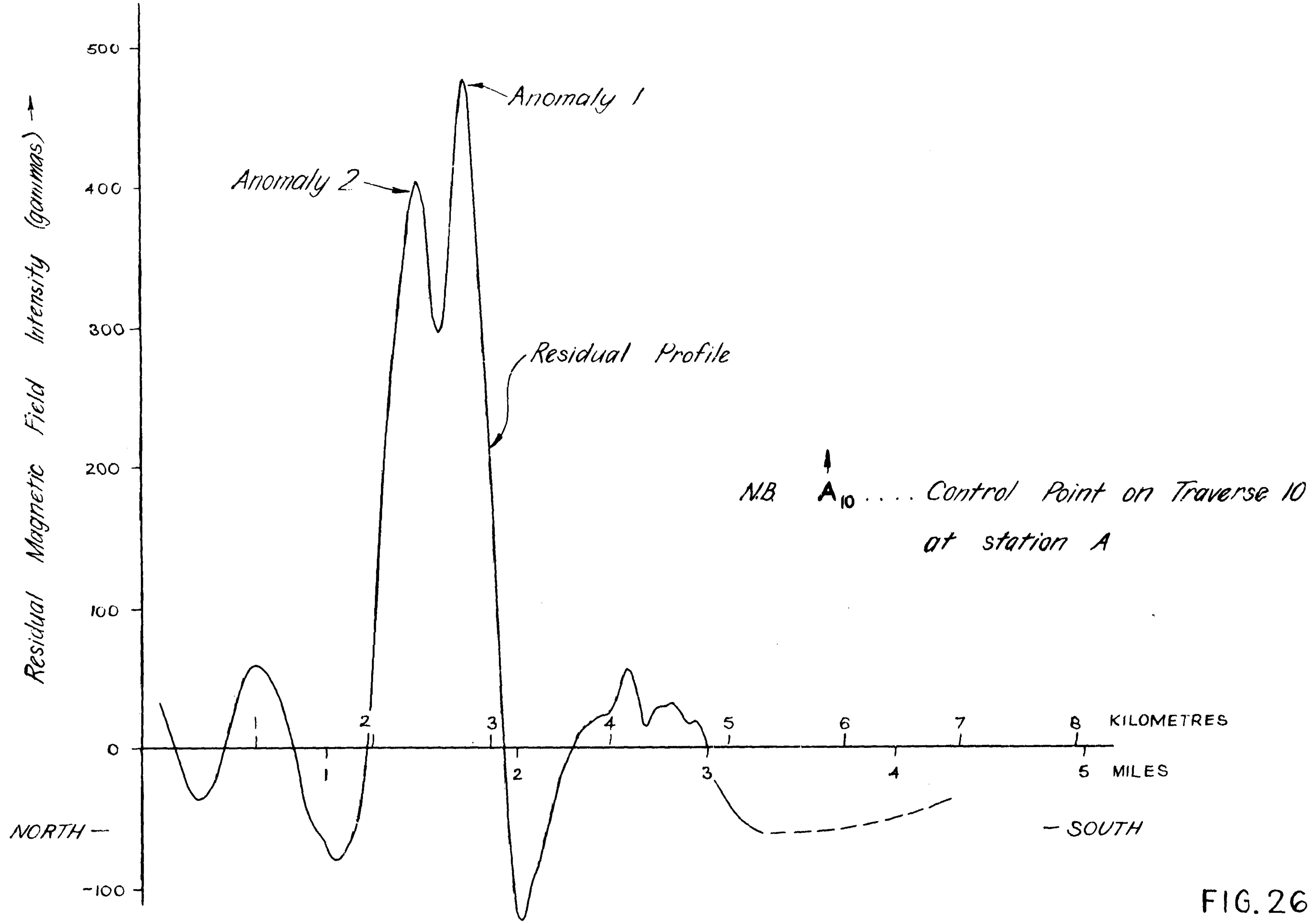
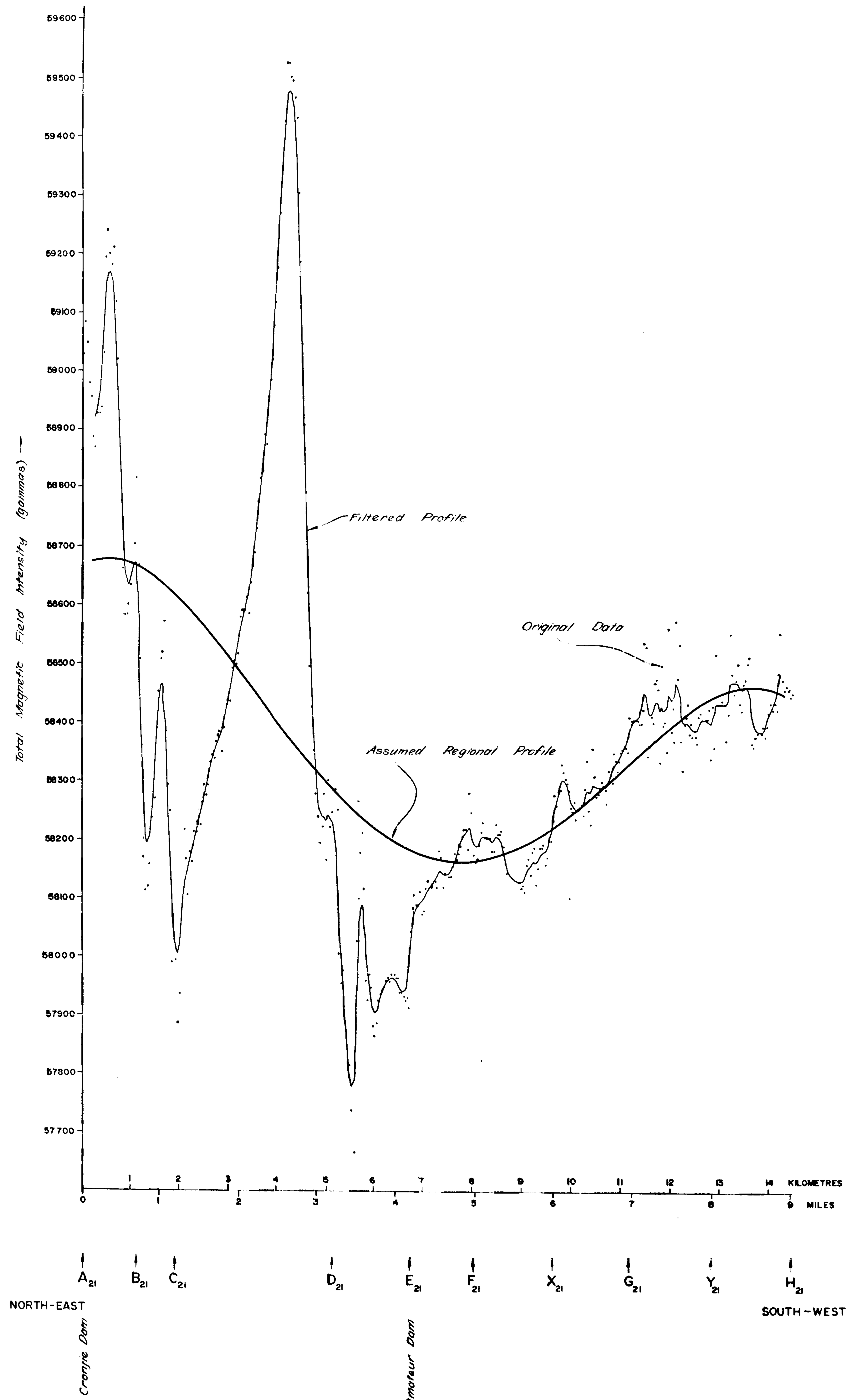


