DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept.Bk.No. 80/33

WALLOWAY BASIN SEISMIC AND GRAVITY SURVEY

GEOLOGICAL SURVEY

GEOPHYSICS SECTION

By

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D.M. No. 1836/67

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DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

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WALLOWAY BASIN SEISMIC AND GRAVITY SURVEY

ABSTRACT

A seismic refraction and gravity survey in the southern portion of the Walloway Basin suggests that the western margin is influenced by faulting. The survey has also indicated a fault which controls groundwater movement within the basin.

Five seismic horizons can be recognised within the basin of which three can be correlated with aquifers. In addition, two types of Precambrian bedrock can be identified beneath the basin fill, which has a maximum thickness of over 300 m.

INTRODUCTION

The Walloway Basin is an intermontane basin located in the mid-north of South Australia (fig. 1) associated with a valley some 45 km long and up to 16 km wide. Drainage within the valley collects in a flat depression 20 km northeast of Orroroo, from where it drains via Hillpara Creek into the Koonamore Lake. In periods of exceptional rainfall this basin in turn drains via the Siccus River towards Lake Frome.

The Walloway Basin is partially infilled with Cainozoic lacustrine and alluvial sediments consisting of over 300 m of clays, sandy clays and clayey sands (Binks, P.J. 1966) which form a strong contrast with underlying high density Adelaide System basement. This contrast contributes significantly to gravity patterns in the area.

The basin is of similar age to the adjacent Willochra Basin (fig. 1). It has fill of the same type with similar geophysical characteristics (Milton, 1978).

The major economic significance of the basin lies in its groundwater resources which have been the subject of several studies (Sprigg, 1949; Hillwood, 1964). This particular study was conceived to clarify the extent of the basin as an aid to studies of the groundwater and, in particular, to determine the nature of the basin margins and the total depth of sedimentation.

GEOPHYSICAL OPERATIONS

Seismic Recording Procedures

The location of seismic traverses along which refraction data were obtained is shown in Fig. 2. Profiles WB-79-1 to -4 where shot over 15 days in June, 1979. Detectors were laid at 50 m intervals in line with the energy source, the location of which relative to the detector array was designed to give continuous coverage of the basement refractor in forward and reverse directions. Information on near surface material was obtained from "weathering spreads" in which the detector interval was staggered in expanding intervals from 2.5 m to 70 m. These were shot on the eastern end of line WB-79-2 at 600 m separation, and elsewhere at 1200 m intervals. Records were examined as recorded and shooting routine adjusted as basement refractor depths altered.

Seismic Computing

Information extracted from seismic data measures depth to a refracting horizon relative to Australian Height Datum and velocity along the interface (fig. 3).

"Time-distance" curves are constructed by plotting arrival times at individual detectors against their distance from an energy source. If the assumption is valid that velocities within seismic strata are constant, the plotted points fall on straight-line segments (fig. 4).

Depths to refracting horizons below detector locations, other than the near surface seismic events, were computed using a method described by Hawkins (1961). In areas where velocity changes seemed apparent or rapid changes in depth occurred, the more involved method outlined by Palmer (1974) was used to give better resolution.

Sources of error in the computation processes arise from:

(1) Errors in timing events on the seismic records. Record quality for the Orroroo survey was in general good, with occasionally poor records. Consequently picked times are of fair reliability with an estimated error of ± 2 milliseconds.

(2) Variations in elevation between detector stations. The survey area is mostly one of low, gentle topographic relief and differences between detector/detector and detector/source elevations do not result in significant errors in most instances.

(3) Variations in thickness and velocity of near-surface layers. During computing of data it became apparent that lateral variations of thickness and velocity resulting from changes in moisture and sand content etc., could account for large variations in computed depths to the deeper refracting horizon.

(4) Small-scale structure is expected on the high-speed refracting horizon as it represents an erosional surface. Computing procedures require an assumption of a planar surface between detecting points. This has probably resulted in the introduction of small errors in depths to basement computed along the seismic lines.

(5) The presence of velocity inversions and "blind zones" of insufficient thickness to appear as 'first breaks' on the seismic records are a problem in computing depths within the Walloway Basin. Both are present within the survey area and their total effect upon the computed depths cannot be accurately estimated (Appendix I).

The effects of 2) and 3) above on velocities are removed by "reciprocal coverage" techniques. These involve calculating velocities by the method of "differences" from data collected in opposite directions over the same detector array. The effects of 4) are minimized by the method outlined by Palmer, 1978, but not removed.

Depth calculations involve both velocity and time terms and are hence subject to greater errors than velocities. It is considered that the effects of 5) above will in this survey be greater than 1)-4) combined.

Because of the velocity inversion which occurs between layers 3 and 4, calculated depths to the base of layer 4 are subject to an error of up to 240% (Appendix I), where this occurs. However, extrapolation from adjacent portions of the profile on line WB-79-2 together with interpretation of water well information indicates the calculated depths to the base of this layer are likely to be correct to within ± 20% of their true position. Depths to basement where inversion occurs appear to be within ± 13%.

Elsewhere the errors mentioned would give an uncertainty in depths of close to ± 8%.

Control of seismic depths from water well log data is limited. Within the survey area, which is contained in the Hundred of Walloway, 14 wells are of some relevance to the survey as possible control wells (figs. 3 and 9).

Six of these wells bottom in weathered basement at depths up to 40% shallower than the high speed refractor. None intersect fresh basement and so direct correlation with the high speed refractor is not possible. Six wells indicate sufficient differentiation in sequence to suggest correlation with intermediate seismic horizons.

These comparisons are discussed later under interpretation but it can be seen that the well logs are of qualitative assistance in increasing control over seismic data.

Velocity Analysis

Velocities of refractors encountered along traverses appear to fall into individual groupings as shown in table 1.

Layer 1

From the 'weathering data', the near surface poorly consolidated material has a thickness of about 1 m and a velocity of close to .2 km/s. This layer has been omitted from interpreted sections (fig. 3) for ease of presentation.

Layer 2

This forms a layer between 7 m and 30 m thick, beneath layer 1. It has an average velocity of .6 km/s.

Layer 2A

This is a thin lens shaped refractor, the average velocity of which is 1.1 km/s. It occurs at the western end of lines WB-79-1 and -3 beneath layer 2. It may exist beneath layer 2 on line WB-79-2 but be too thin to be recognised on the seismic record.

Between these layers and bedrock three possible refractors may exist.

Layer 3

This is the uppermost and has an average velocity of close to 1.95 km/s and a thickness which varies from 0-25 m. It is apparent across almost all of line WB-79-1, but only occurs in the western half of line WB-79-2. From water well information it probably occurs on line WB-79-4 and the western part of line WB-79-3 but is indistinct from layer 5 in those areas.

Layer 4

This is termed the "low velocity layer" and because its velocity is lower than that of layer 3, with an interpreted velocity of 1.67 km/s it causes velocity 'skips' on the seismic record (fig. 4) where layer 3 is present. Layer 4 is expected to be up to 120 m thick. It appears absent from line WB-79-4 and only occurs as a broad lens on line WB-79-3 from SP 9-13.

Layer 5

This has a velocity slightly greater than layer 3 at 2.05 km/s and a thickness of up to 250 m.

Layer 6

This is the bedrock horizon and the horizontal velocity variations are listed in table 1B and shown in Figs. 3 and 5.

It is apparent that velocity changes occur close to the margins and that the floor of the basin largely consists of a single velocity group.

Four anomalous velocity zones were noted. The first of these was 6.7 km/s on line WB-79-1 between S.P. 26-30, the second was 6.7 km/s on WB-79-4 between S.P. 4-6, the third, on WB-79-2 at S.P. 35 was 2.8 km/s and the fourth on WB-79-3 from S.P. 36-38 was 2.8 km/s.

Possible shallow water table refractors occur intermittently, on WB-79-2 at S.P. 9, 25, 33 and 37 and on line WB-79-3 from S.P. 13-17.

GRAVITY DATA

Gravity expression of the basin can be seen on the central portion of ORROROO 1:250 000 sheet for which the Bouguer gravity contour map was published in 1975. This map is based on data from a helicopter survey flown for the Bureau of Mineral Resources by Wongela Geophysical Pty. Ltd in 1970 (Tucker and Brown, 1973) with stations on a grid spacing of about 7.2 km and also on ground data from S.A. Department of Mines and Energy surveys.

In addition, for this survey, data were collected at shot points, that is, at stations every 300 m over lines WB-79-1, -2 and -3. Following initial interpretation of the seismic and gravity data, a gravity survey was undertaken on an additional 7 lines at the same interval. These data, together with the initial information, are presented in contour form in fig. 7. The data are recorded on the State Gravity File under survey number 79E7. An earlier ground survey was carried out in 1950 as part of a study of the Walloway Basin for which contoured plans are available but, unfortunately, for which data are not available (Erkelens, C.H., 1950).

Profiles of residual gravity were obtained by deducting a regional profile from the line data. This regional profile was obtained from "smoothing" of the 1:250 000 data and represents a linear east to west decrease of 6.3 μ gallileo/km over the survey area. It corresponds with a deepening of magnetic basement of 6 km over a distance of 40 km through the central portion of ORROROO and thus implies a density contrast of 100 kg/m^3 between magnetic basement and non-magnetic cover. This is interpreted to correspond with the interface between Adelaide System Rocks and older metamorphic basement equivalent to the Willyama and Gawler Craton basement rocks which occur east and west of the Adelaide System outcrop.

