FRONTIER EXPLORATION LIMITED

A.C.N. 008 266 555

THE RESOURCE POTENTIAL

OF THE

CENTRAL FLINDERS ZONE

ADELAIDE GEOSYNCLINE

SOUTH AUSTRALIA

PREPARED BY
ERIC A. RUDD A.C.

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SUMMARY

Since 1990 Frontier Exploration Limited has explored in the Central Flinders Zone of the Adelaide Geosyncline in order to assess its hydrocarbon and mineral potential and the relationship of diapirs to these resources.

The basic concepts used have not been proved but results to date are encouraging and a critical target has been selected.

Although the area contains many similar structures, three domal structures, unbreached by diapirs, have been studied in more detail. One of these, Willippa Dome offers the opportunity to test critical aspects of the programme, namely the presence of hydrocarbons, salt and basemetals as well as non metallic minerals. A test hole, preferably cored and logged geophysically to a depth of 1500 to 2000 metres could assess the resource potential of this important province, and indicate whether further effort is justified.

CONTENTS

INTRODUCTION

The intuitive impulse to review the mineral potential of the Flinders Ranges of South Australia was initiated by Bulletin 53 "The Adelaide Geosyncline" by the Geological Survey and encouraged by the comprehensive geological maps which cover this province. This geological knowledge has accumulated over the past 80 years since Sir Douglas Mawson's pioneering involvement.

The Adelaide Geosyncline is a major stratigraphic and structural province of Neoproterozoic strata extending some 1000 km north south with widths of 100 km or more east west. It outcrops over one third and together with its continuation under cover the Neoproterozoic extends over approximately half of South Australia. The best area to study this province is obviously in the well documented area of outcrop. (Fig.1)

In the Flinders Ranges the Adelaide Geosyncline can be divided into three regions namely the North, Central and South Flinders Zones with the latter two separated by the northern limit of the Nackara Arc. These zones have different structural characteristics. The Northern Zone is complexly folded and the Southern Zone contains a more orderly series of sub-parallel arcuate anticlines and synclines. The Central Zone contains large and more open dome and basin structures and appears to have a relatively sheltered position between the Gawler Craton to the west and the Curnamona Craton to the east. (Fig.2)

The Neoproterazoic Adelaidean System is extremely thick but the thickness of individual stratigraphic units vary between localities.

Although the strata are well mapped and correlated in outcrop there is sparse information below the surface as deep drilling is relatively limited.

Geophysical surveys by gravimetric and magnetic methods have enhanced the geological knowledge but seismic surveys are restricted to a few short traverses in the outcrop area. Few of the geophysical interpretations have been tested by deep drillholes.

The Adelaidean overlies Archean to Mesoproterozoic and is overlaid by Cambrian Strata. The Adelaidean is divided into the Callanna Group, (at the base) Burra Group, Umberatana Group and Wilpena Group, (at the top below the Cambrian).

One aspect of the Adelaide Geosyncline which has attracted much attention and discussion is the occurrence of some 180 known bodies of intrusive breccia of various shapes and sizes. These bodies are interpreted as diapirs and consist mainly of brecciated sediments, mostly derived from the Callanna Group.

Neither Burra nor Callanna Groups are known to outcrop in most of the Central Zone but Callanna Group are believed to be present at depth because of the disrupted strata in the diapirs. Mapping in other areas suggest that the Burra Group are thin or absent in the Central Zone and none has been identified in the diapirs.

This review of the mineral potential is mainly concerned with the Burra and Callanna Groups and the lower section of the Umberatana Group and is mostly restricted to the Central Flinders Zone. (Fig.4)

In the Adelaide Geosyncline sedimentation is thought to have been initiated following rifting between the Gawler and Curnamona Cratons as indicated by dyke swarms on the western side and basic intrusives in the lower part of the Callanna Group. With these exceptions the greater part of the Adelaide Geosyncline is notably free of igneous intrusives, dykes and sills.

Basemetal mineralisation is widespread in numerous small prospects in the Adelaide Geosyncline more particularly in the Central and Northern Flinders Zones. Significant basemetal occurrences have been worked at Kapunda, Burra, Blinman and Puttapa. Deposits of barite are numerous and some are still being mined.

In the Central Flinders Zone the strata of the Adelaide Geosyncline have been little affected, if at all, by metamorphism and subjected mainly to diagenesis. Parts of the Callanna Group have adequate organic content to suggest that hydrocarbons could have been formed. The area therefore merits interest as the source of hydrocarbons by comparison with Russian gas fields and the similar geological conditions in Central Australia.

Note is also taken of the planetary theory that the Earth is degassing with the escape of hydrogen and helium. The hydrogen becomes natural gas by contact with carbon and natural gas samples from the Cooper Basin and Central Australia area have recorded relatively high helium content. The opportunity to check this theory would arise if a massive salt layer acting as a seal could be penetrated.

CONCEPTS

The reasoning behind the Frontier Exploration programme which has been followed since 1990 can be stated as follows:-

1. The Callanna Group strata in the Central Finders Zone are potentially rich in basemetals derived either from carbonaceous sediments deposited in a rift valley setting or from the known metal rich Gawler and Curnamona Cratons.

2. The Callanna Group includes dolomites, black shales and sandy sediments which were deposited in an evaporitic environment and contained organic material.

3. The Burra Group strata are probably similar to the Callanna strata with a more notable magnesium content but the thickness and extent in the Central Zone is not known.

4. Elsewhere in the Adelaide Geosyncline a marked unconformity has been mapped between the Burra and Umberatana strata. However in the only known contact in the Central Zone on Willippa Dome this is apparently not an angular unconformity.

5. The Callanna and Burra Groups were buried under a thick pile of Umberatana and Wilpena Group strata until into Cambrian time. While time disconformities exist in the stratigraphic column there are no major angular unconformities apparent. The major structural developments in this region apparently resulted from the Delamerian Orogeny in Cambro Ordovician time.

6. There is evidence of evaporites in the Callanna Group and the presence of salt has been predicted for some time. It is now suggested that a massive salt horizon as distinct from narrow interbedded salt layers has been involved. This has not been proved and its prediction has been based upon the following:-

   (a) the structural pattern of folding in the Flinders Ranges as compared to known salt provinces.
   (b) examples of pillow structures referred to in this report with gravimetric and seismic support.
   (c) the presence of diapirs of significant size and the transport of masses of debris.
   (d) The plucking of basement rocks and the transport of massive rafts of dolomite for over 2km vertically.
   (e) the prevalence of Callanna strata in the debris suggests that the salt horizon was toward the base of the Callanna Group.

7. The basemetal rich dolomites and shales had a long geological period when they were "marinated" in saline solutions. In post Neoproterozoic time when the present structures developed the salt and saline solutions moved into anticlinal axes and more specifically into domal crests. In some cases these solutions probably leaked along faults and joints and were responsible for the many small basemetal and barite deposits which occur throughout the Flinders Ranges in otherwise unpromising locations.

8. When the domes were breached by the diapirs the saline solutions were dispersed but some mineralisation may have remained on the salt if it still exists below the debris.

9. Where the domes and anticlines have not been breached the possibility of accumulations of minerals including sulphur on the crests is worth testing.

10. There is evidence from chemical and radiometric surveys that potassium salts occur with the diapirs.

11. The salt of the evaporite system, if it is accessible by drilling could contain valuable salts recoverable by solution mining.

12 There is evidence that the Neoproterozoic strata have produced hydrocarbons. Natural gas seems more likely to have survived but there is no proof that these strata are outside the oil window. Porosity and permeability and therefore deliverability, in Umberatana Group strata would be largely dependent on fracture patterns while in Burra or Callanna Group carbonates cavitation would be important.

PROGRAMME

In 1990 Frontier Exploration Limited was formed as a small unlisted public company to investigate the mineral potential of the Adelaide Geosyncline. The area selected for exploration is part of the Central Flinders Zone and PEL41 of approximately 16000 sq km was granted to cover exploration for hydrocarbons.

ELs 1642 and 1762, within PEL 141 and covering 1166 and 408 sq km respectively to cover all minerals, metallic and non-metallic, were also granted. (Fig.4)

These areas were selected for the following reasons.

- The Central Flinders Zone is a well mapped and relatively simple structural province.

- The region has many basemetal occurrences and a number of large diapirs, some of which have been mapped in detail. PEL 41 covers a major anticlinal structure extending from east of Wilpena Pound in the south to north of Blinman.

- On this major structure are three subsidiary domes each of which is breached by a diapir. These are from north to south, Blinman, Oraparinna and Upalinna Diapirs.

- The strata along the axis of the major structure and adjacent to these diapirs are the lowest in the outcropping section in the region. They were thought to immediately overlie the Burra and Callanna Group which are important targets in the program.

- Although massive salt has never been seen or intersected in the Adelaide Geosyncline there are reasons to believe it existed and may still exist. It was considered that this area offered an opportunity to test for it.

- The Blinman Copper Mine was a significant basemetal deposit which is considered to occur in a raft of Callanna Group which has been brought to its present upturned position by

the action of the diapir. The evidence suggests that the sulphides in the Blinman Mine are of Willouran age.

The basis for exploration was that the basemetal and barite deposits of the district are related to the diapirs and that the diapirs were caused by the mobility of one or many salt horizons which pushed up xenoclasts of disrupted Callanna Group. The salt itself could be of value and the apex of salt intrusion could host a concentration of base metals and possibly sulphur.

The first activity by Frontier Exploration was in and adjacent to Blinman Dome and Diapir.

Blinman No. 1 was drilled in Blinman Diapir in an attempt to reach a salt core beneath the diapiric breccia. The drill hole reached a depth of 481 metres when it was discontinued still in breccia containing disoriented rafts of Callanna Group which made drilling difficult and resulted in lost circulation. A useful result was the presence of traces of potassium salts in the lower part of the core.

Blinman No. 2 was drilled on the eastern flank of Blinman Dome just outside the upturned rim of the Blinman Diapir. The test was drilled to reach the Burra(?) or Callanna Group below the outcropping Umberatana Group. One previous theory was that the diapir breccia came from an horizon just below the rim rocks and therefore should be relatively shallow. The site for Blinman No. 2 was chosen in an unfaulted area to avoid the possibility of diapiric material intruded into the section. It was realised that the drillhole would tend to deviate to the west normal to the dip of the strata and this was used in an attempt to intersect the diapir at depth. (Fig.5)

Blinman No. 2 was discontinued at 2031 metres still in Umberatana Group. The depth to Burra and Callanna Group is therefore more than 2000 metres. The drillholes deviated to within approximately 500 metres from the plane vertically below the diapir margin at the surface. Although the section was tight there were significant indications of natural gas in joints and thin sections of the strata showed bitumen rims to sand grains.

As a result of the Blinman drilling it was decided that to test for salt within the diapir would require extremely deep drilling and that any salt encountered might be disturbed or leached. It was also decided that the depths to the target strata (Burra(?) and Callanna) were too great for testing in the central areas of the major domal structure.

A decision was made to investigate some known but unbreached domes in the south eastern area of PEL 41 where it was thought the stratigraphic section might be thinner toward the Curnamona Craton. (Fig.6)

The possibility of no Callanna Group in the area was considered but the presence of a number of barite and basemetal prospects

and the dyke like diapir west of Bibliando Dome are thought to indicate the presence of Callanna Group below.

Two previously mapped domes are Martins Well and Bibliando Domes which are covered by outcropping Umberatana Group and the depths to underlying Burra and Callanna Group strata are not known. A geophysical interpretation of the magnetic data in the Parachilna Sheet had indicated depth to basement at the Martins Well Dome area as 3-4km compared with a depth of 6-8km in the Blinman area.

The broad circular structure named Martins Well Dome suggested a salt "pillow" where mobile material such as salt had migrated to the crestal part of the dome. The South Australian Department of Mines & Energy (MESA) had made a gravimetric survey of the crest of the dome where the strata are relatively flat lying and geophysical interpretation of the negative gravity anomaly coincident with the dome suggested a salt(?) body at a depth of approximately 3km below the surface. (Figs.8 & 9)

Frontier Exploration contracted for a 10 km east-west seismic survey across the crest of Martins Well Dome. This survey by Seismograph Services together with some experimental surveys by MESA indicated a pillow structure at approximately 3-3.6km on the crest of the dome and a low velocity material through that section suggested salt. The salt section may occur low in the Callanna Group and the base of the salt at 3.6km may support the interpretation of 3-4km depth to basement. (Figs.10 & 11)

Bibliando Dome is a major structure which has been known for many years and has attracted previous exploration activity because of a pronounced magnetic anomaly coincident with the core. Gravity surveys suggest a gravity high which also coincides with the structure but the high relief of the terrain makes interpretation more difficult.

Frontier Exploration contracted Aerodata to fly a detailed aeromagnetic survey over Bibliando Dome and the interpretation indicates a massive magnetic body at a depth of approximately 1500 metres. The interpretation infers that the magnetic body is conformable with the strata rather than extending to depth. (Figs.13, 14, 15)

Both Martins Well and Bibliando Domes are targets but the depths to Burra(?) and Callanna Group are unknown. Exploration of these domes would involve deep and expensive drilling and no additional geophysical investigation could be suggested.