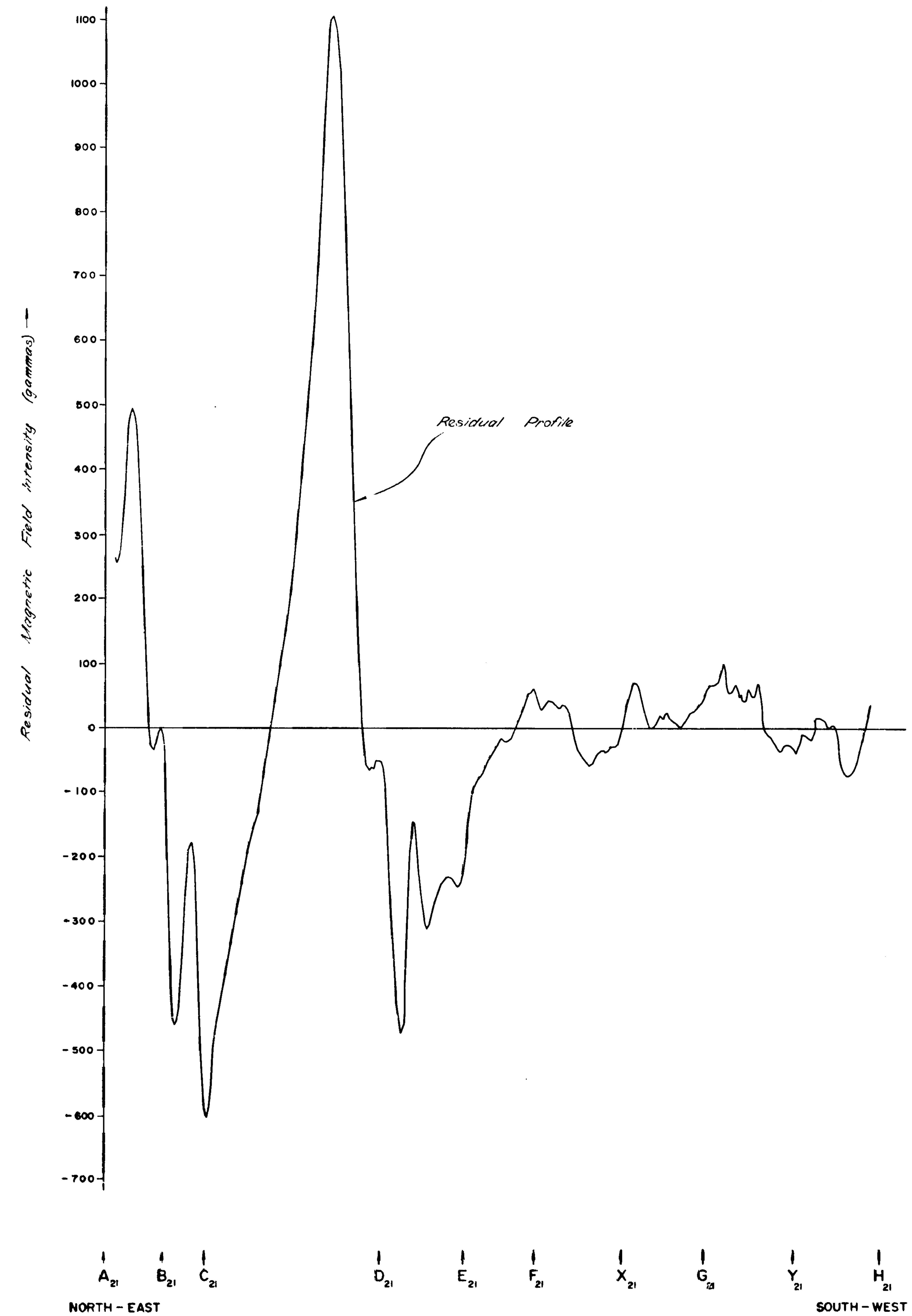
FIG. 26

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ANABAMA FAULT PROJECT
GROUND MAGNETIC TRAVERSE 10

EXPLORATION GEOPHYSICS SECTION	R.A.Gerdes GEOPHYSICIST	Drn. R.A.G.	SCALE: 1 INCH = 0.75 MILES
		Tcd. D.J.M.	73-91
		Ckd. A.F.	FG
Director of Mines	SUP GEOPHYSICIST	Exd.	DATE: 30 OCT 1972





N.B. A_{21} .... Control Point on Traverse 21 at station A

FIG 27

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT GROUND MAGNETIC TRAVERSE 21			
EXPLORATION GEOPHYSICS SECTION	R A Gerdes GEOPHYSICIST	Drn. R.A.G. Tcd.	SCALE: 1 INCH = .75 MILES
			73-92
		Ckd. A F	FG
Director of Mines	SUP. GEOPHYSICIST	Exd.	DATE: 21 NOV 1972