The basin shows as an area of low gravity values and its bounds are clearly defined by the gravity expression due to the high density contrast between basement rocks and fill.

Equivalent specific gravity values have been estimated from velocities using a graphic relationship between density and velocity (Drake <u>in</u> Grant and West, p. 200, 1965) for use in interpreting gravity patterns. The graph does not give accurate values of density for the Adelaide system of rocks but they do fall within the range given in Tucker and Brown (1973, p. 14). As density contrasts are used it was considered that these would be reasonable. These values were used to derive computed gravity profiles (fig. 6).

These profiles, based on the seismic depth profiles give good fit to the residual gravity (fig. 6).

The differences in fit shown could result from four uncontrolled influences:

(1) Variations in thickness of the low velocity layer.

(2) Undetected layers within the basin.

(3) Shallow variations in density of bedrock.

(4) Deeper variations in basement affecting the regional gradient which has been removed for these comparisons.

The individual effects of these four influences can with present information only be speculated on.

INTERPRETATION

Interpretation has been directed to the nature and location of the basin margins, the configuration of the basin floor, the nature of the basement rocks and basin fill.

Basin Margins

The western margin is marked by a steep sloping basement with a recorded slope of 23° on line WB-79-1 and 13° on line WB-79-2. These slopes alone cannot be directly interpreted as arising from fault activity as they are consistent with slope development in normal piedmont deposition. However, the central and steepest part of the scarp on line WB-79-1 corresponds with a zone of low velocity within basement from S.P. 3-7, indicative of selective weathering on a fault plane (Fig. 3).

The steepest part of the slope on WB-79-2 corresponds to a velocity change in basement from S.P. 4-6 and could be due to differential weathering of rock types. However, if this were to occur, it would be expected that the high-velocity (high-density) type would be the resistant up-slope member, which in this case it is not. The reverse occurs, and so this slope too is interpreted to be the result of fault activity.

Some post-depositional movement is likely on the slope at WB-79-2 and cannot be excluded from consideration where the fault crosses WB-79-1. Because of the continuity of gravity response between the two lines, this faulting is interpreted to occur along the same narrow zone between them. At the surface a mapped boundary between Quaternary units coincides with this subsurface fault.

The eastern side slopes more gently and the margins lie beyond the end of the seismic lines where the horizons probably pinch out against basement.

A small fault is evident on line WB-79-3 at S.P. 5 which coincides with the steepest portion of gravity gradient and velocity change in basement. Fault activity is not apparent on the other lines along the same gravity trend.

Bedrock configuration

Features on the bedrock surface are of the same order of magnitude as errors associated with depth calculations and cannot thus be confidently interpreted without any associated measured gravity response.

At S.P. 35 on line WB-79-2 a depression in bedrock corresponds with a low velocity zone and a gravity low. The depression in bedrock alone is not sufficient to produce the marked gravity response and the low-velocity zone must indicate a response from bedrock beneath the depression. The feature is interpreted as differential weathering at a rock type boundary which is fault-controlled. From interpretation of gravity and salinity contours (Figs. 7 and 9), the fault implied is continuous through from S.P. 25 on line WB-79-1 to S.P. 39 on line WB-79-3 (Fig. 5), where low velocity zones also occur. Fig. 9 indicates it must have had an influence on basin groundwater movement and is also likely to have an influence on basin fill. This is not readily apparent in changes in the intermediate refractors over this zone, although from examination of airphotos a distinct linear feature cross cuts Quaternary and PreCambrian units along the same trend. (A weak magnetic response indicated on a single traverse across this zone (fig. 8) indicates an intrusion which is possibly diapiric).

The depressions on line WB-79-1 between S.P. 35-40 and 26-32 also have low gravity responses, this time in proportion to their interpreted depths and they are interpreted as former stream channels cut into bedrock surface prior to basin infill.

The general shape of the valley is that of an assymetrical "V" with western margins steeper than east and bedrock depth up to 350 m deep at the observed deepest point on line WB-79-1.

Basement rock types

The changes in velocity shown in Table 1B could result from variations of weathering or from changes in rock type. A combination of both is considered likely. Since some changes are consistent from line to line it is suggested that they do primarily reflect a change in rock type although changes in velocity need only indicate a differential weathering of those rock types. Comparison with ORROROO 1:250 000 geological map indicates a possible correlation of the lower velocity group with Tapleys Hill Formation.

Unfortunately, water well information is insufficient to give any basis for comparison of these velocity differences. From that information, however, it appears that weathering of basement, particularly at the margins, is extensive. In addition outcropping siltstones within the vicinity of S.P. 45 on line WB-79-1 indicate that low velocity material recorded beyond the basin margins is likely to be highly weathered bedrock and not fill. The high velocity seismic refractor is interpreted as a weathering horizon within bedrock.

It should be noted that the extent of magnetic weathering within the area is approximately 100 m (Tucker and Brown, p. 14, 1973). (The term 'magnetic weathering' refers to removal by weathering of magnetic minerals, magnetite in particular, from a rock formation).

Information from a drilling programme for Utah Development Co. to the west of the Basin at Carrieton indicates that 'weathered' basement has a density mean of 2100 kg/m^3 compared with 2700 kg/m^3 for fresh basement (391 samples); a contrast directly comparable to that observed for infill in the Walloway Basin. In the Carrieton area, weathering depth varies from 6 m to 150 m (Rowlands, 1973). The extent of weathering beneath the basin can thus only be surmised.

Two high velocity anomalies occur within bedrock, one on line WB-79-4, S.P. 4-6, and the other on line WB-79-1, S.P. 26-30, both of approximately 6.67 km/s^{-1}. Neither has any positive discernable gravity effect and are thus probably due to bodies of limited depth extent. The most likely explanation would be that the anomalies arise from either quartz reef type bodies or from a Tertiary silcreted surface with the latter as the preferred interpretation because of the lateral extent of the anomalies. Both types of body occur in similar geological settings on the ORROROO 1:250 000 geological sheet (Binks, 1966).

Basin Fill

As indicated on fig. 3, sedimentary fill is indicated to be up to 300 m thick.

From a comparison between water well data and the seismically interpreted sections, it appears that layers 2A, 3 and 5 are water-bearing horizons whereas layer 4 is not.

- Layer 2A consists of silts and gravels. It is poorly consolidated.
- Layer 3 consists of clays and weakly cemented gravels.
- Layer 4 consists almost exclusively of clays.
- Layer 5 is a more sandy sequence with interlayered clays. The sand content increases toward the centre of the basin.

The presence of layer 4 on lines WB-79-1 and -2 means that there are two distinct aquifers in this area, the upper aquifer consisting of layers 2A and 3, the lower coinciding with layer 5. With the probable absence of layer 4 over most of lines WB-79-3 and-4 as suggested by seismic evidence, the two aquifers would be hydraulically connected.

Hydrology

Salinity contours (fig. 9) indicate that there are three important intake areas for the basin:

1. Rainfall along the western margin at the foothills of the Oladdie Range is predominantly a source for the shallow aquifer in that region but a small amount may percolate via weathered basement rocks through the fault zone to the deeper aquifer layer 5.
2. Fresh water intake occurs via the Pekina Creek system into both layers 3 and 5 and is the major source for the basin.
3. Saline water intake occurs via the Yadena Creek System again into both aquifers. The reason for the salinity of this intake is unclear. The movement of this saline water is controlled in part by the eastern fault indicated on fig. 5, indicating that the fault must have some expression within the basin itself.

CONCLUSIONS AND RECOMMENDATIONS

Several important conclusions arise from this study.

1. The western margin of the Walloway Basin is likely to be fault-controlled.
2. Up to 300 m of sedimentary fill occurs in the basin.
3. Water movement within the Basin is controlled by a northwest-southeast fault which cuts across the basin.
4. Water movement occurs principally from south to north with two types of intake: a/ Fresh water via the Pekina Creek.
   b/ Saline water via Yadena Creek.
5. Only one aquifer occurs in this intake region but an intermediate layer separates the aquifer into two in the northern portion of the basin with the shallow aquifer subject to additional intake from the hills north of Walloway.
6. The northwest-southeast fault may be a zone of diapiric activity.

The geophysical methods described in this report are capable of delineating the margins of the Walloway Basin and mapping the floor of that basin with a fair degree of accuracy. The thickness and probable type of fill can be deduced by the methods used, as can features likely to affect groundwater movement. Gravity data are particularly useful for extrapolation beyond seismic control and for interpolation between seismic lines.

Because of the success of the procedures used it is recommended that further work be carried out in the northern portion of the basin across the Oladdie plains.

Within the region studied, electrical resistivity surveying could be a useful adjunct to this work as it could, indirectly, indicate porosity changes in the basin relating to quantitative supply from the aquifers. It would also indicate the extent of saline penetration from the Yadena Creek intake.

Drilling of the northwest-southeast fault zone is recommended to investigate possible diapiric intrusion along it.

Finally the accuracy of this seismic work could be greatly increased by having control of velocities of all infilling layers. To this end it is recommended that a stratigraphic well be sited on line WB-79-1 to test all horizons through to fresh bedrock and that the well be geophysically logged and a seismic well survey be carried out.