Between Martins Well and Bibliando Domes there is another known structure, the Willippa Anticline, which had not been considered previously. (Figs.4 & 7)

It was decided to map the Willippa Anticline and the section between Martins Well to Bibliando Domes as previous mapping had recorded an outcrop of Holowilena Ironstone. This horizon is lower in the Umberatana Group than beds outcropping in the

adjacent domes and suggested that the depth to Burra(?) and Callanna Group could be less.

The surface remapping of Willippa Anticline indicated that it should be renamed Willippa Dome as it is a closed structural high. (Figs.16, 17, & 18)

The main discoveries were that Burra Group strata outcrop along the crest of the dome and are structurally concordant with the overlying Umberatana Group and that the structure is not breached by diapiric material. A subsequent extension of the gravity survey south from Martins Well Dome indicates a gravity low over Willippa Dome. The interpretation of the survey is that a salt(?) body is approximately 350 metres thick and 1200 metres below the surface. It also suggests that at two localities the salt(?) has risen to within approximately 200m of the surface. (Figs.19, 20)

A number of small copper-bearing gossans outcrop on the crest of Willippa Dome. The discovery of outcropping Burra Group in the Willippa Dome is the first occurrence within the Central Flinders Zone and presents the first opportunity to drill and record the Burra and Callanna stratigraphy in that region where not disrupted by diapirism. There is also the opportunity to test for salt and the presence of hydrocarbons and basemetals.

In November 1993 MESA indicated that it wished to drill a stratigraphic hole on the crest of Willippa Dome. Drilling commenced on 30th April 1994 but was discontinued on 21st May 1994 at a depth of 129 metres due to difficulty in drilling and loss of circulation. The hole was spudded in Burra Group with very gently dipping bedding indicating that it was in the crest of the dome.

MESA has indicated that it wishes to continue the stratigraphic test subject to the availability of funds, and is seeking an air hammer plant to drill a larger diameter hole in the same locality, with the option for coring selected intervals if drilling conditions improve.

Frontier Limited has continued with further mapping on Willippa Dome together with sampling of gossan outcrops and has reviewed the section from Martins Well over Willippa to Bibliando Dome.

RESULTS TO DATE

The results to date while not conclusive with regard to the concepts, are encouraging for the following reasons.

HYDROCARBONS

- The presence of gas in the tight strata of Blinman No. 2 and the evidence of bitumen traces in these sediments.

- The recognition of significant domal structures close to oil and gas pipelines.

- Geophysical indications that two of these domes contain pillow structures of salt.

- The knowledge that the target strata in the Burra and Callanna Groups are within reasonable drilling depths and are probably fractured with improved permeability in the crests of the domes.

SALT

- The interpretation of salt pillows in domes appears to be confirmed by gravity and seismic. The interpretation from gravity data that the salt can be reached by drilling to reasonable depths.

- While the value of the salt is unknown, chemical and radiometric results suggest the presence of potassium salts.

MINERALS

The discovery of copper gossans on and adjacent to the crest of Willippa Dome supports the concept of transport of basemetals by saline solutions. The occurrence of salt bodies in higher structural positions allows for testing for sulphur and other non-metallics.

CONCLUSIONS

Although other structures within the Central Flinders Zone could be developed into prospective targets, it is considered that the three domal structures in the south-eastern part of P.E.L.41 offer the best opportunity to assess the resources potential of this region.

It is also considered that as much geological mapping as is needed at this stage has been completed and no further geophysical surveys are recommended until a well documented third dimension of sufficient depth can be established.

It is recommended that the next exploration effort should be a drillhole to a depth of 1500 to 2000 metres with the recovery of cores and detailed geophysical logs.

Bibliando Dome

There may be a marked difference in stratigraphic section between Willippa and Bibliando Domes. The depths to Burra and Callanna Groups on Bibliando Dome are not known. The magnetic anomaly at 1500 metres could be within the Neoproterozoic section or in basement rocks. So far there is no evidence to suggest the presence of salt in this structure.

To test the magnetic anomaly would require a drillhole to between 1500 to 2000 metres. This is considered justified although an orebody at that depth would make testing and access development expensive.

The potential for hydrocarbons would depend largely on the presence of Burra and/or Callanna Group strata.

While this prospect should not be ignored, its interest could be dependent on results from the exploration of Willippa and/or Martins Well Domes.

Martins Well Dome

This structure is as well documented as it can be without a significant test drillhole.

Depths to Burra and/or Callanna strata are unknown, but the presence of a pillow salt(?) structure suggests that evaporite strata are present. The estimated depth to the top of the pillow at 3000 metres indicates that a much deeper drillhole would be required to adequately test this structure.

If the salt horizon is below most of the Callanna Group there may be adequate Callanna and Burra sections within reasonable drilling depth to indicate the hydrocarbon potential of the structure.

The test of Martins Well Dome should await the results of a deep test on Willippa Dome.

Willippa Dome

The recognition of Burra Group strata in the crest of Willippa Dome suggests this as an ideal location to test both the Burra and Callanna Group strata in a structurally favourable location.

A drillhole to 1500-2000 metres should test the hydrocarbon potential of the Burra and Callanna Group. If a salt horizon acting as a seal can be penetrated the test would be more conclusive.

Willippa Dome is within 20km of the Moomba to Adelaide natural gas pipeline.

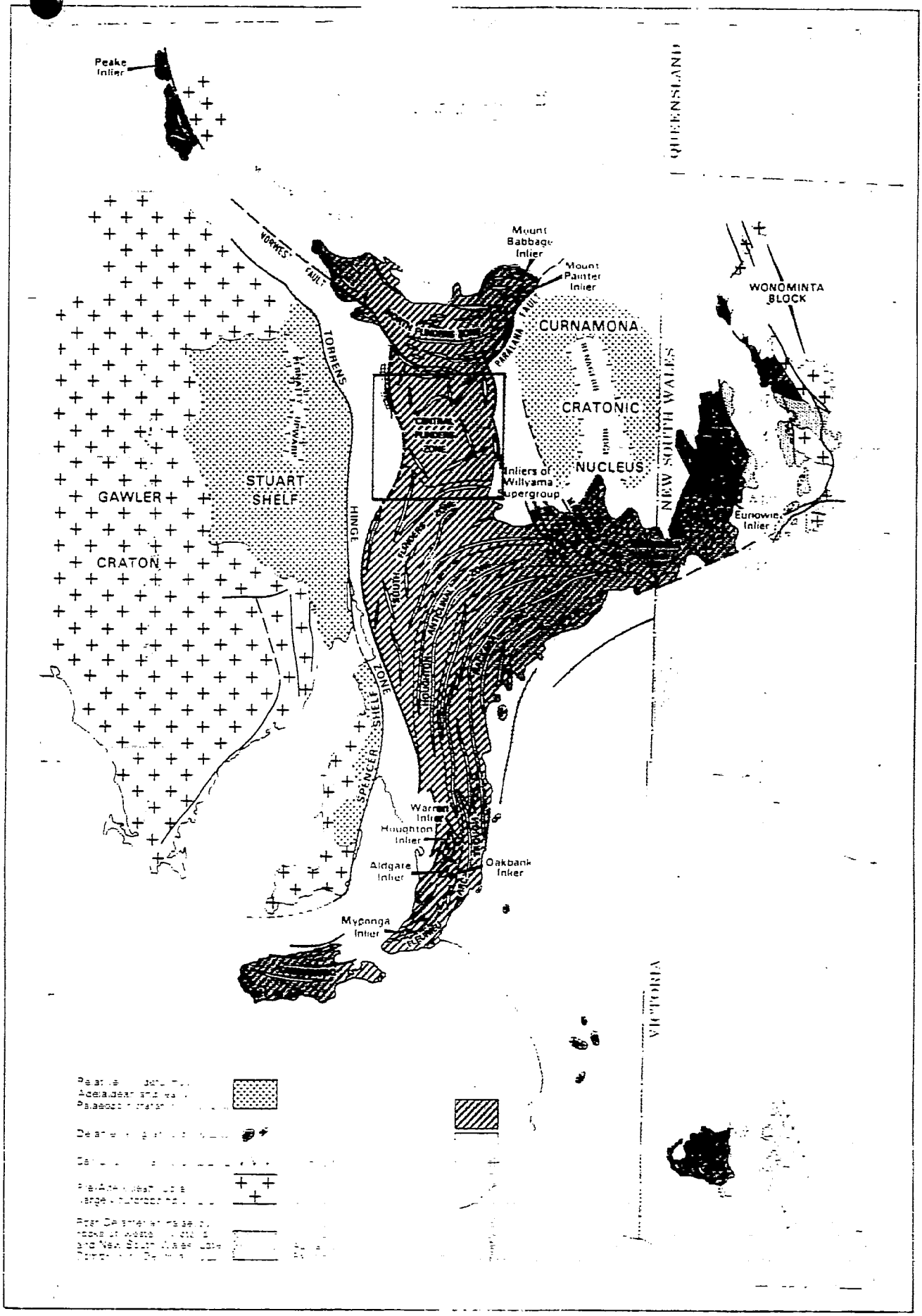
The outcrops of copper bearing gossans in the crest of the dome and related to inferred salt intrusions justifies the testing of the strata for salt and base metal and non-metallic minerals.

The Willippa Dome prospect is considered attractive because a drillhole can test the potential for hydrocarbons, salt, metallic and non-metallic minerals in the Central Flinders Zone and the Adelaide Geosyncline generally.

FIGURES AND PLATE

Figures

Plate



ADELAIDE GEOSYNCLINE
SHOWING AREA OF INTEREST

FIGURE 1

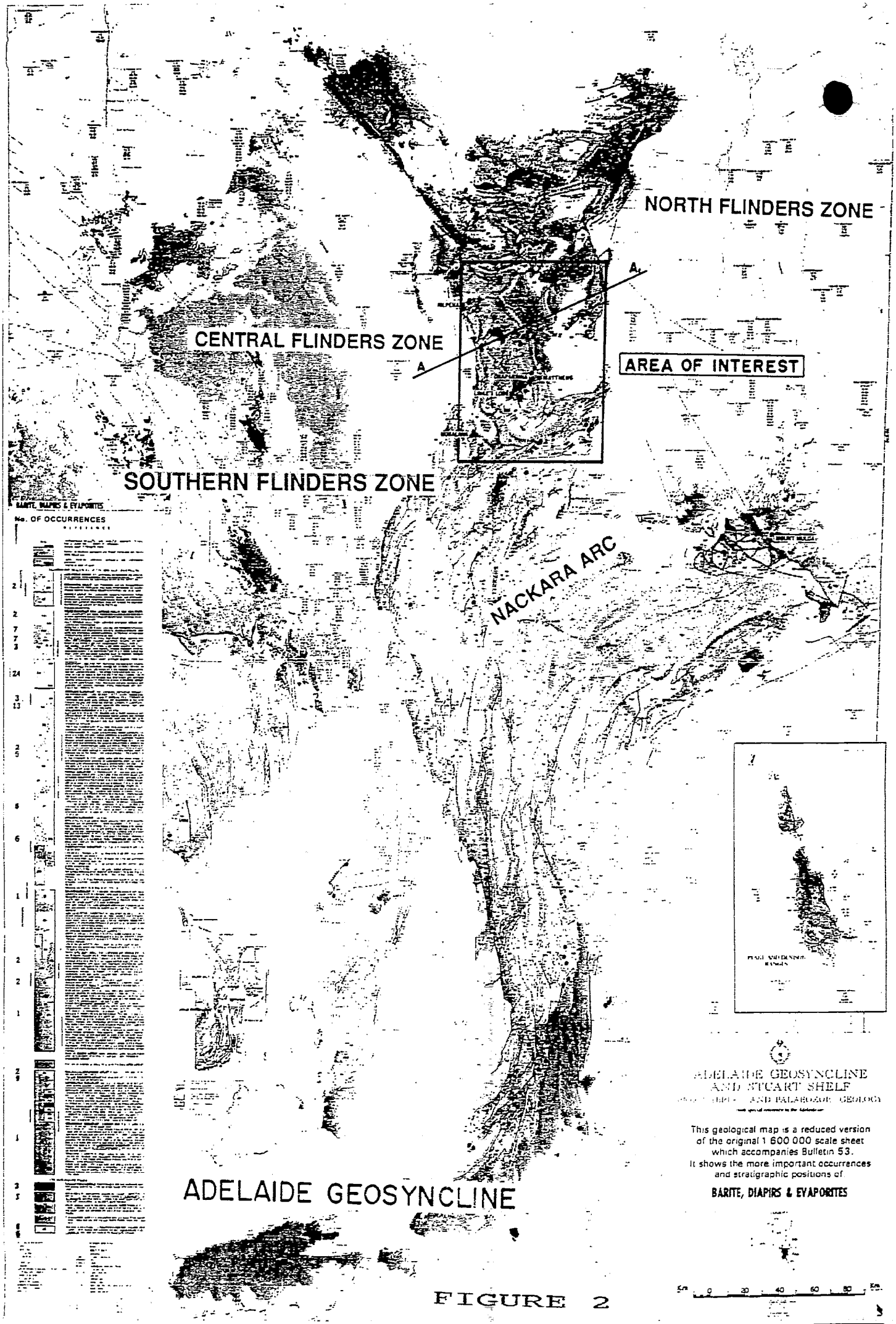
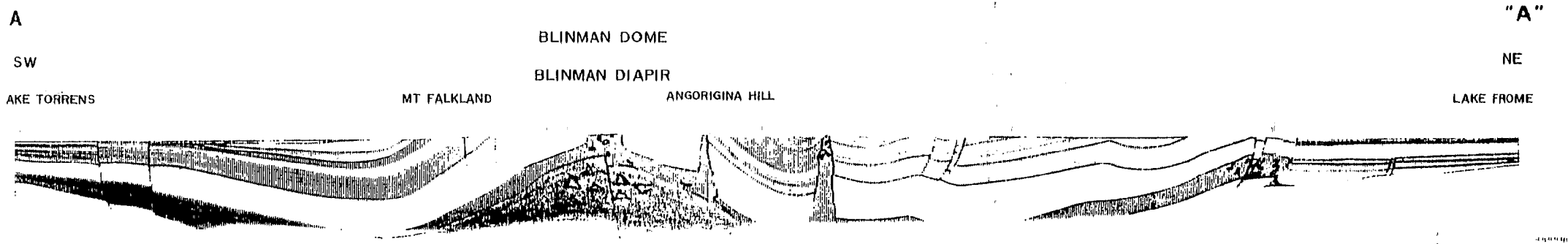