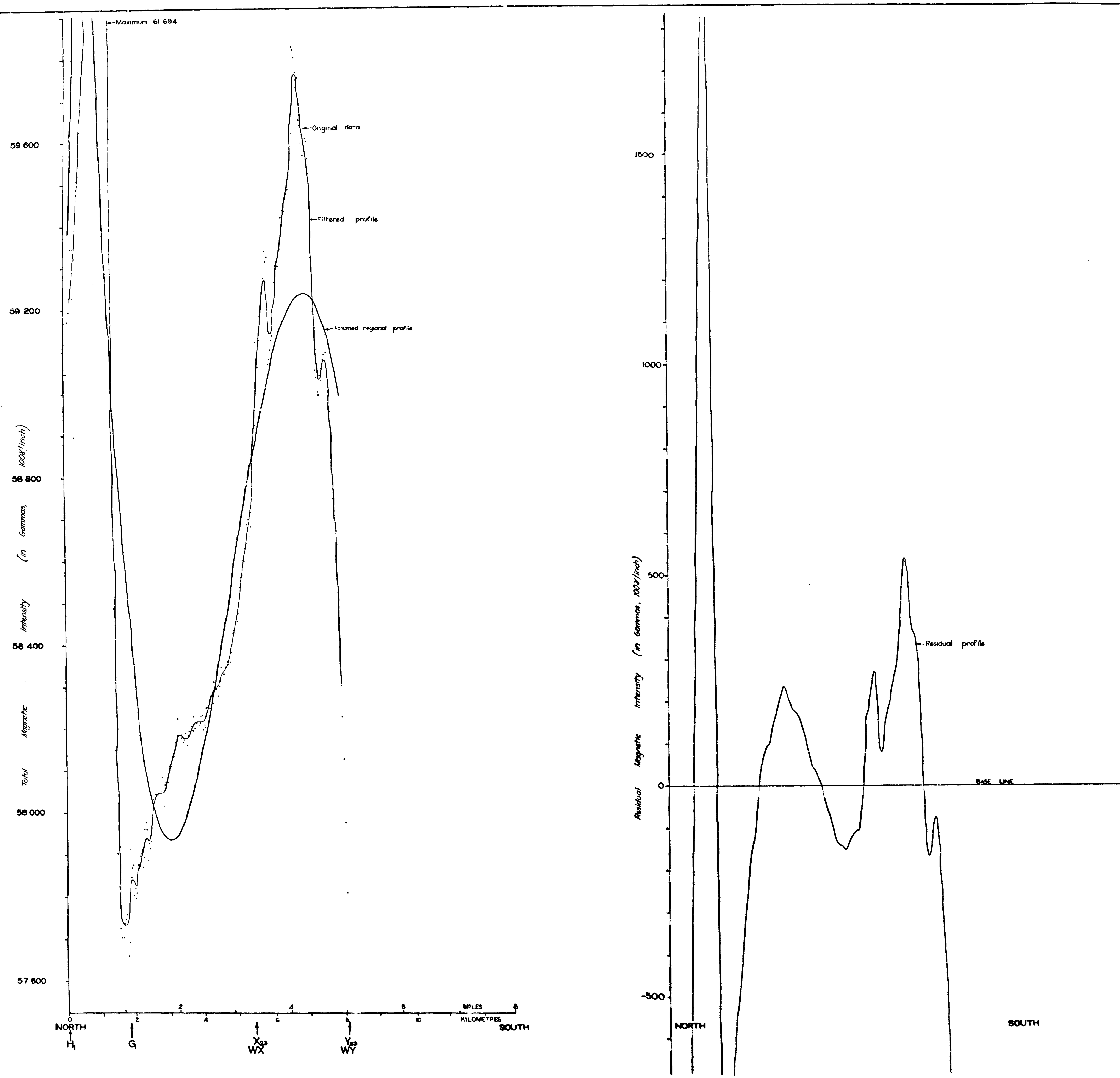
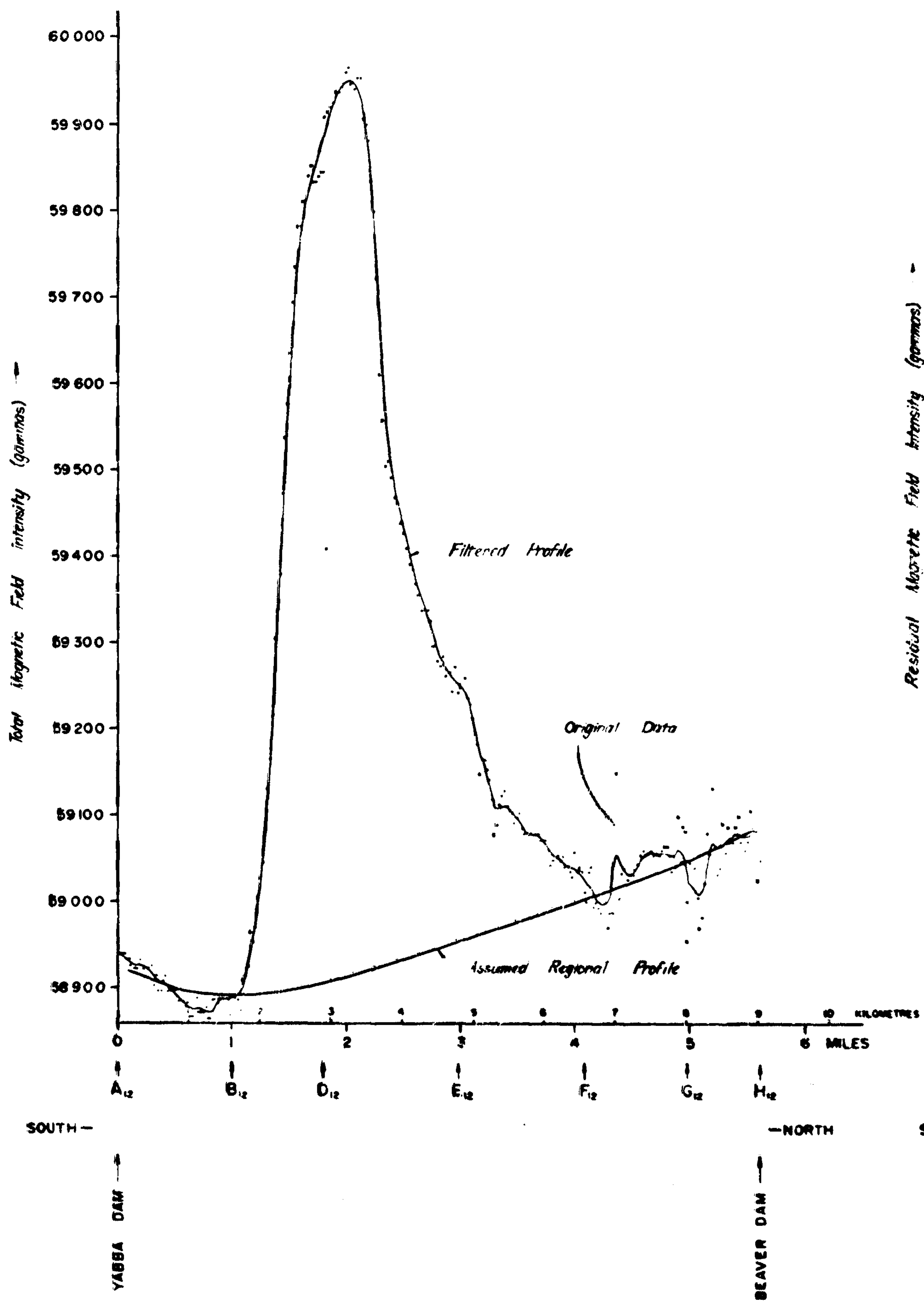