BF:GU

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TABLE 1

VELOCITY ANALYSIS

1A. Infill Velocities

Line	Layer	Velocity (Km/s)	Standard Deviation	No. Observations	Equivalent Density (Kg/m^3)
WB-79-1	1	.19	0.02	16	
	2	.59	0.18	15	
	2A	1.0	0.19	8	
	3	2.1	0.27	31	2 000
	4	1.7	-	1	1 800
	5	2.1	0.22	15	2 000
	6	See below			
WB-79-2	1	.21	0.1805	12	
	2	.59	0.18	7	
	2A	1.1	0.06	4	
	3	2.0	0.09	18	2 000
	4	1.7	0.14	22	1 800
	5	2.2	0.24	13	2 000
		See below			
WB-79-3	1	.24	0.05	7	
	2	.71	0.12	5	
	2A	1.1	0.13	4	
	3	Not observed?			
	4	1.6	0.01	3	1 700
	5	1.9	0.09	7	1 900
	6	See below			
WB-79-4	1	.21	0.01	3	
	2	.52	0.07	3	
	2A	Not observed			
	3	Not observed?			
	4	Not observed			
	5	2.0	0.14	8	2 000
	6	See below			

1B. Bedrock Velocities

Line	Shot Point	Velocity (Km/s)	Standard Deviation	No. Observations	Equivalent Density (Kg/m^3)
WB-79-1	0-3	4.6	0.02	7	2 500
	3-7	3.6	0.08	23	2 300
	7-10	4.3	0.04	12	2 400
	10-14	5.3	0.01	7	2 600
	14-20	5.2	0.50	5	2 600
	20-24	5.7	0.08	11	2 700
	24-26	4.1	0.08	12	2 400
	26-30	6.7	0.14	16	2 800
	30-36	5.3	0.11	22	2 600
	36-46	4.8	0.09	4	2 500

Cont.

Line	Shot Point	Velocity (Km/s)	Standard Deviation	No. Observations	Equivalent Density (Kg/m^3)
WB-79-2	0-4	4.0	0.05	23	2 400
	4-6				
	6-11	5.4	0.03	19	2 600
	11-24	5.0	0.11	54	2 500
	24-33	5.4	0.10	5	2 600
	33-34	4.8	-	1	2 500
	35	2.8	-	1	2 200
	36-42	4.8	0.05	3	2 500
WB-79-3	0-4	5.0	0.01	4	2 500
	4-5	4.5	-	1	2 400
	5-10	5.4	0.31	5	2 600
	10-17	5.1	0.04	4	2 500
WB-79-4	3-4	6.7	-	1	2 800
	4-8	5.2	-	1	2 600

TABLE 2

Comparison of the effect of different interpretations of the low velocity inversion problem.

Example 1. 'Thin' low velocity layer

	Layer	Velocity Km/s	Calculated thickness (m)	Calculated depth to base (m)
	1	0.25	1.3	1.3
	2	0.67	4.3	5.6
	2A	1.50	20	26
CAP LAYER	3	1.95		
LOW VELOCITY	4	1.67		
LAYER		1.95*	243†	209
	5	2.00	64	
BASEMENT	6	5.30		332

Example 2.

	Layer	Velocity Km/s	Calculated thickness (m)	Calculated depth to base (m)
	1	0.25	1.3	1.3
	2	0.67	4.3	5.6
	2A	1.50	25	31
CAP LAYER	3	1.95		
LOW VELOCITY	4	1.67		
LAYER		1.75*	92†	
	5	2.00	200	123
BASEMENT	6	5.30		323

Example 3. 'Thin' cap layer

	Layer	Velocity Km/s	Calculated thickness (m)	Calculated depth to base (m)
	1	0.25	1.3	1.3
	2	0.67	4.3	5.6
	2A	1.50	29	35
CAP LAYER	3	1.95		
LOW VELOCITY	4	1.67		
LAYER		1.67*	72†	
	5	2.00	213	106
	6	5.30		320

* Assumed average velocity for composite layer (3+4).

† Thickness of composite layer (3+4).

APPENDIX I

The presence of low velocity inversions in the data causes uncertainty in the configuration of bedrock. These limits can be estimated for this type of refraction survey (Knox, 1967; Whiteley and Greenhalgh 1979).

As an example of the effect of different interpretations of the low velocity layer, three geological models which would each give the same first-break information are given in table 2. It is assumed in these calculations that the velocity of the low velocity inversion layer is the same as that observed east of S.P. 21 on line WB-79-2, i.e. 1.67 km/s. It can be seen that the difference in basement depth is small but the difference in estimates of thickness and depth to the base of the low velocity layer is as great as 238% in these examples. This error is then dependent on the assumed, versus true, relative thickness of layers 3 and 4. In example 1, the low velocity layer would be relatively thin and the average velocity through layers 3 and 4 would approach that of layer 3. On the other hand, in example 3, the cap layer would be relatively thin and the average velocity would approach that of layer 4.

A crude estimate of cap layer thickness is given by Whiteley and Greenhalgh, 1979, p. 131 and this would give a thickness of the cap layer of up to 30 m within the survey area. Accordingly an intermediate velocity similar to example 2 seems appropriate and has been used in depth calculations. These methods involve a depth to basement error of ± 5% additive to normal errors estimated at ± 8%. Thus overall accuracy in bedrock depths would appear to be within bounds of ± 13%.