NORTH FLINDERS ZONE
CENTRAL FLINDERS ZONE
AREA OF INTEREST
SOUTHERN FLINDERS ZONE
NACKARA ARC
ADELAIDE GEOSYNCLINE
A
A
BARITE, DIAPIRS & EVAPORITES
No. OF OCCURRENCES
ADELAIDE GEOSYNCLINE
AND STUART SHELF
This geological map is a reduced version
of the original 1 600 000 scale sheet
which accompanies Bulletin 53.
It shows the more important occurrences
and stratigraphic positions of
BARITE, DIAPIRS & EVAPORITES
0
20
40
60
80
Km

FIGURE 2

CROSS SECTION FROM LAKE TORRENS TO LAKE FROME

NATURAL SCALE



Section by W. V. Preiss

REFERENCE

- QUATERNARY
- TERTIARY
- CRETACEOUS
- Lake Frome Group
  Wirrealpa Limestone
  Billy Creek Formation
- HAWKER GROUP
- WILPENA GROUP
- UMBERATANA GROUP
- BURRA GROUP
- CALLANNA GROUP AND DIAPIRIC MATERIAL
- PRE-ADELAIDEAN BASEMENT

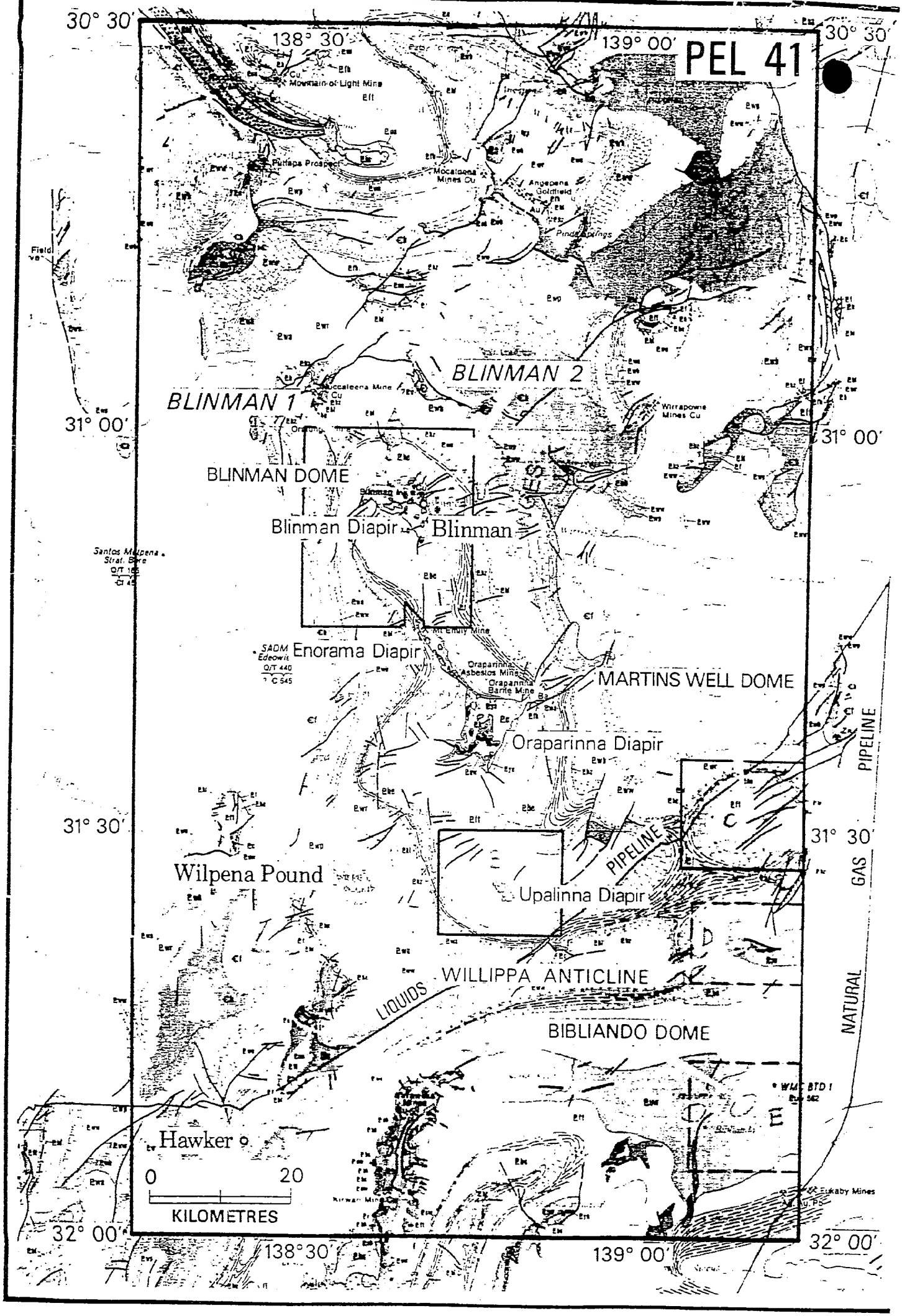
SCALE

10 5 0 10

KILOMETRES

FIGURE 3

FIGURE 4


PEL 41
30° 30'
138° 30'
139° 00'
31° 00'
31° 30'
32° 00'
BLINMAN 1
BLINMAN 2
BLINMAN DOME
Blinman Diapir
Blinman
Enorama Diapir
MARTINS WELL DOME
Oraparinna Diapir
Wilpena Pound
Upalinna Diapir
WILLIPPA ANTICLINE
BIBLIANDO DOME
PIPELINE
GAS
LIQUIDS
NATURAL
Hawker
0
20
KILOMETRES

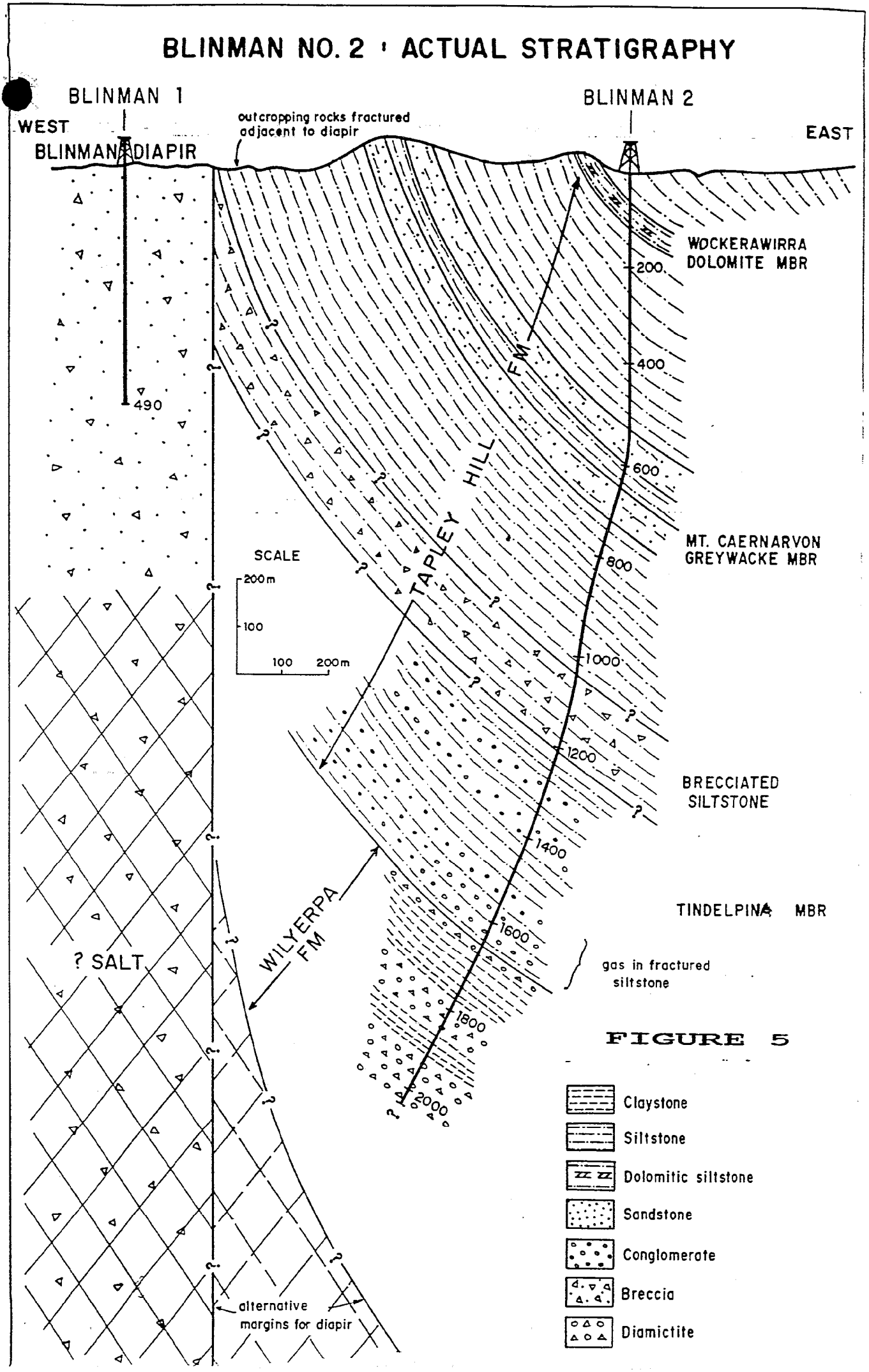
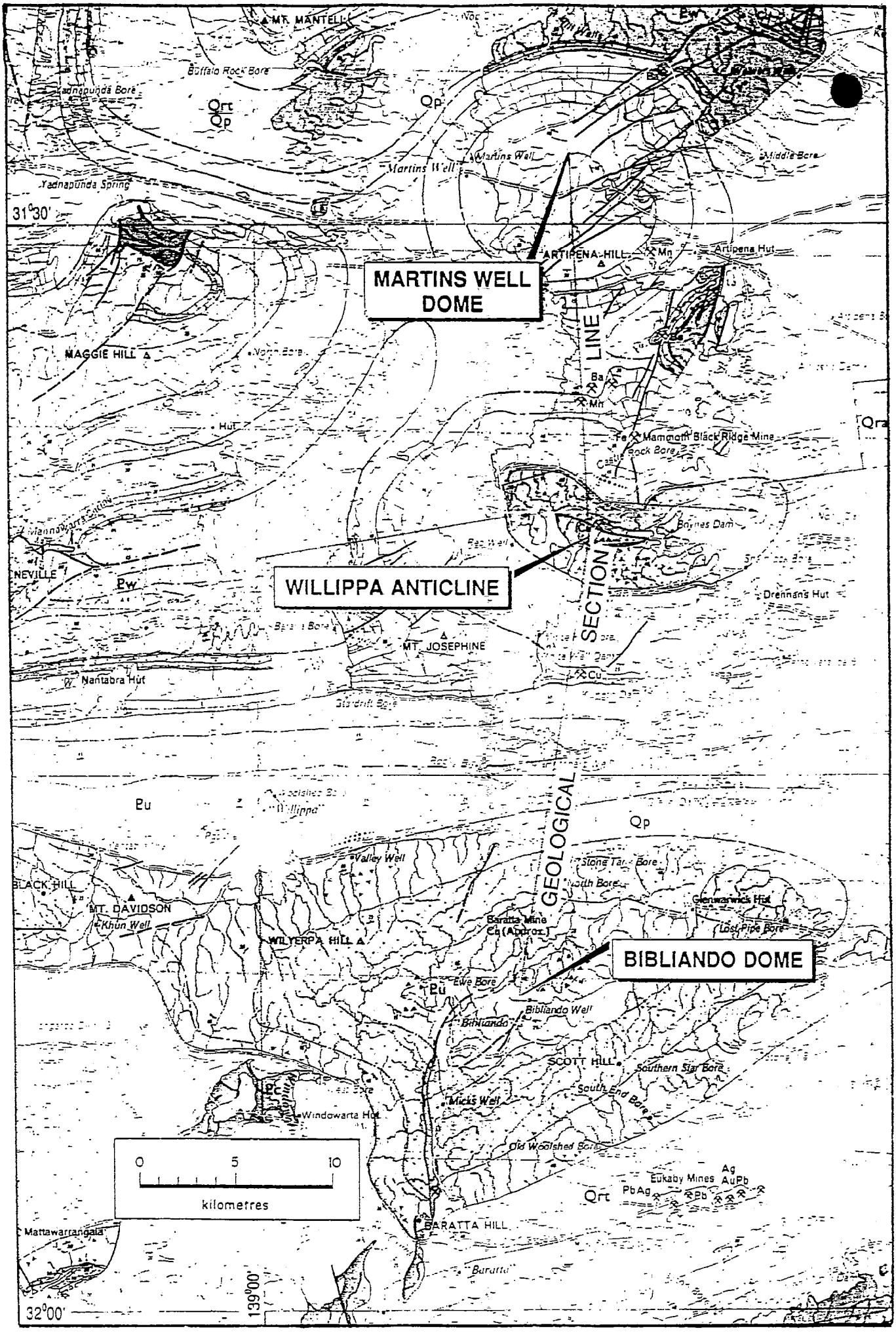
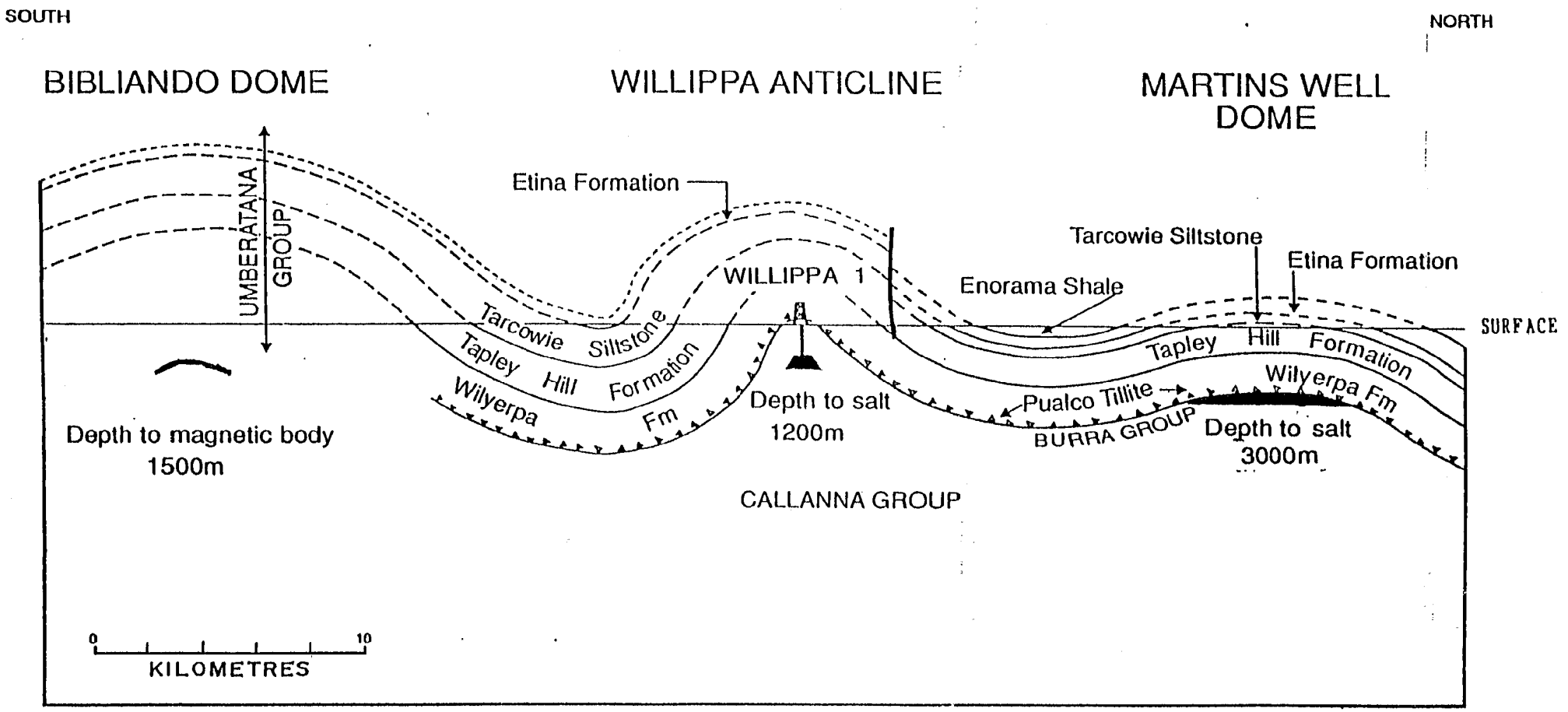