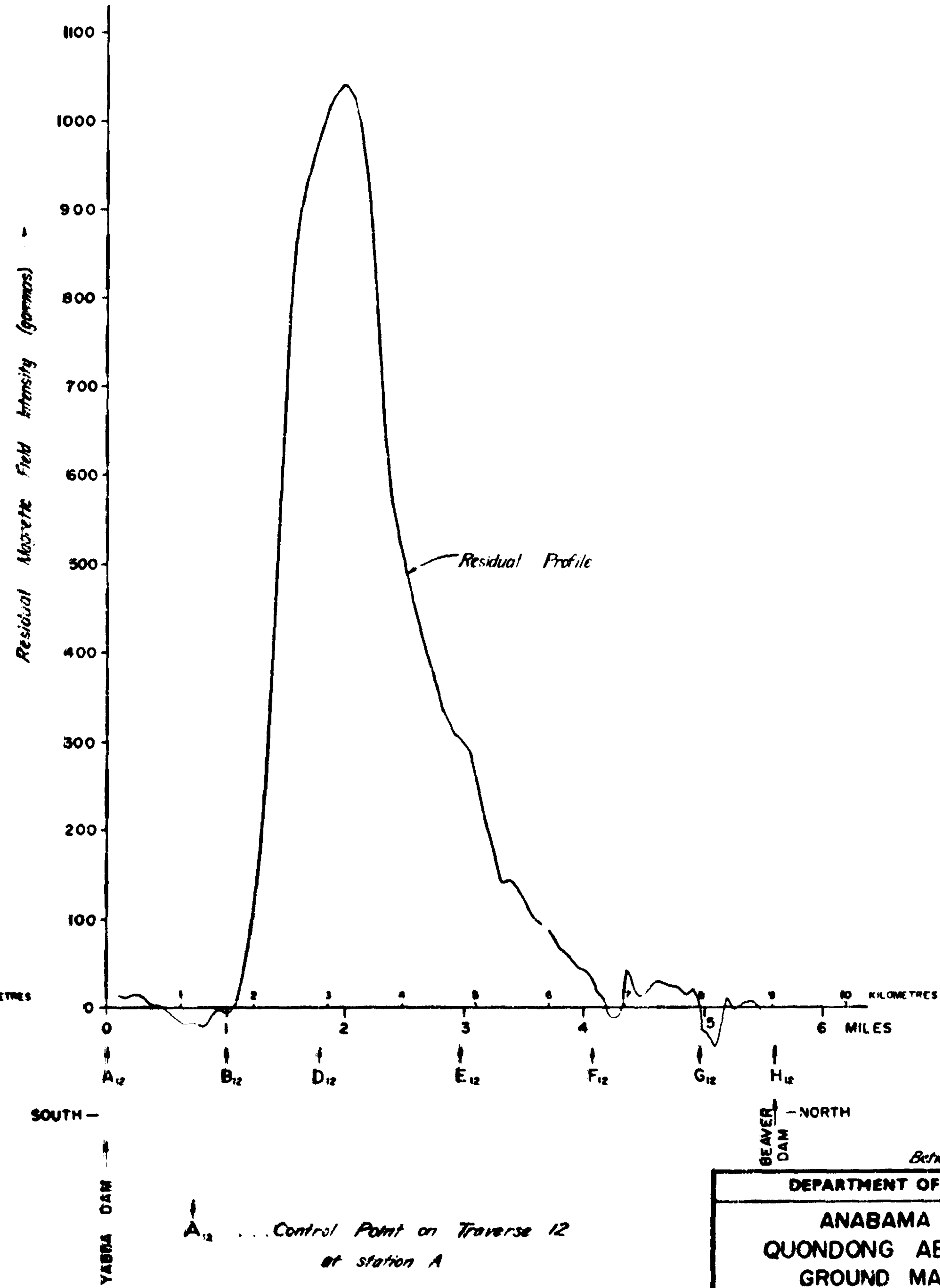