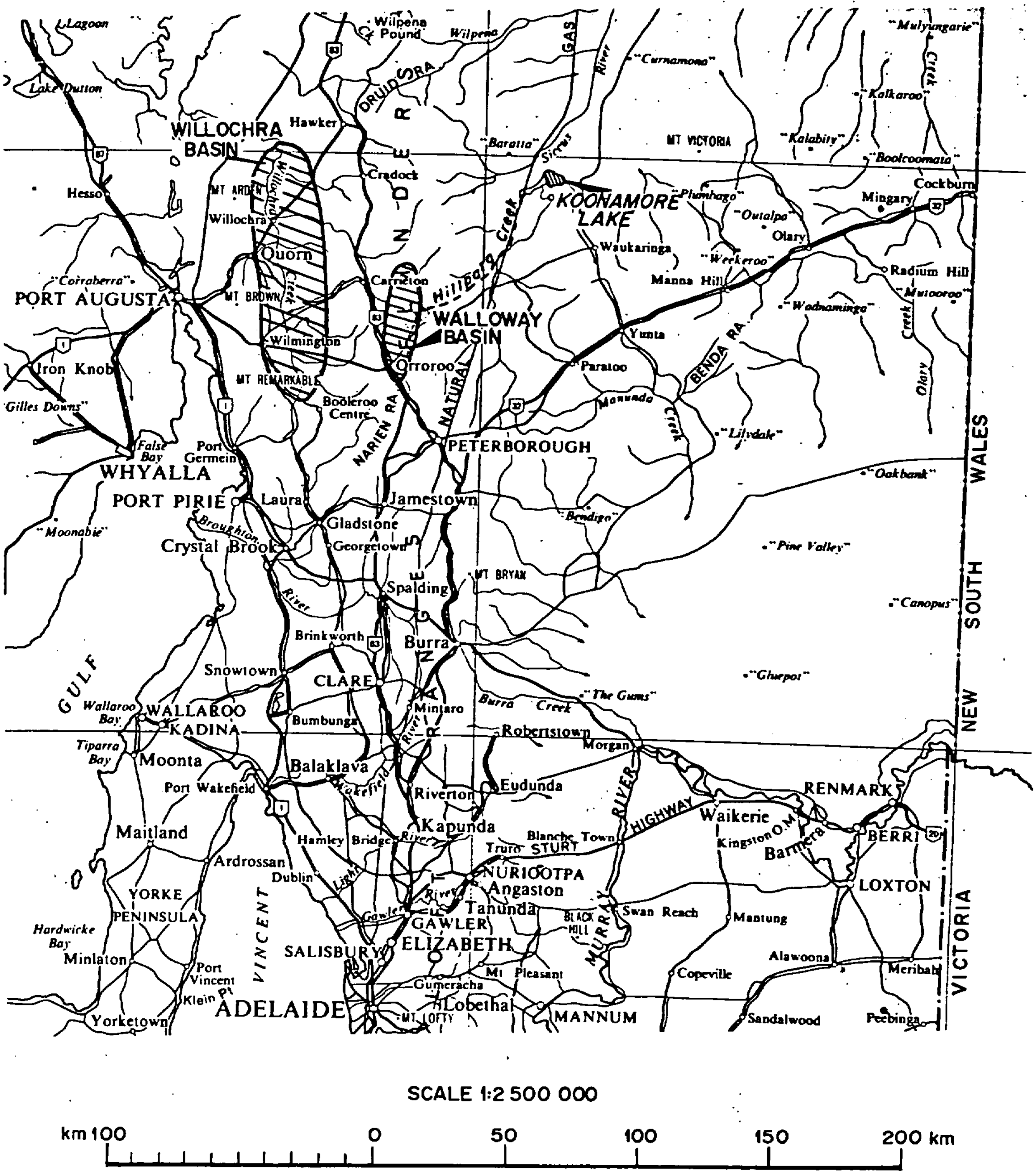

FIG. 1

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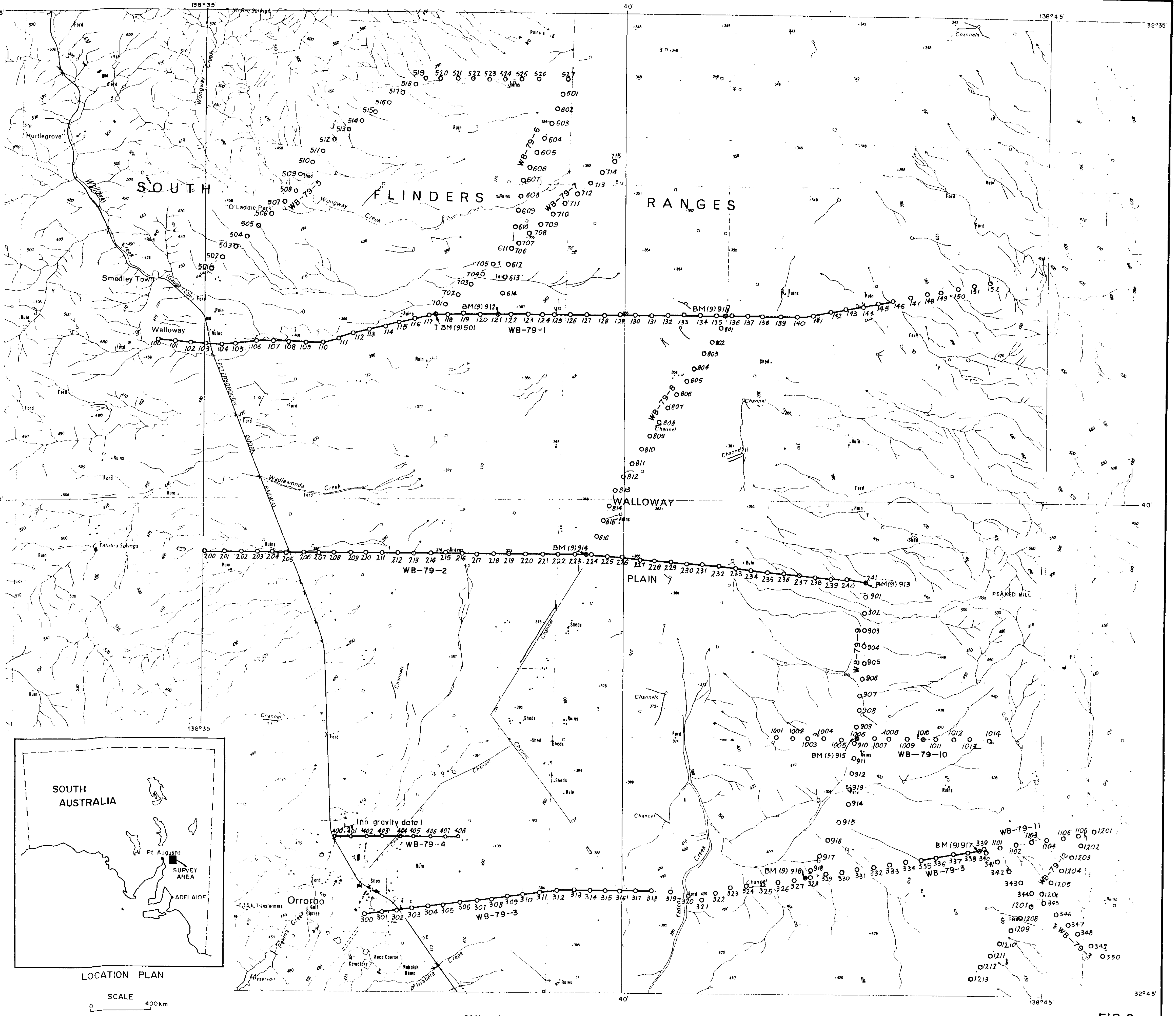
COMPILED: B.F.	WALLOWAY BASIN SEISMIC AND GRAVITY SURVEY LOCALITY PLAN	DATE: SEPT. 1979
DRN: S.R. CKD:		PLAN NUMBER
		S14396

1614



SCALE 1:50 000

METRES 1000 0 1 2 3 4 5 KILOMETRES

FIG. 2

LEGEND

- 616 .... Gravity Data point
- 619 620 621 .... Seismic shot points Line 6
- BM(9) 917 ..... Bench Mark

DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA

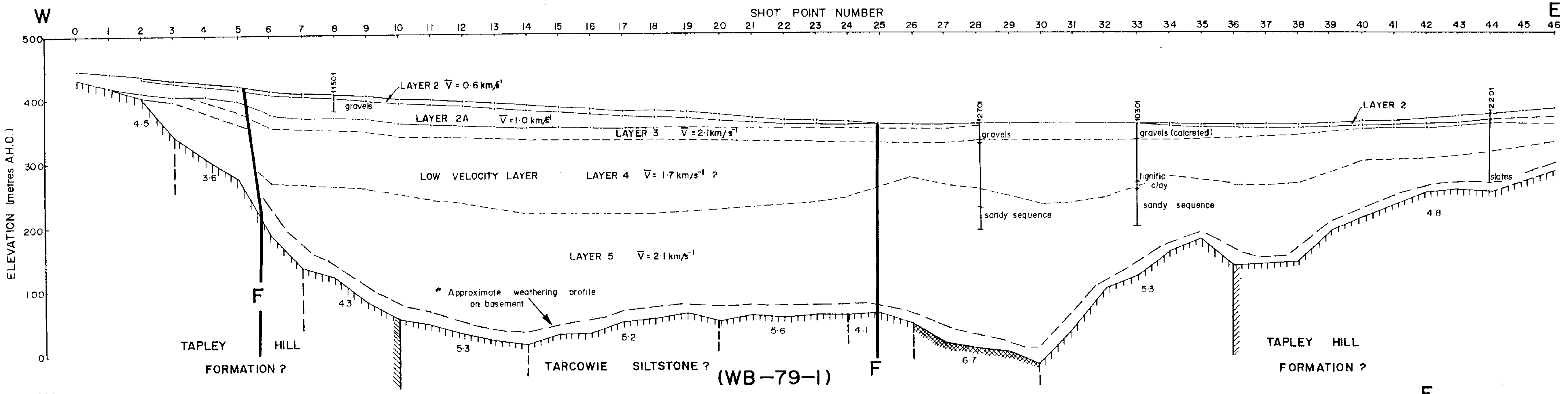
WALLOWAY BASIN

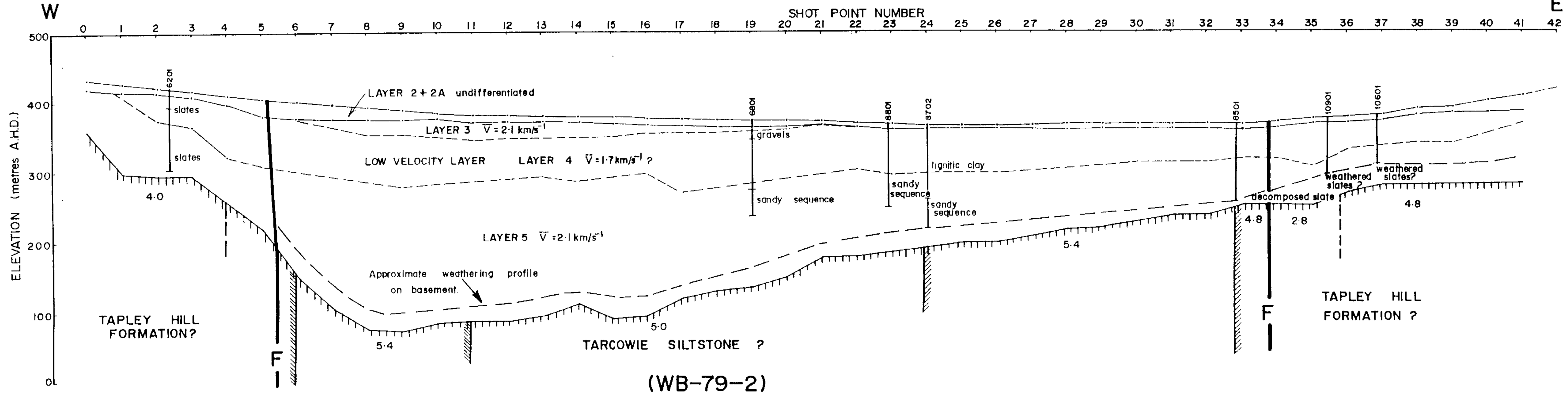
SEISMIC AND GRAVITY SURVEY

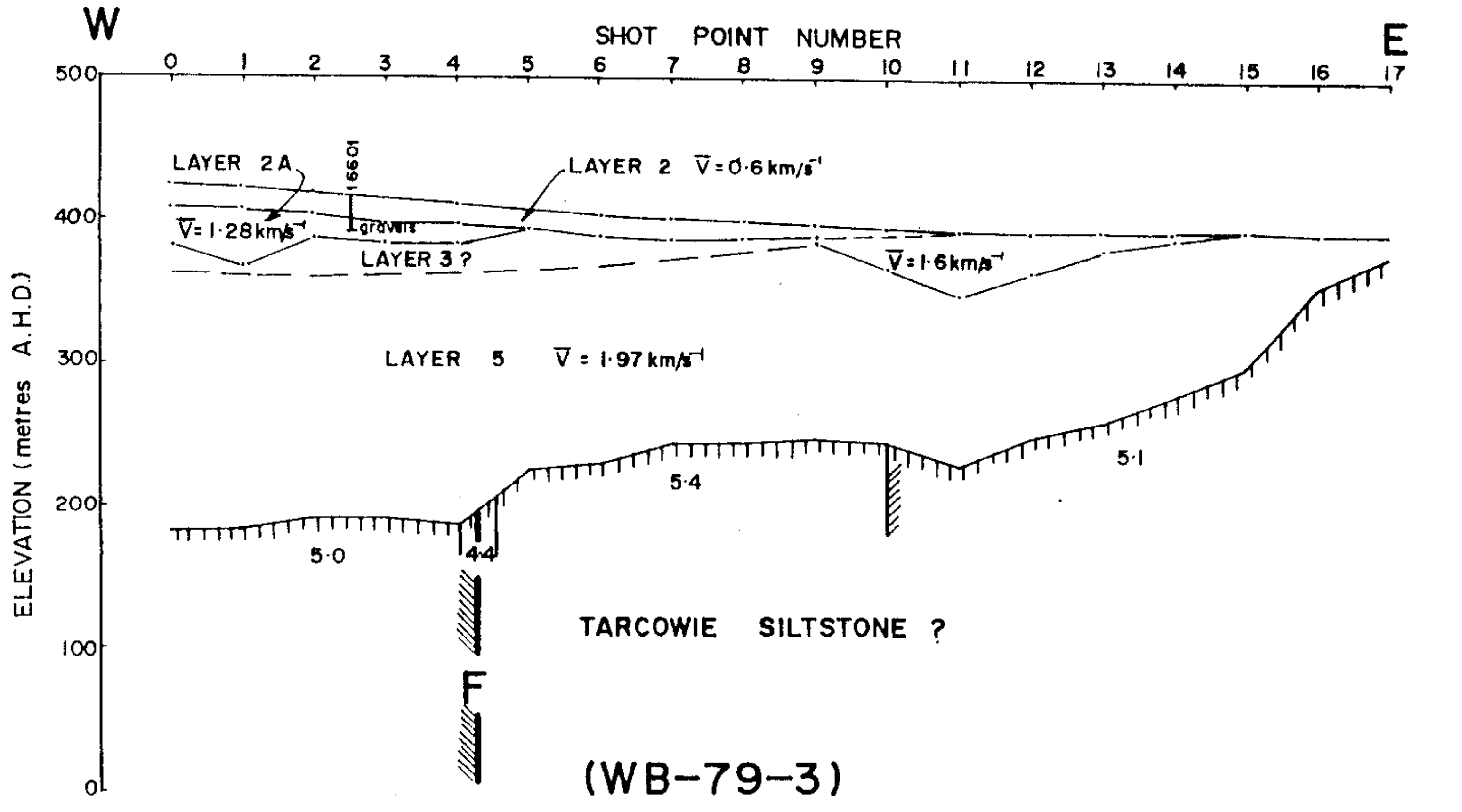
SEISMIC SHOT POINT AND GRAVITY STATION LOCATION

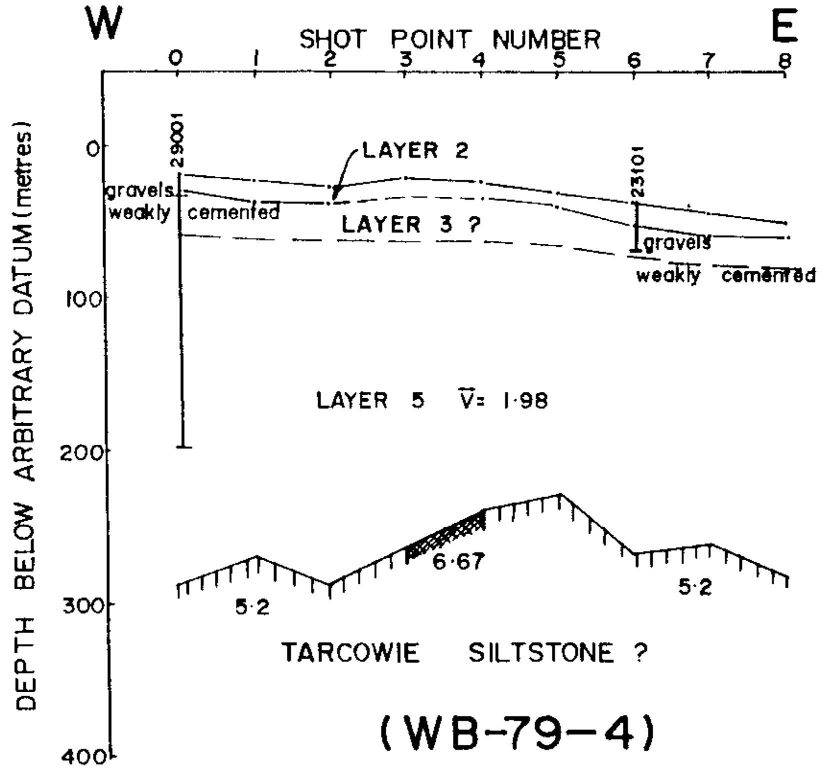
	COMPILED: B.F.	DRN: S.R.	SCALE: 1:50 000	PLAN NUMBER 79-689
DIRECTOR GENERAL		CKD	DATE: DEC 1979	

1814









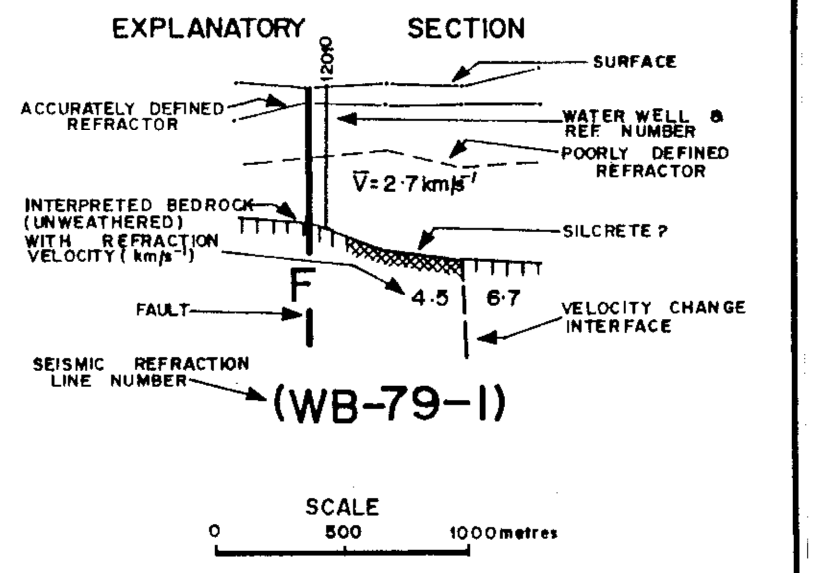


FIG. 3

For location of section lines see plan 79-689.

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED B.F.	C.O.O. DATE
WALLOWAY BASIN	DRAWN S.R.	SCALE AS SHOWN
SEISMIC AND GRAVITY SURVEY	DATE 20-2-80	PLAN NUMBER
INTERPRETED SEISMIC CROSS SECTIONS	CHECKED	79-690