BLINMAN NO. 2 : ACTUAL STRATIGRAPHY
BLINMAN 1
BLINMAN 2
WEST
EAST
BLINMAN DIAPIR
outcropping rocks fractured adjacent to diapir
490
WOCKERAWIRRA DOLOMITE MBR
200
400
600
800
1000
1200
1400
1600
1800
2000
TAPLEY HILL FM
MT. CAERNARVON GREYWACKE MBR
SCALE
200m
100
100 200m
BRECCIATED SILTSTONE
TINDELPINA MBR
WILYERPA FM
? SALT
gas in fractured siltstone
alternative margins for diapir
Claystone
Siltstone
Dolomitic siltstone
Sandstone
Conglomerate
Breccia
Diamictite

FIGURE 5



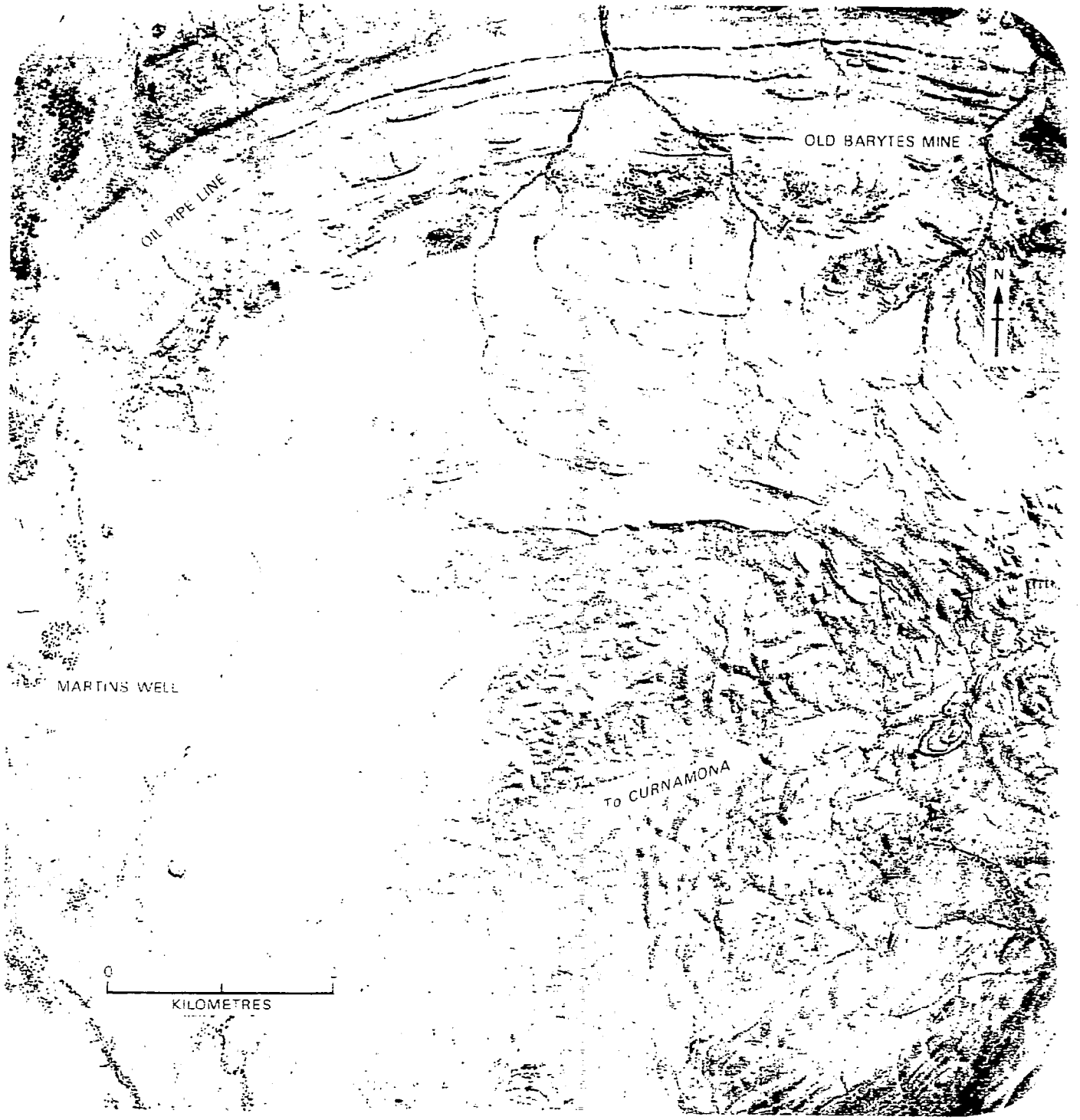
GEOLOGICAL MAP OF SOUTH-EASTERN PART OF PEL 41

FIGURE 6



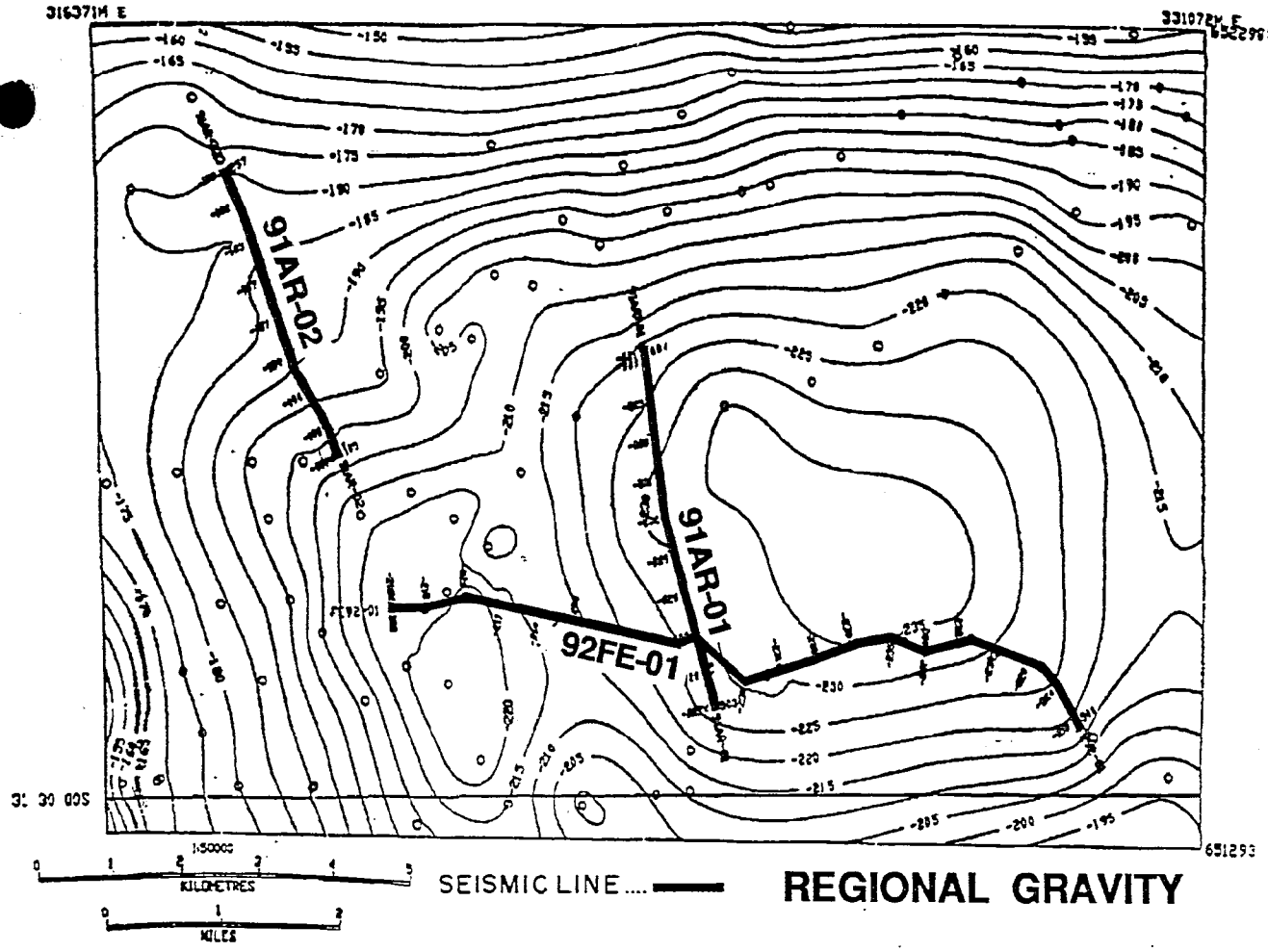
BIBLIANDO - MARTIN WELL GEOLOGICAL SECTION

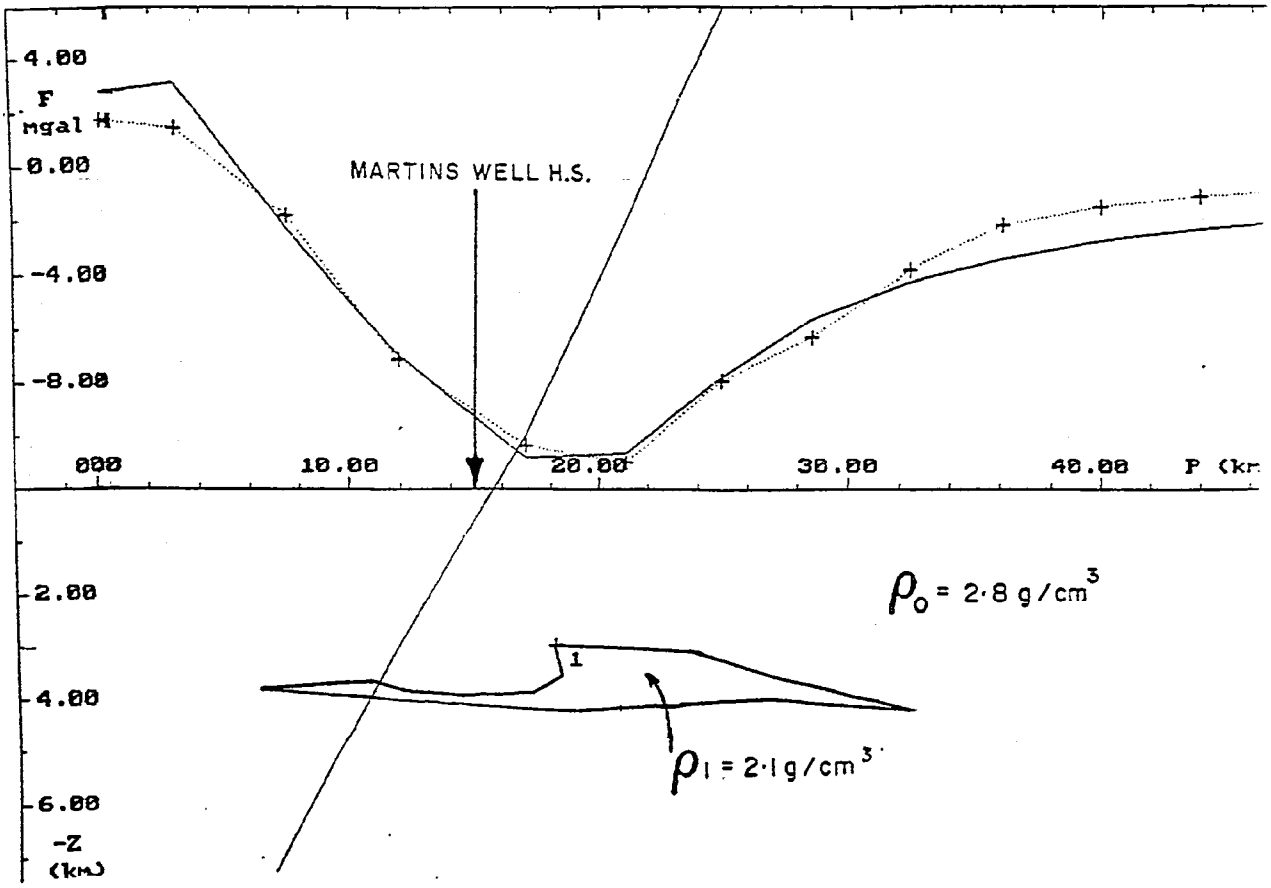
FIGURE 7



MARTINS WELL DOME

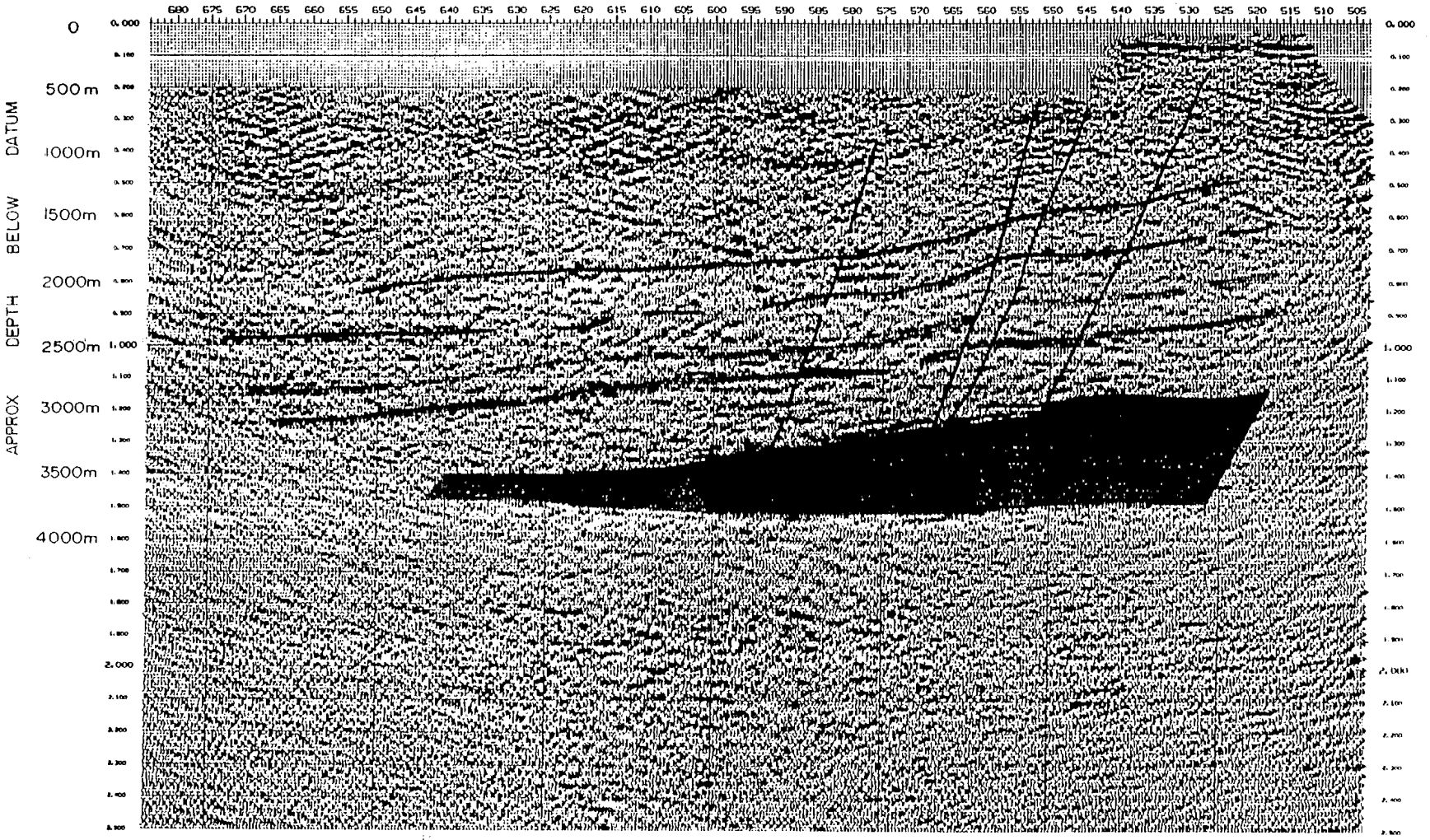
FIGURE 8





RESIDUAL PROFILE AND MODEL
MARTINS WELL DOME

FIGURE 9



MARTINS WELL DOME
SEISMIC LINE 91AR-01

FIGURE 10

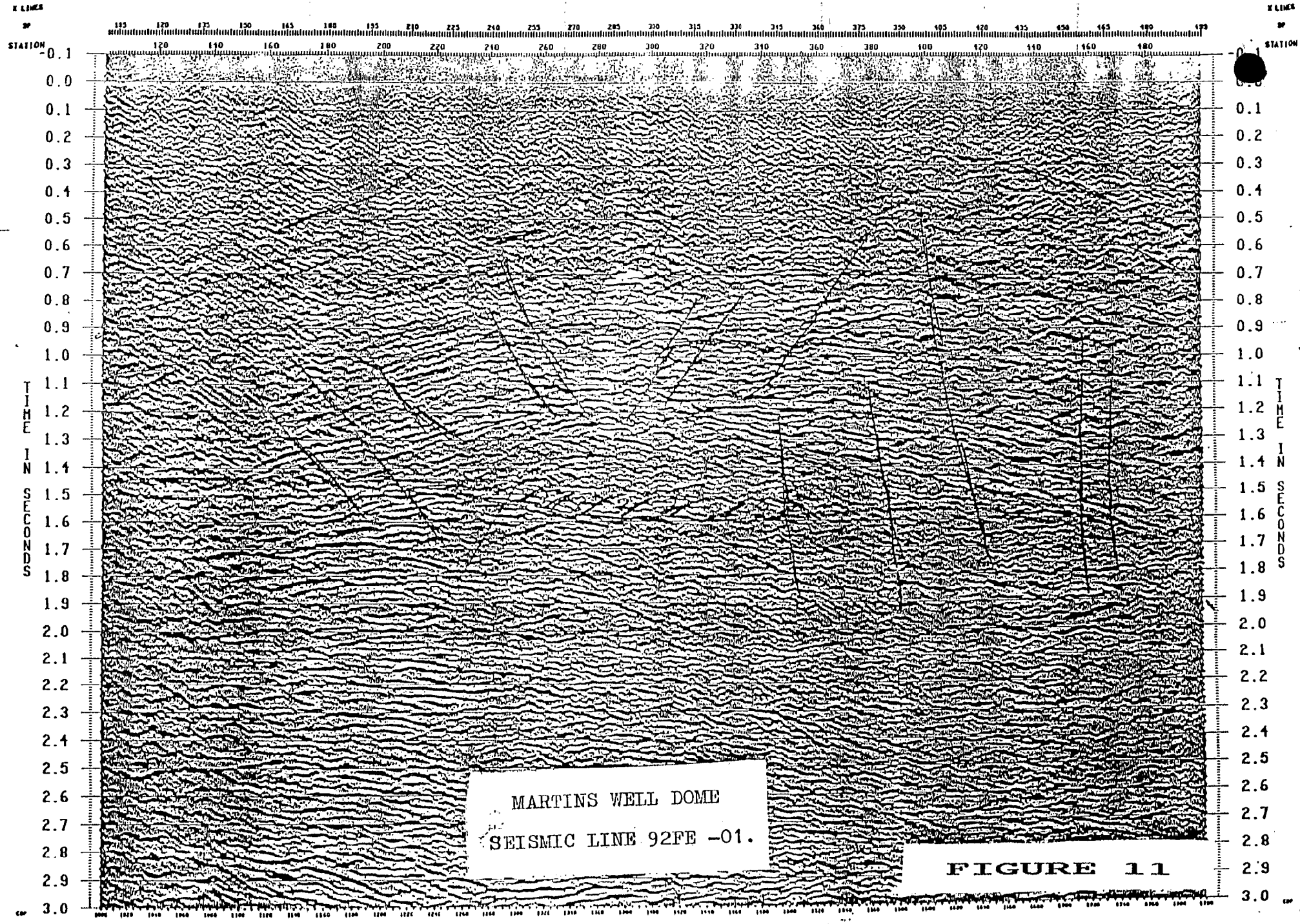
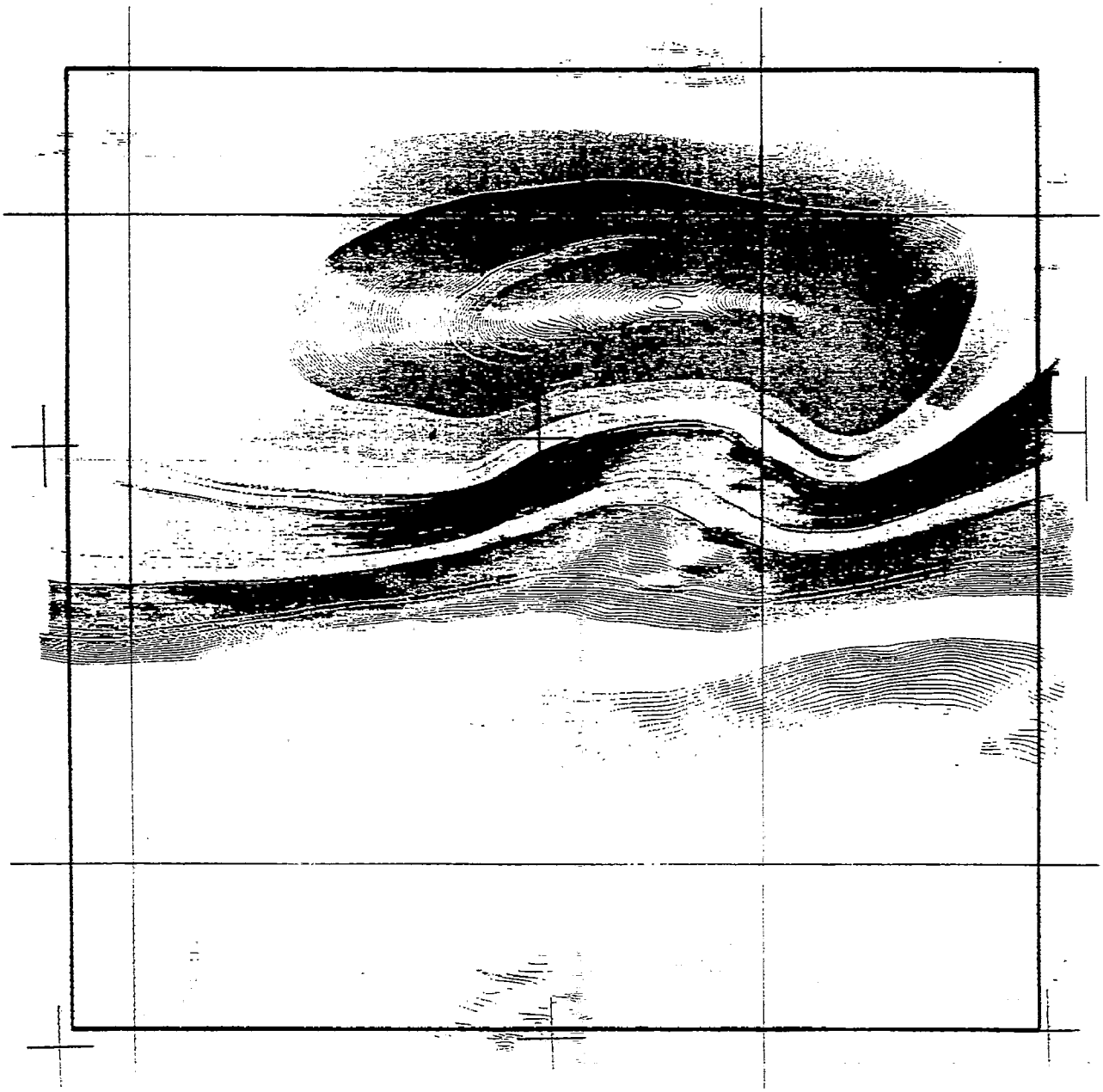