FIG 28

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT GROUND MAGNETIC PROFILES LINE W (23)			
EXPLORATION GEOPHYSICS SECTION	R A Gerdes GEOPHYSICIST	Drn. RAG	SCALE: AS SHOWN
		Tcd. S.J.C.	73-93
		Ckd. A F	FG
Director of Mines		Exd.	DATE: 18 JANUARY 1973





A_{12} . . . Control Point on Traverse 12 at station A

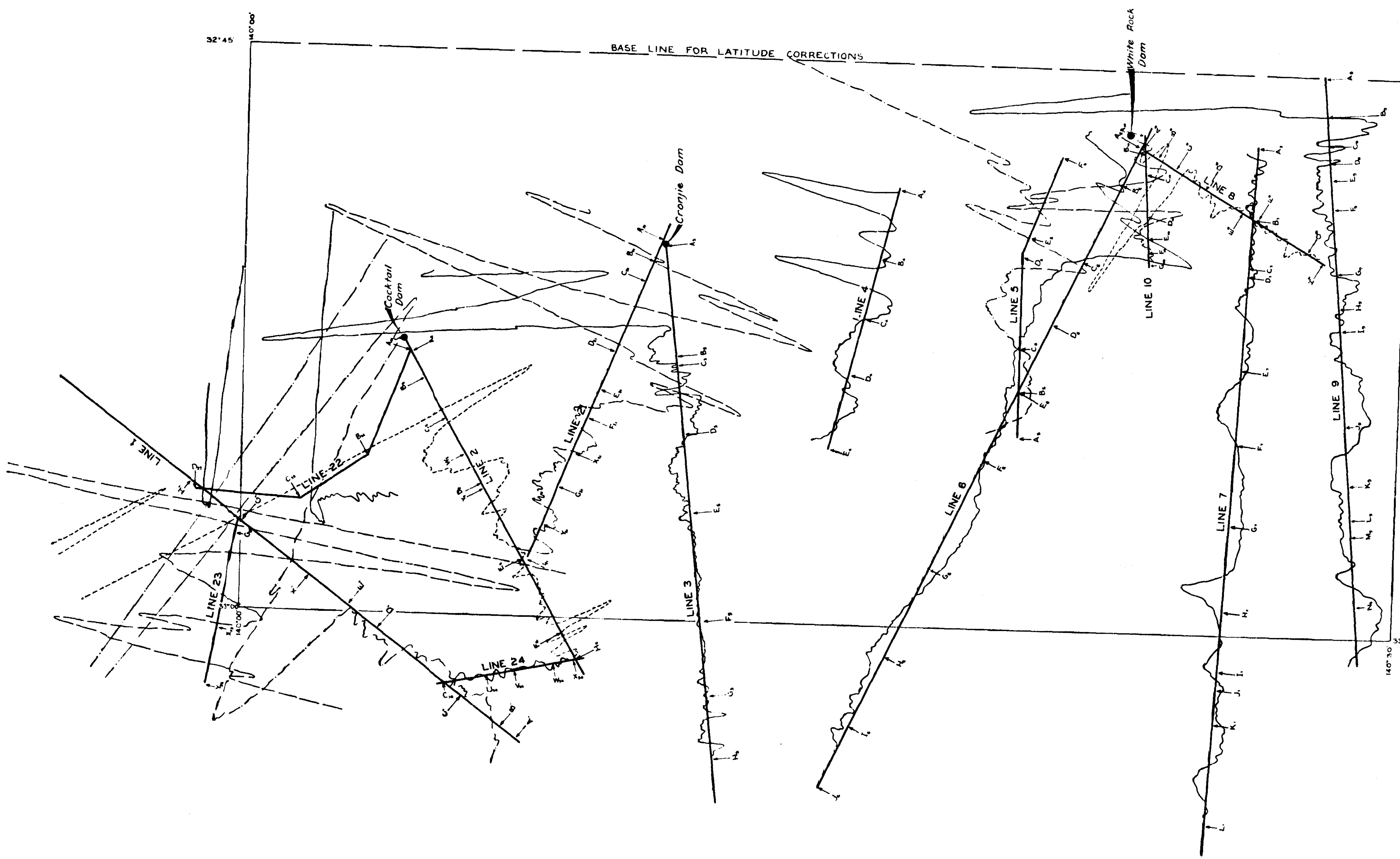
FIG.30

Between Beaver Dam and Yabba Dam

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ANABAMA FAULT PROJECT
QUONDONG AEROMAGNETIC ANOMALY
GROUND MAGNETIC TRAVERSE 12

EXPLORATION GEOPHYSICS SECTION	R A Gerdes GEOPHYSICIST	Drn. RAG	SCALE: 1 INCH = 0.75 MILES
		Tcd. D.M	73 - 95
		Ckd. A F	F0
Director of Mines	SUP. GEOPHYSICIST	Exd.	DATE: 27 OCTOBER 1972