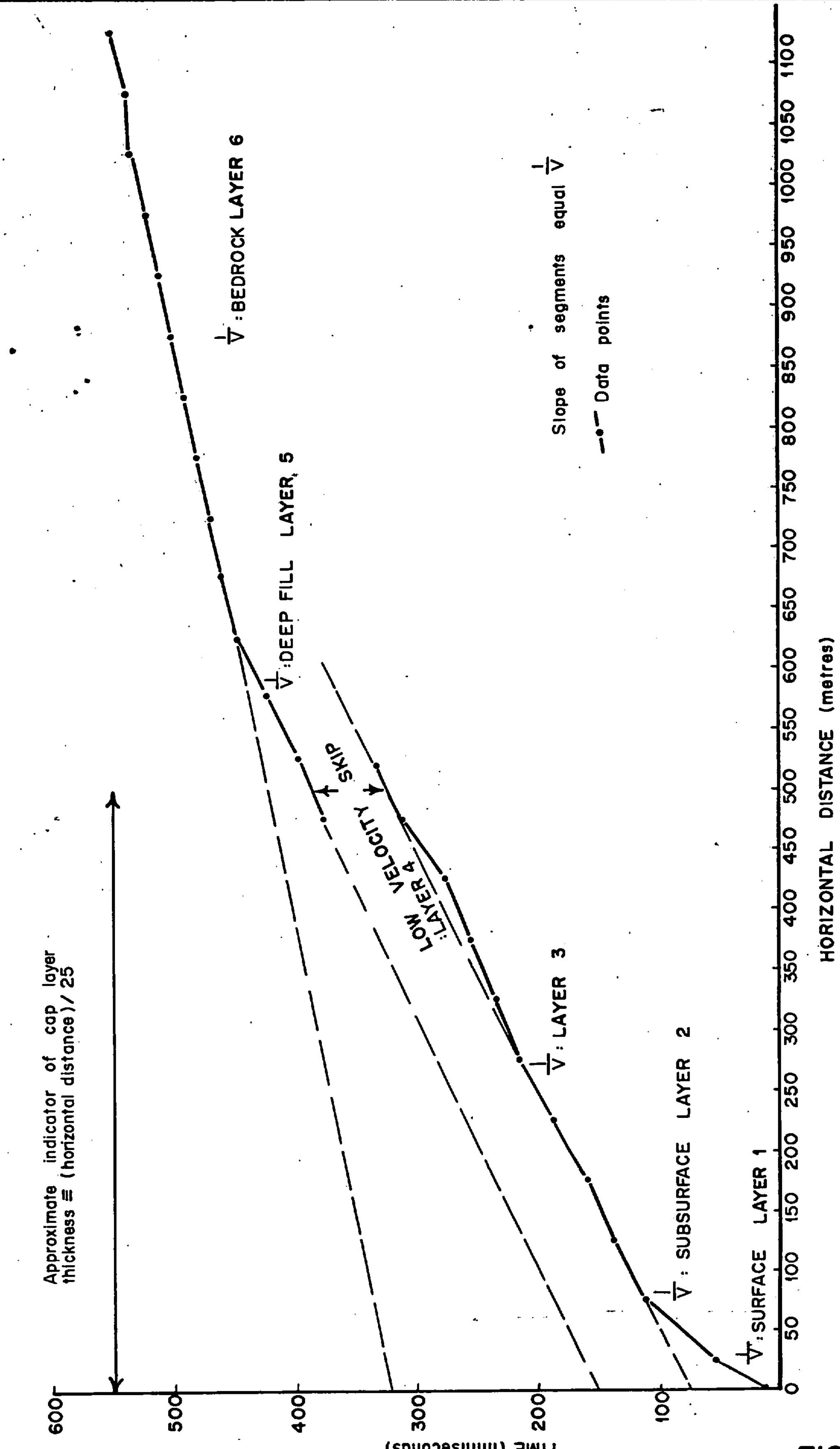


FIG. 4

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

SCALE: AS SHOWN

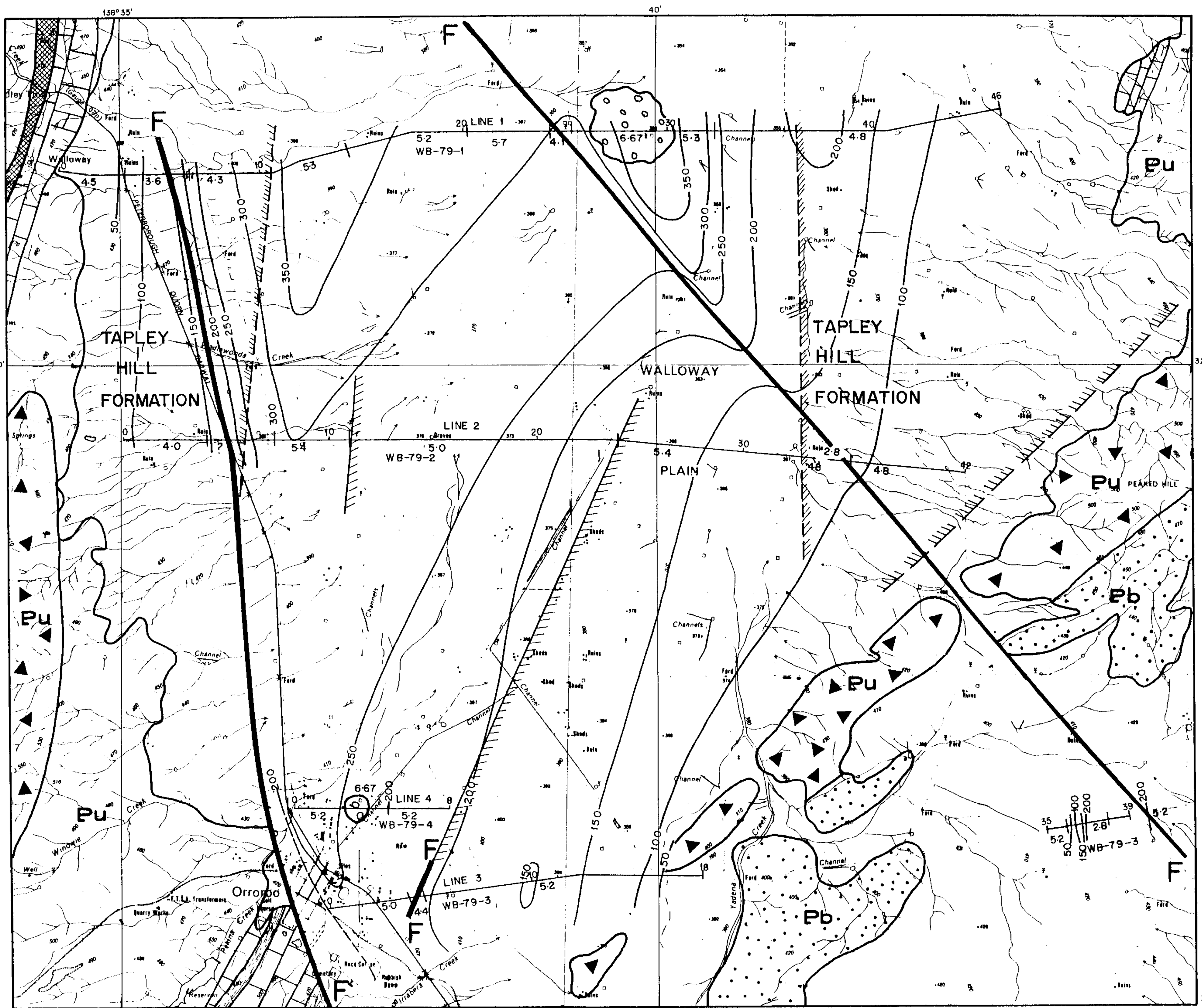
COMPILED: B.F.

WALLOWAY BASIN
SEISMIC AND GRAVITY SURVEY
TYPICAL TIME DISTANCE CURVE

DATE: SEPT. 1979

DRN: S.R. CKD:

PLAN NUMBER
S14397



OUT CROP

UMBERATANA GROUP

TARCOWIE SILTSTONE

Pu TAPLEY HILL FORMATION

Pu TILLITE

Pb BURRA GROUP

DIAPIRIC BRECCIA

SUB CROP

TERTIARY SILCRETE HORIZON

50 CONTOUR showing depth (metres) below surface of HIGH VELOCITY REFRACTOR

FAULT

INTERPRETED ROCK TYPE BOUNDARY

5 WB-79-2 10 / 5·7 SEISMIC REFRACTION LINE with basement velocity in km/s^{-1} SEISMIC POINT NUMBER

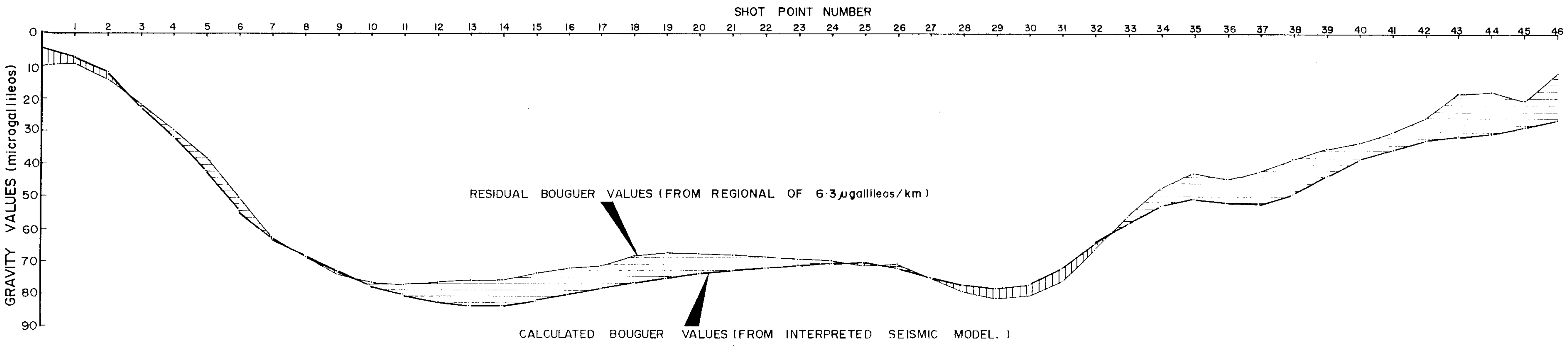
SCALE 1:50 000

METRES 1000 0 1 2 3 4 5 KILOMETRES

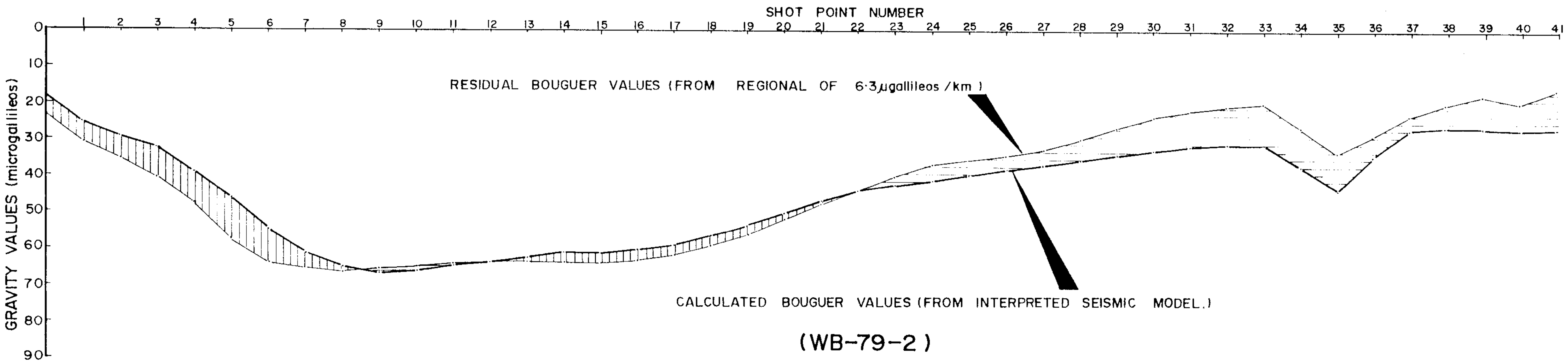
FIG. 5

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE 1: 50 000
COMPILED: B.F.	WALLOWAY BASIN	DATE: SEPT. 1979
DRN: S.R. CKD:	SEISMIC AND GRAVITY SURVEY INTERPRETATION OF BEDROCK INFORMATION	PLAN NUMBER 79-692