X LINES
SP
STATION
TIME IN SECONDS
MARTINS WELL DOME
SEISMIC LINE 92FE -01.

FIGURE 11

FIGURE 12

BIBLIANDO DOME
AIRBORNE GEOPHYSICAL SURVEY



TOTAL INTENSITY MAGNETIC CONTOURS

FRONTIER EXPLORATION LIMITED

North point relationships are shown for the centre of the map. Magnetic north is true for 1990.

Scale 1-100 000

0 2 4 6 8

AUSTRALIAN MAP GRID

DATA PROCESSING

REGIONAL FIELD	IGRF MODEL 1990 REMOVED
GRID CELL SIZE	150 metres
CONTOUR INTERVAL	5 nanoTeslas
PARALLAX CORRECTION	-0.6 fiducials

COLOUR LEGEND

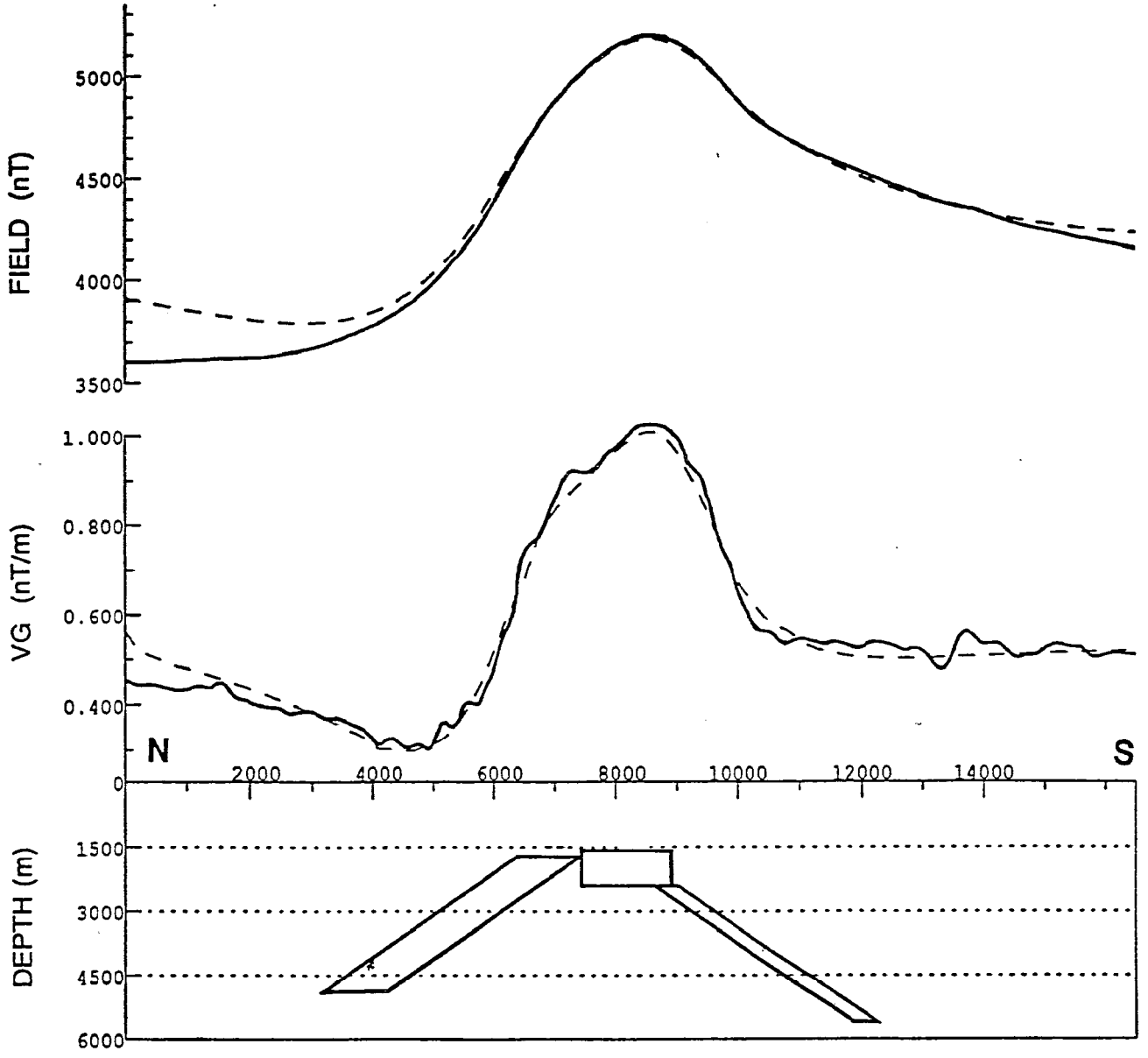
57310 > < 58161
57400 > < 58315
57475 > < 58530
57700 > < 5853