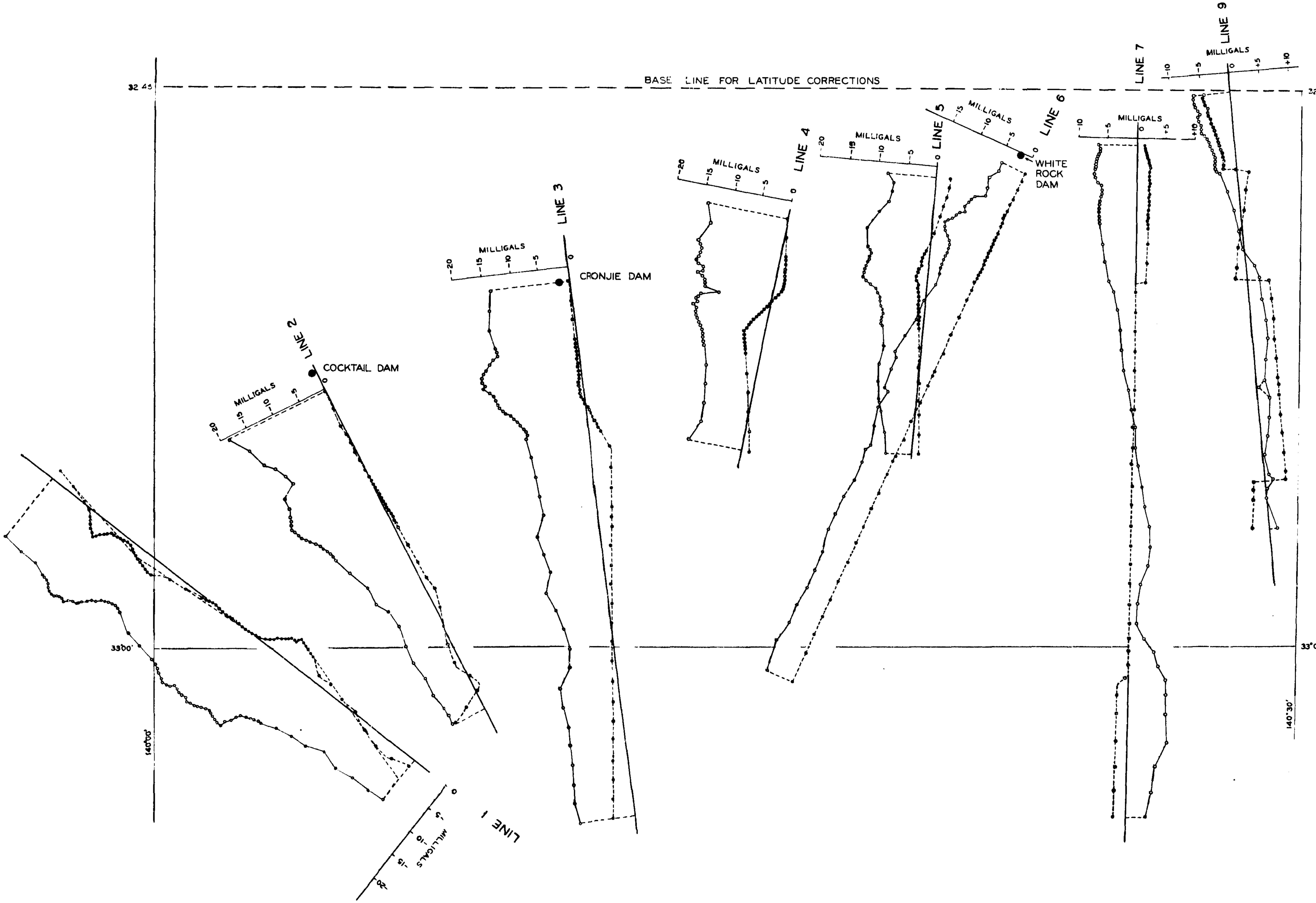
SCALES

HORIZONTAL SCALE : 1 INCH REPS 1½ MILES

VERTICAL SCALE : 1 INCH REPS 200 GAMMAS

FIG. 31

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT			
RESIDUAL MAGNETIC INTENSITY PROFILES OF TRAVERSES			
EXPLORATION GEOPHYSICS SECTION	R. GERDES GEOLOGIST	Drn. R.A.G.	SCALE: AS SHOWN
		Tcd. M.A.S.	73-96 FG
		Ckd. A.F.	
Director of Mines	SUP-GEOLOGIST	Exd.	DATE: 4TH JAN 1973