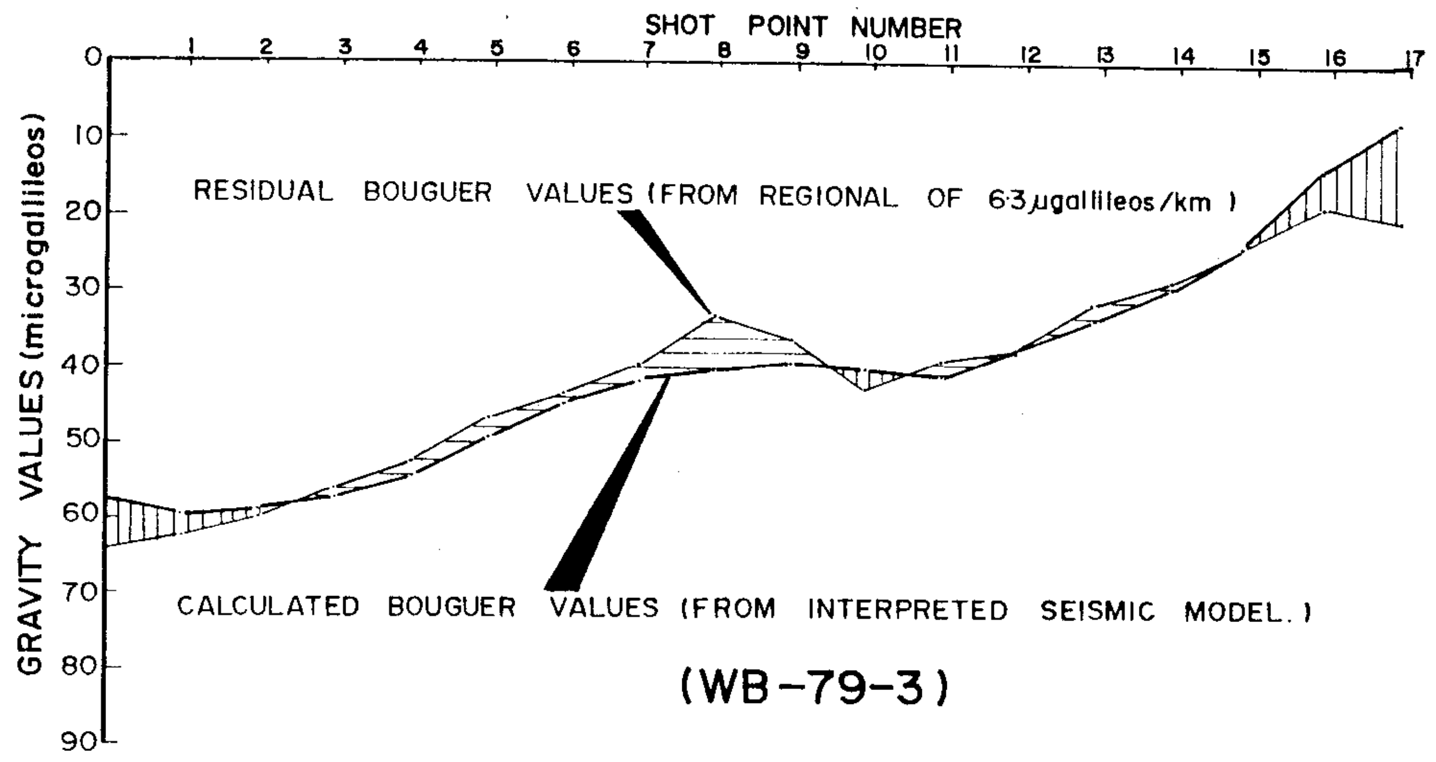
1614



(WB-79-1)



(WB-79-2)



(WB-79-3)

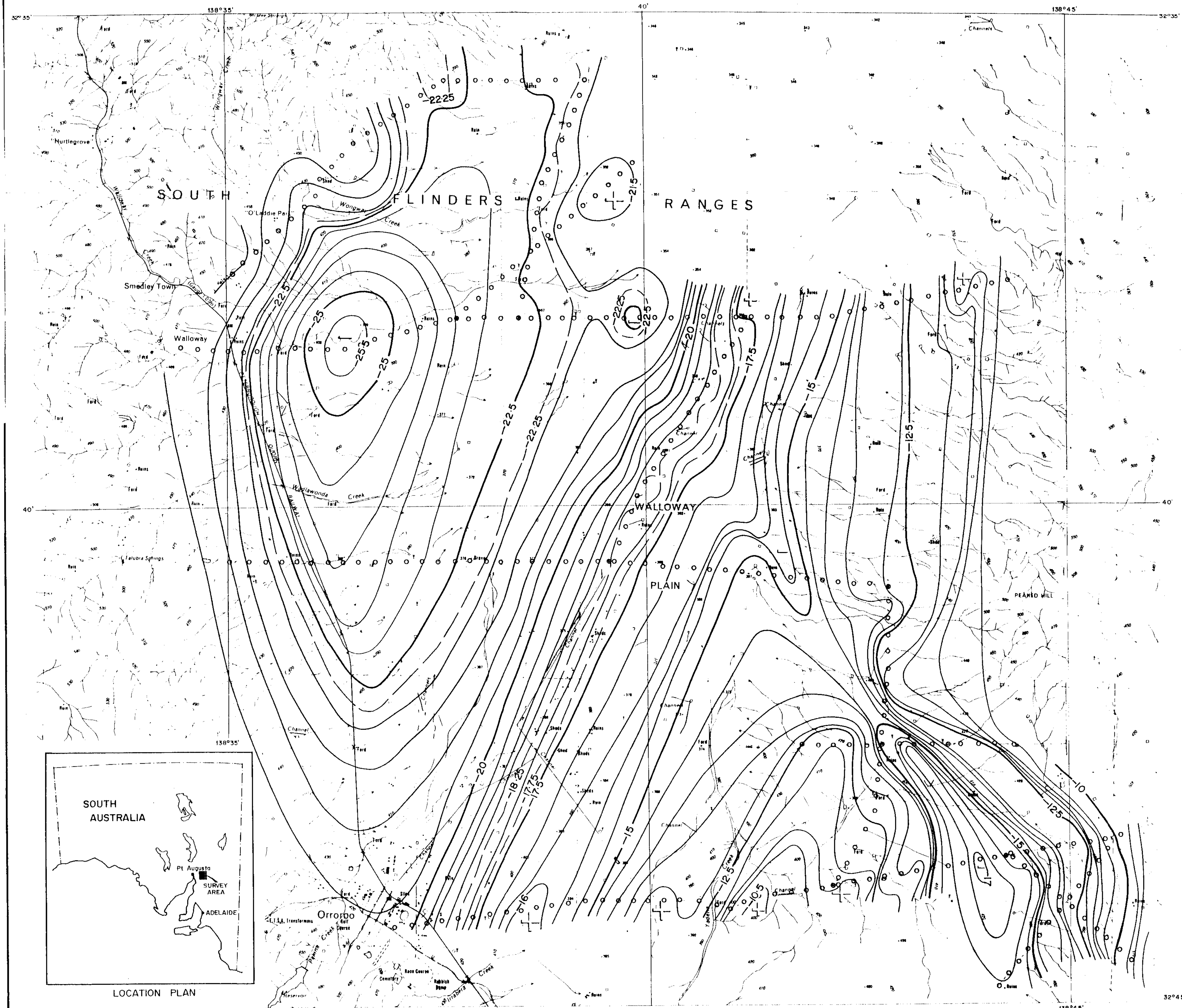
LEGEND

RESIDUAL GRAVITY BETWEEN MODEL VALUES AND REGIONAL–RESIDUAL VALUES.