Surveyed and compiled by AERODATA HOLDINGS LIMITED
AUGUST 1992
Job No. 1307

GRID/MAGNETIC ANGLE	8°12'36"
GRID CONVERGENCE	-0°58'0.92"
SECULAR VARIATION	0°1'38" east per year

AERODATA

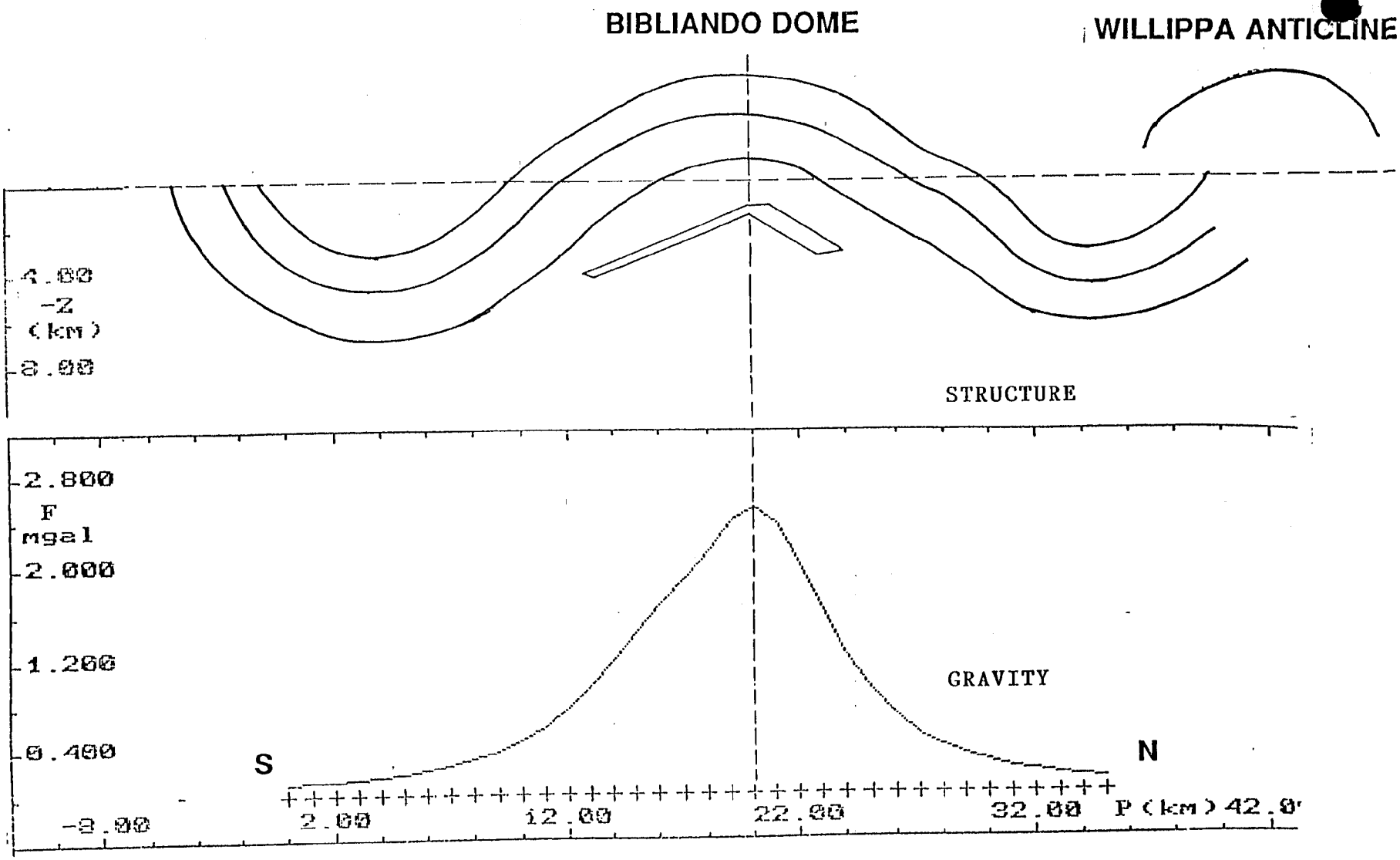
FIGURE 13



AEROMAGNETIC MODEL
TIE-LINE 160, PARACHILNA SHEET
ACROSS BIBLIANDO DOME

LOOKING EAST

FIGURE 14

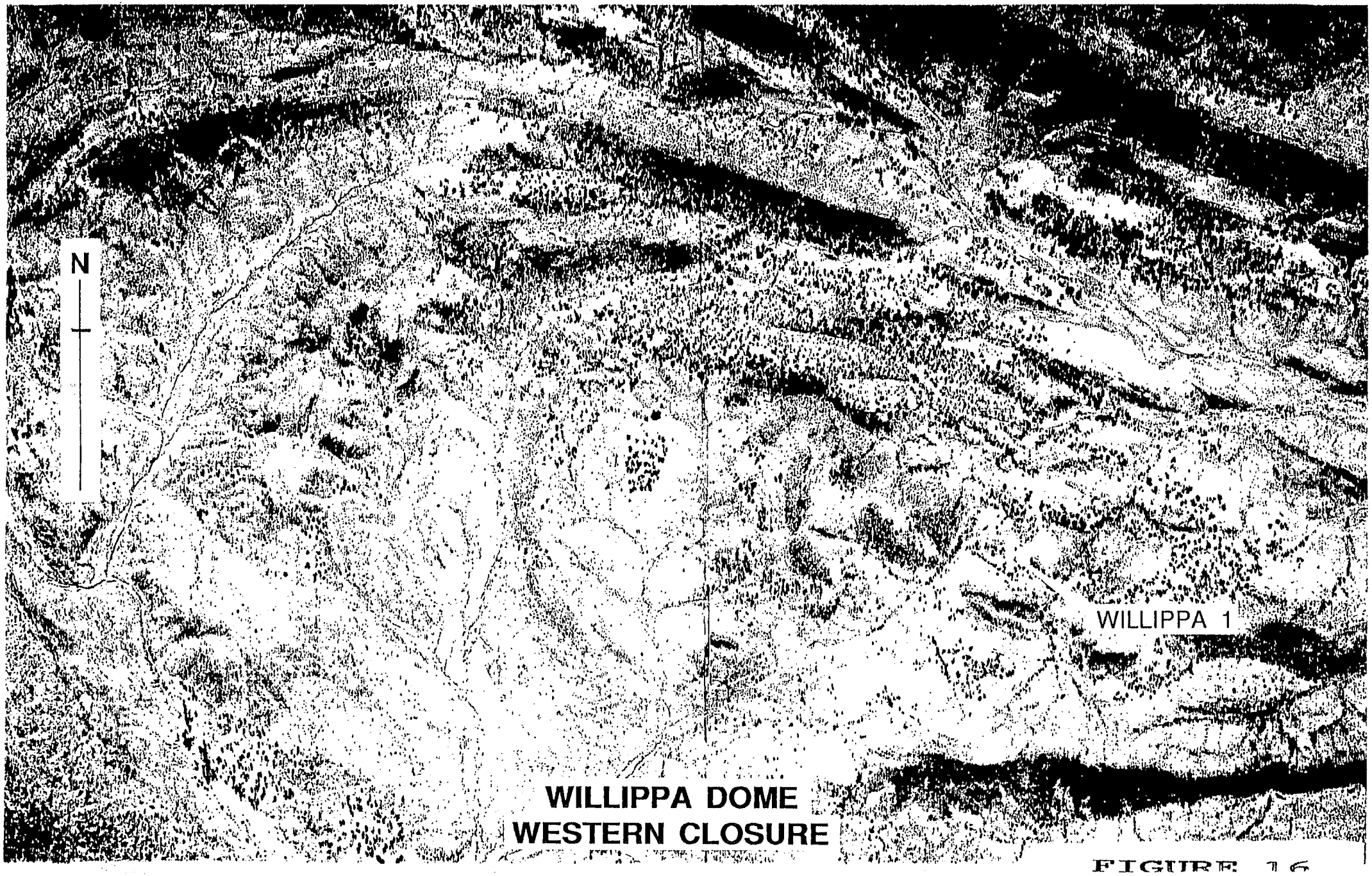


BIBLIANDO DOME

Showing Coincidence of Surface Structure

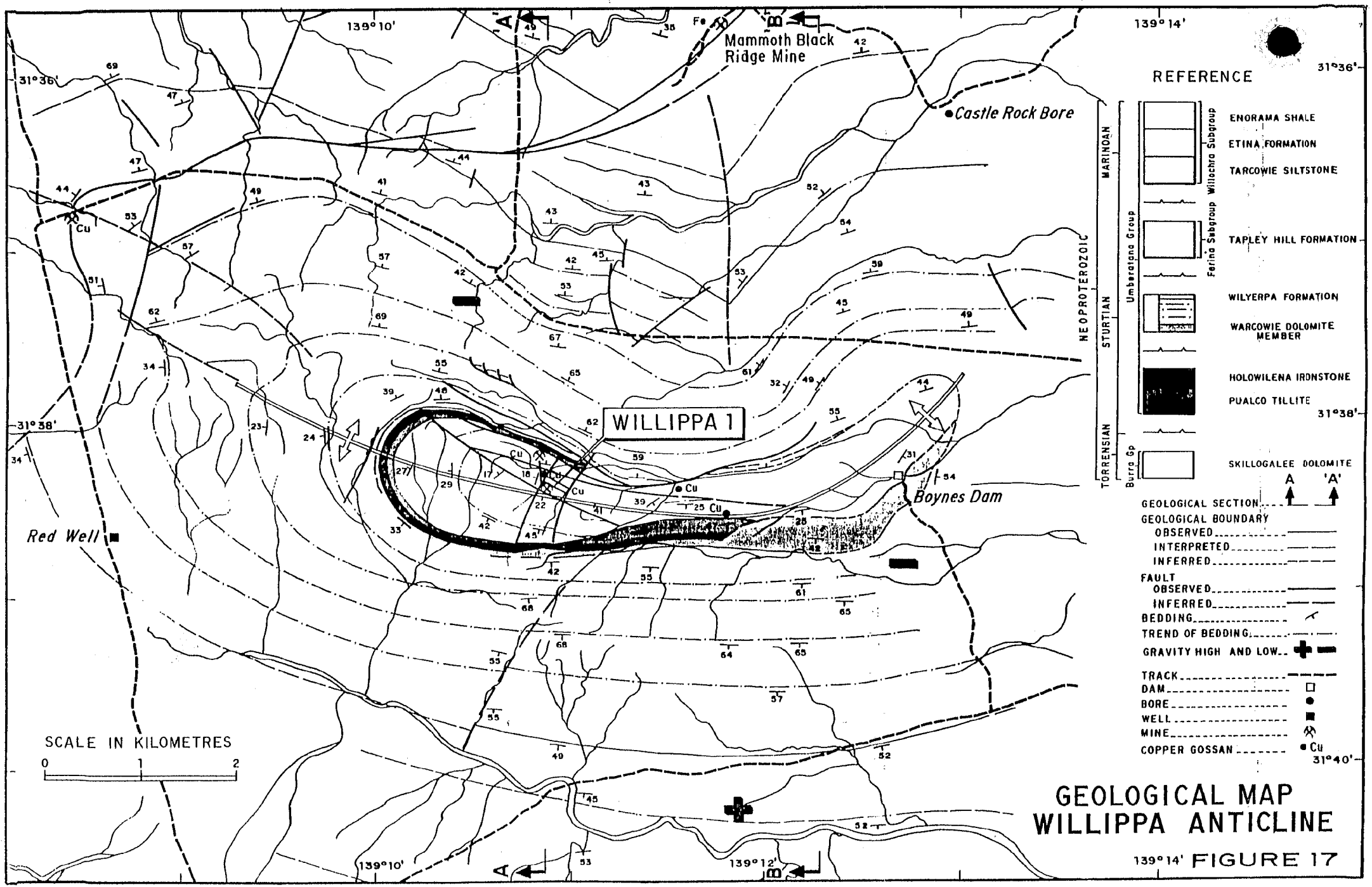
Magnetic anomaly and Gravity profile

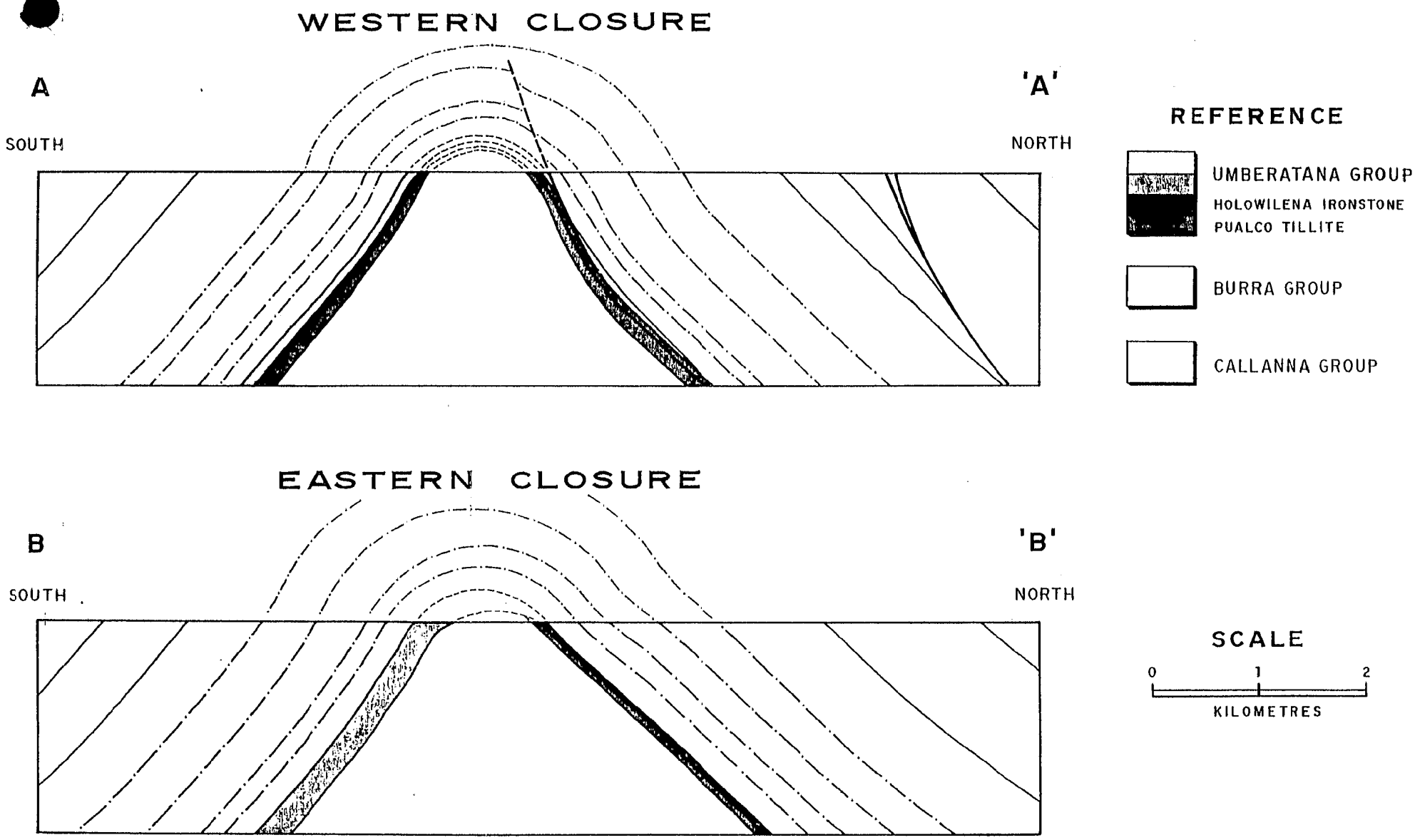
FIGURE 15



WILLIPPA DOME
WESTERN CLOSURE

FIGURE 16


139°10'
139°14'
31°36'
31°38'
31°40'
Mammoth Black Ridge Mine
Castle Rock Bore
WILLIPPA 1
Boynes Dam
Red Well
Cu
Fe
'A'
A
139°12'
SCALE IN KILOMETRES
0 1 2
REFERENCE
NEOPROTEROZOIC
MARINOAN
STURTIAN
TORRENSIAN
Umberatana Group
Burra Gp
Willochra Subgroup
Ferina Subgroup
ENORAMA SHALE
ETINA FORMATION
TARCOWIE SILTSTONE
TAPLEY HILL FORMATION
WILYERPA FORMATION
WARCOWIE DOLOMITE MEMBER
HOLOWILENA IRONSTONE
PUALCO TILLITE
SKILLOGALEE DOLOMITE
GEOLOGICAL SECTION
GEOLOGICAL BOUNDARY
OBSERVED
INTERPRETED
INFERRED
FAULT
OBSERVED
INFERRED
BEDDING
TREND OF BEDDING
GRAVITY HIGH AND LOW
TRACK
DAM
BORE
WELL
MINE
COPPER GOSSAN
GEOLOGICAL MAP
WILLIPPA ANTICLINE
FIGURE 17