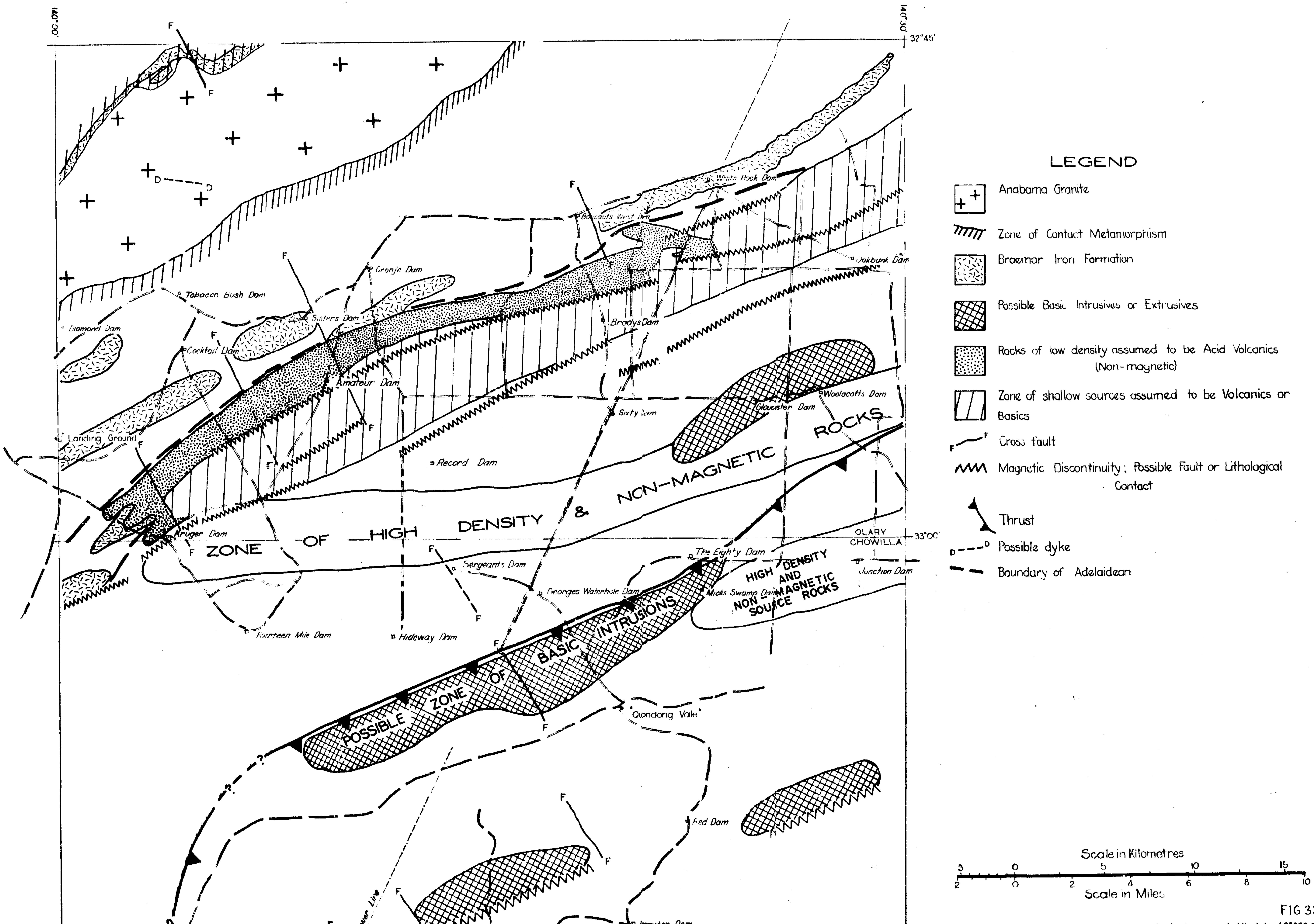
SCALES

VERTICAL : 1in = 10 MILLIGALS
HORIZONTAL : 1in = 1½ MILES

• STATION POINTS

FIG. 32

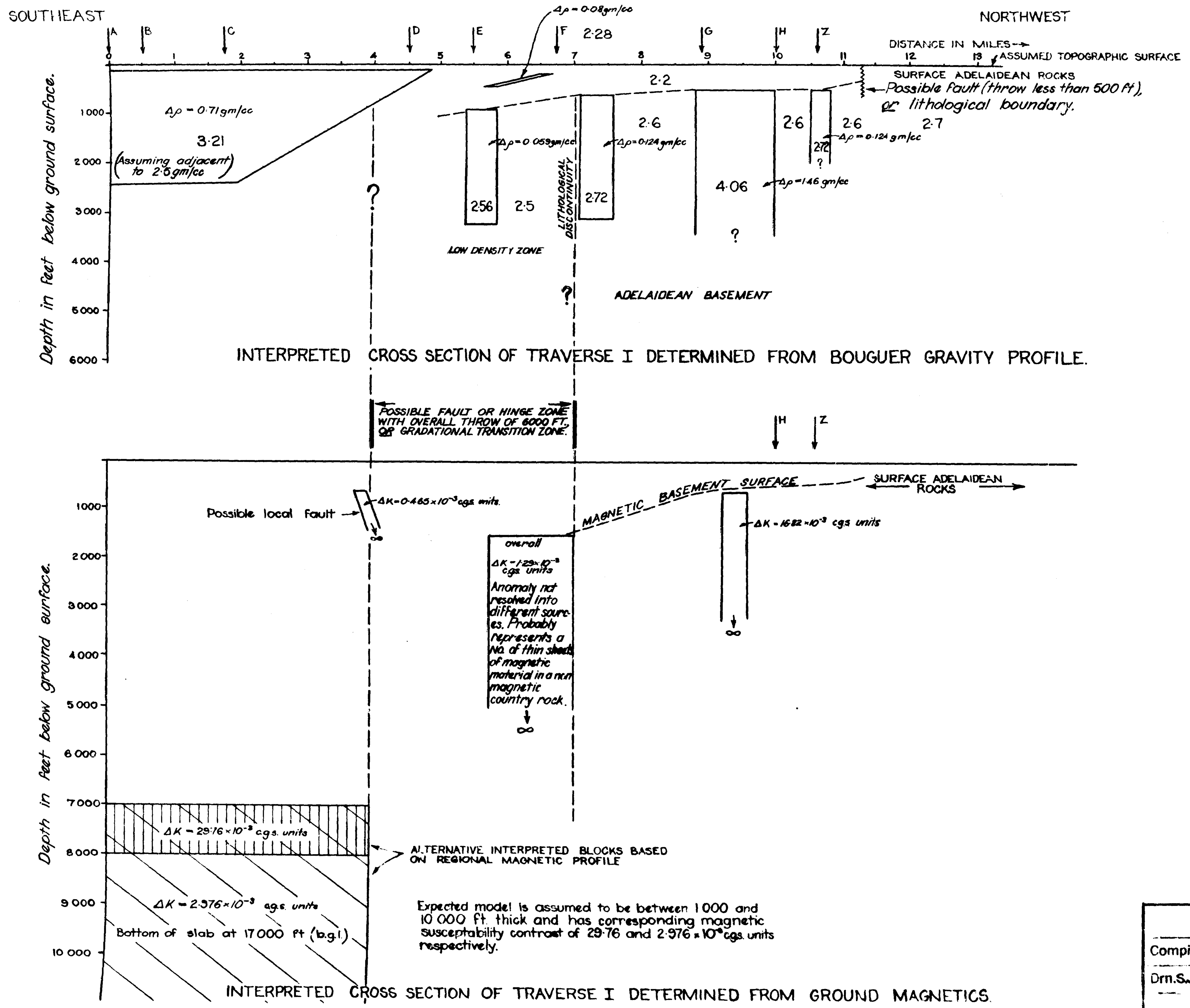
DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ANABAMA FAULT PROJECT PROFILES OF BOUGUER GRAVITY DATA OF TRAVERSES 1,2,3,4,5,6,7,8,9			
EXPLORATION GEOPHYSICS SECTION	R. GERDES GEOPHYSICIST	Drn. RAG Tcd. TJE Ckd. A.F Exd.	SCALE: AS SHOWN 73-97 FG DATE: 15 JAN 1972
Director of Mines			



DEPARTMENT OF MINES — SOUTH AUSTRALIA

ANABAMA FAULT PROJECT
SUMMARY OF INTERPRETED GEOPHYSICAL STRUCTURES

EXPLORATION GEOPHYSICS SECTION	R.A. Gerdes GEOPHYSICIST	Drn. RAG	SCALE: 1:125000 (ORIG)
		Tcd. TJE	73-98 FG
		Ckd. A.F.	
Director of Mines		Exd.	DATE: 18 JAN. 1973



LEGEND

Δρ	Density contrast Density assumed for Adelaidean rock was 2·7gms/cc
2·72	Assumed density of Lithology of models and surrounding country rocks.
----	Basement surface
ΔK	Magnetic susceptability contrast in cgs. units
(bgl)	Below ground level

Scales:
Horizontal 1:95040 (1·5 miles) (1 inch = 1·5 miles)
Vertical 1:24 000 (2000 ft.) (1 inch = 2000 feet)

FIG. 34

	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: AS SHOWN
Compiled: R.A.G.	ANABAMA FAULT PROJECT	Date: 26 JAN 1973
Drn. S.J.C. Ckd. A.F.	INTERPRETED CROSS SECTIONS OF TRAVERSE I BASED ON GRAVITY AND MAGNETIC MODELS	Drg. No. 73-99 FG

1M-2.70 A1811