For location of section lines see plan 79–689

FIG. 6

COMPILED: B.F	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE
DRN: S.R. CKD.	WALLOWAY BASIN	DATE SEPT. 1979
	SEISMIC AND GRAVITY SURVEY COMPARISON BETWEEN THEORETICAL AND OBSERVED GRAVITY IN PROFILE	PLAN NUMBER 79-693



SCALE 1:50 000

METRES 1000 0 1 2 3 4 5 KILOMETRES

FIG. 7

LEGEND

12·5 ....Bouguer gravity contour (interval 0·5 milligals)

22·25 ....0·25 milligal contour.

Density..................2·67

.......Gravity High.

.......Gravity Low.

DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA

WALLOWAY BASIN

SEISMIC AND GRAVITY SURVEY

BOUGUER GRAVITY ANOMALY MAP

	COMPILED B.F.	DRN S.R.	SCALE 1:50 000	PLAN NUMBER
DIRECTOR GENERAL		CKD	DATE MAR. 1980	80-171

184

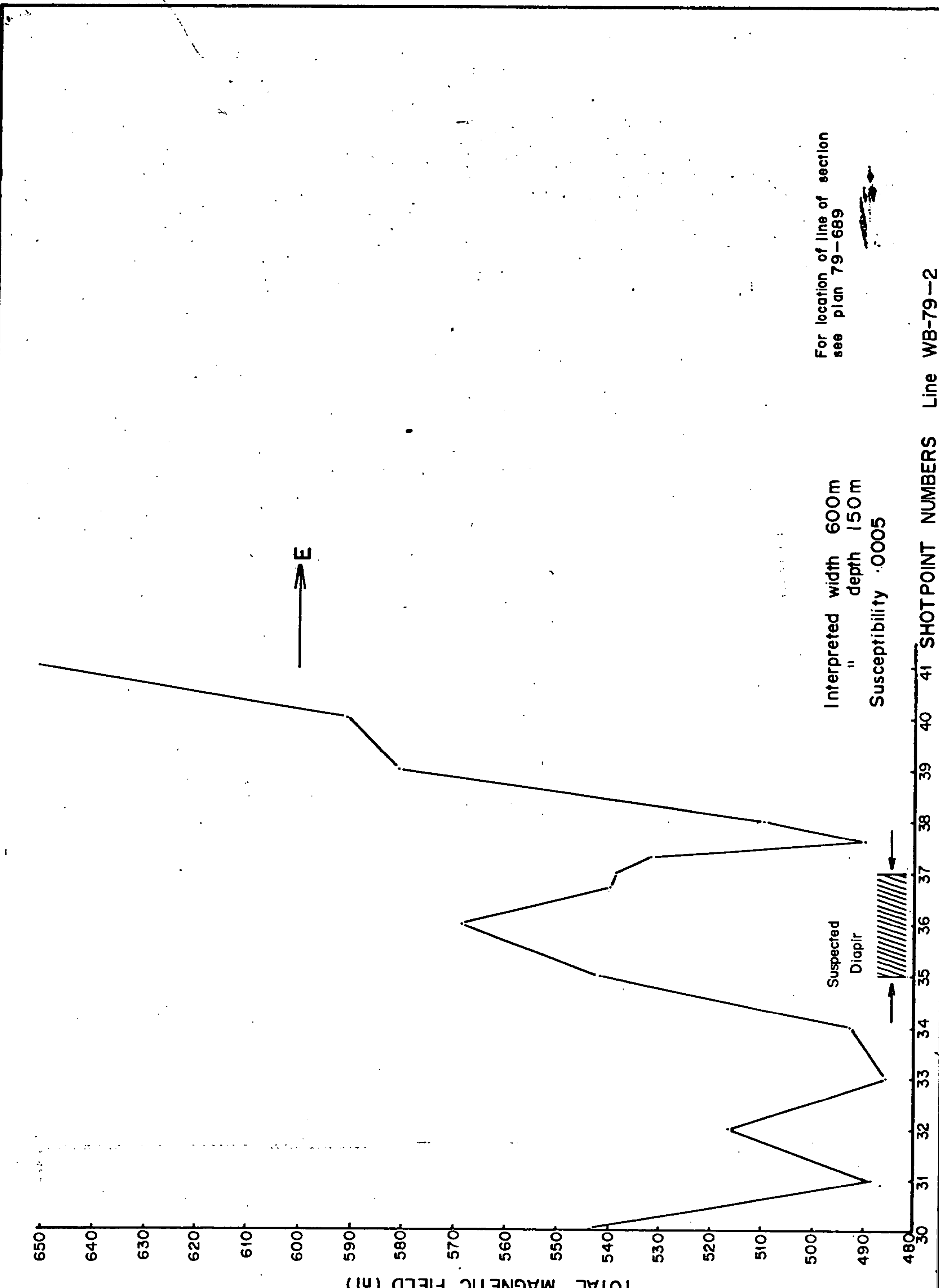


FIG. 8

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE:
COMPILED: B. F.	WALLOWAY BASIN	DATE JAN. 1979
DRN S.R. / CKD:	SEISMIC AND GRAVITY SURVEY TOTAL MAGNETIC FIELD PROFILE OVER SUSPECTED DIAPIR	PLAN NUMBER S14689

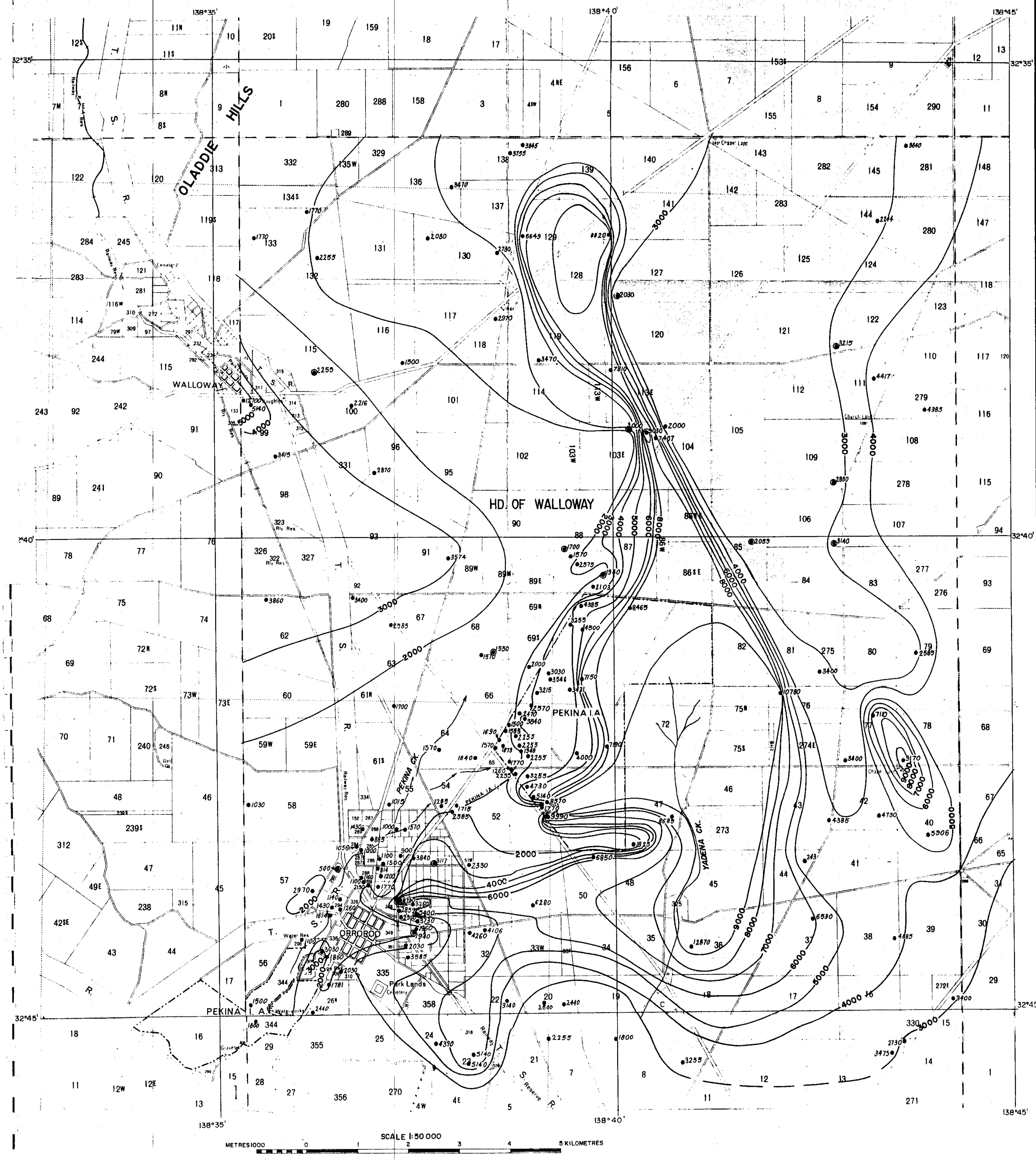


FIG. 9

LEGEND

- •1960 . . . . Water well and salinity value (ppm)
- ◉1700 . . . . Reference well and salinity value (ppm)
- 3000 . . . . Salinity contour (ppm)

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

WALLOWAY BASIN

SEISMIC AND GRAVITY SURVEY

SALINITY CONTOURS AND WELL LOCATIONS

COMPILED	B.F.
DRAWN	S.R.
DATE	MAR. 1980
CHECKED	
C.D.O.	DATE
SCALE	1:50 000
PLAN NUMBER	80-172