GEOLOGICAL SECTIONS
WILLIPPA ANTICLINE

FIGURE 18

WILLIPPA DOME
GRAVITY

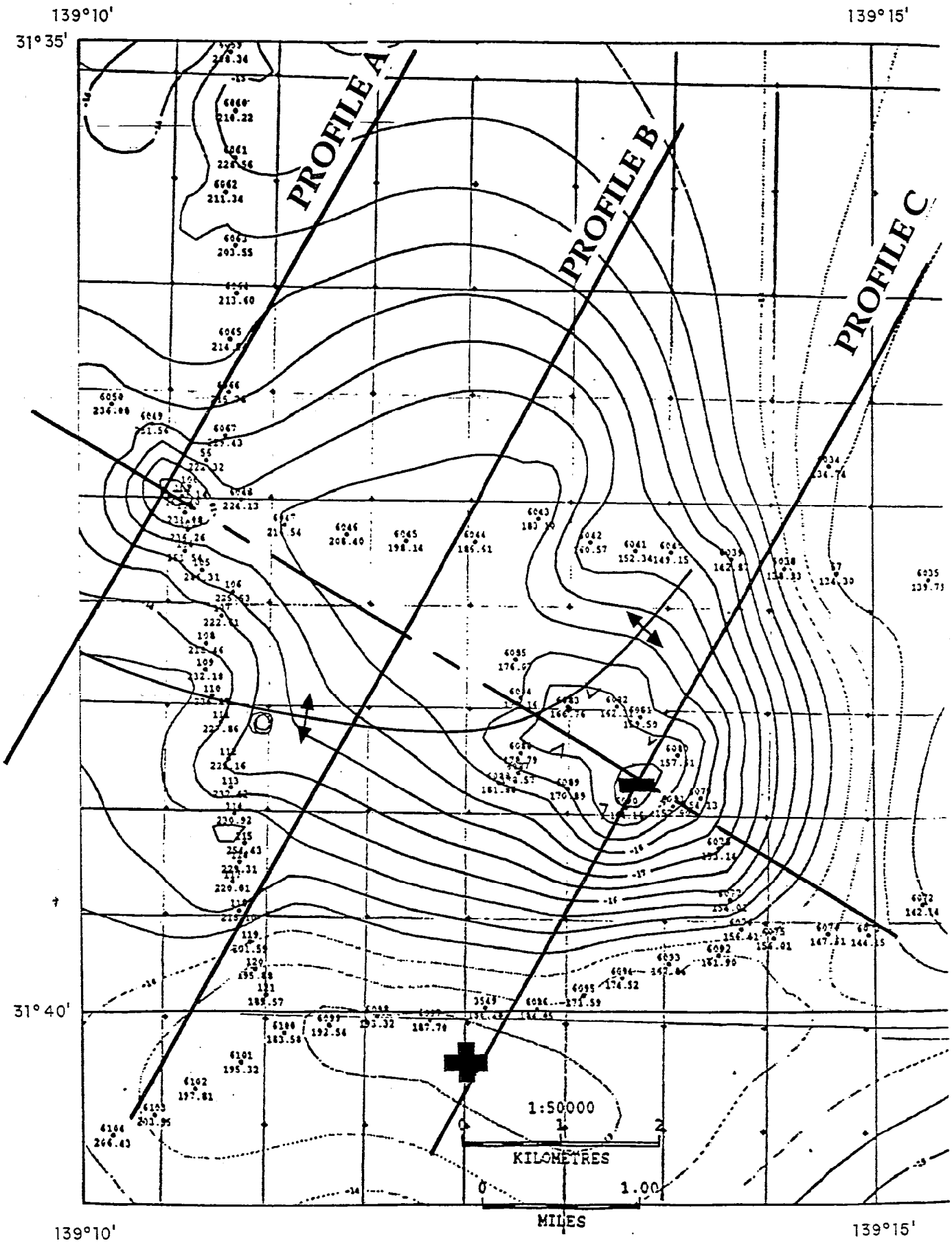
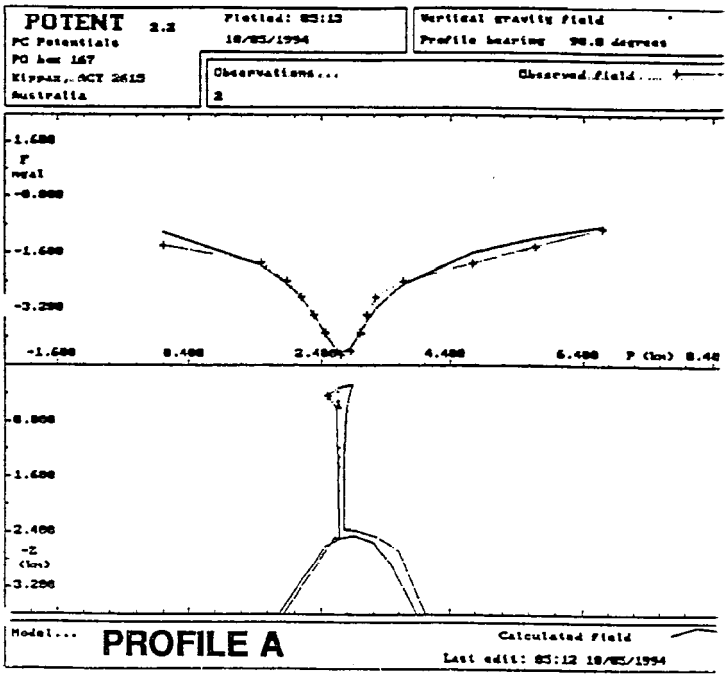
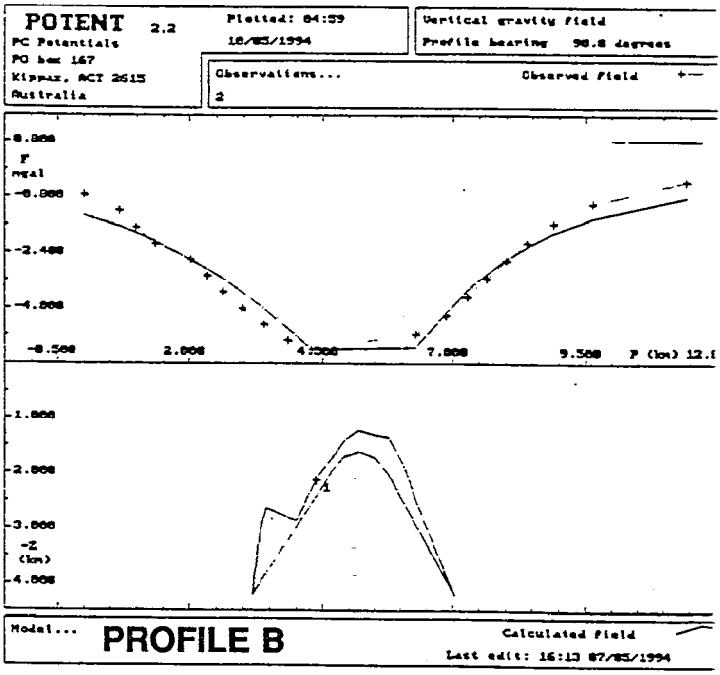


FIGURE 19

WILLIPPA DOME - GRAVITY PROFILES





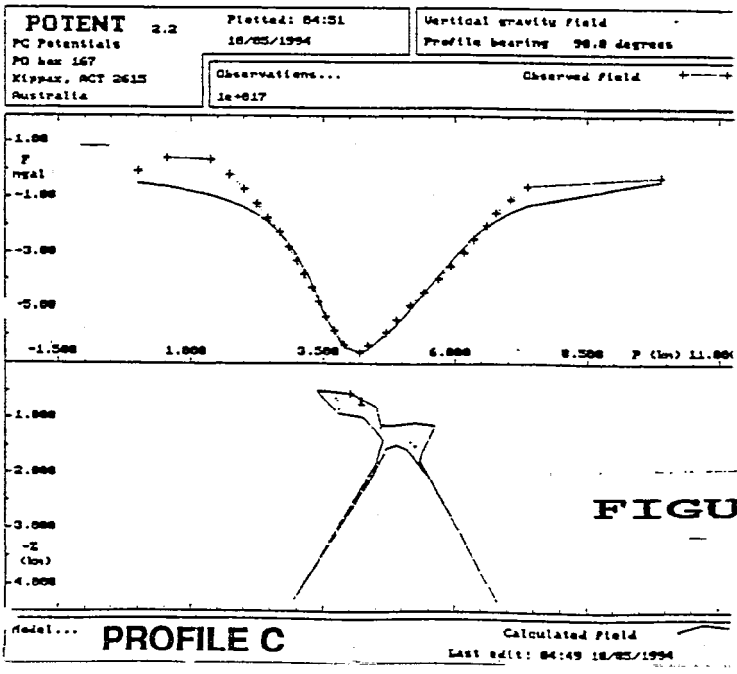
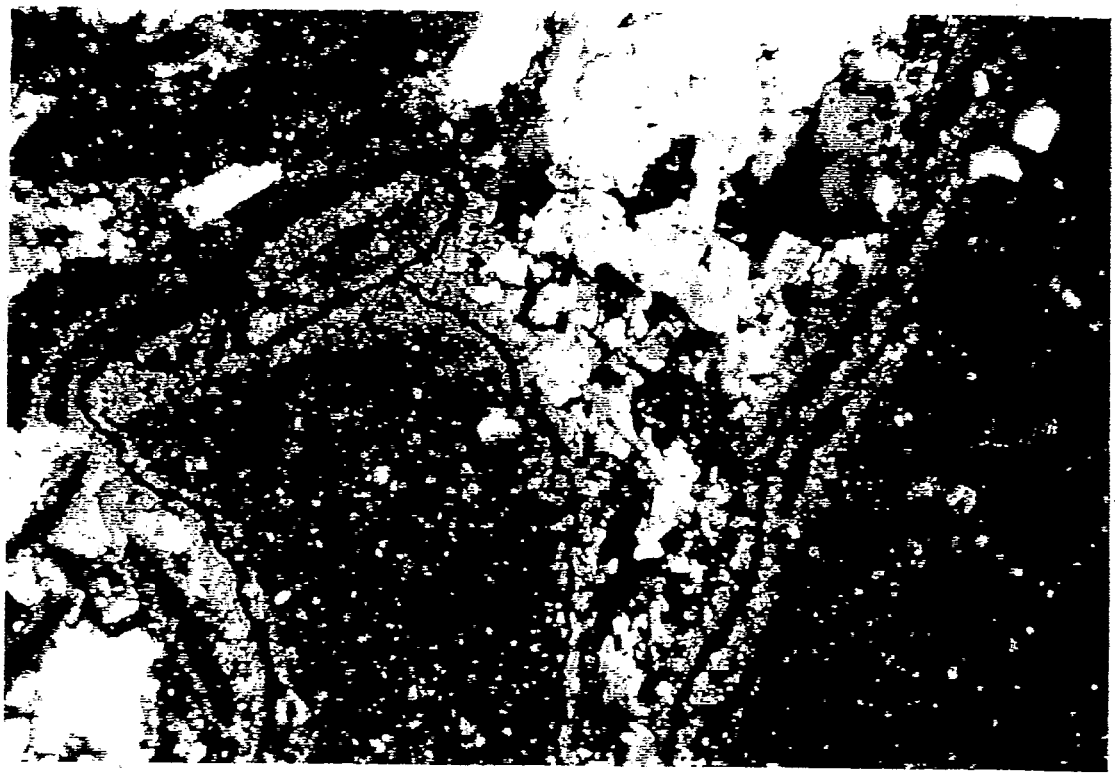
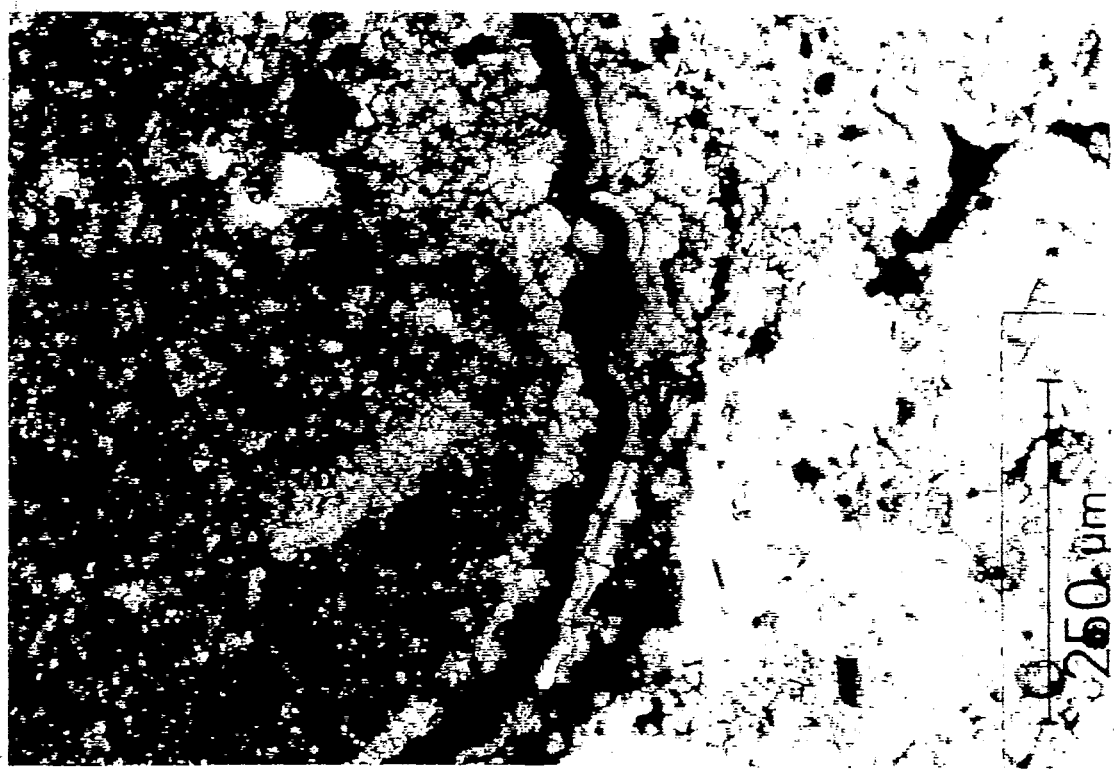


FIGURE 20



Blinman No. 2 at 1540 metres
Bitumen border on grains
Width of photograph 3.0mm



Blinman No. 2 at 1540 metres
Bitumen border on grains
Width of photograph 1.0mm

PLATE 1