S.B.D.

Rept.Bk.No. 74/219

STRATIGRAPHIC DRILLING FOR COAL IN THE COPLEY BASIN - 1974

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Department of Mines
South Australia

DEPARTMENT OF MINES
SOUTH AUSTRALIA

STRATIGRAPHIC DRILLING FOR COAL IN THE COPLEY BASIN, 1974

by

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Rept.Bk.No. 74/219
G.S. No. 5532
D.M. No. 136/73

18th February, 1975

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INTRODUCTION

The Electricity Trust of South Australia (E.T.S.A.) approached the South Australian Department of Mines (S.A.D.M.) for geological advice on several aspects of work in the Leigh Creek Coal Field area. The request, which led ultimately to this report on drilling in the Copley Basin, was for a proposed drilling programme to assess the coal potential and geometry of the Copley Basin.

M.N. Hiern (1973) submitted a tentative proposal of 10 drill holes amounting to approximately 1 660 metres, which formed the basis for initial cost estimates.

E.T.S.A. accepted the proposal in principal and requested the S.A.D.M. to supervise the project. The writer reviewed all available data on the Copley Basin and formulated the final drilling programme (Townsend, 1974).

DRILLING PROPOSAL

In all 10 holes were proposed to be in numerical order. They were positioned so that the first few wells would provide east-west and north-south sections early in the project. Subsequent holes could then be located in optimum positions to provide further information.

The order of drilling could not be adhered to because of rig availability problems which forced the marginal wells

to be drilled before the deepest proposed well CB1.

The programme allowed for 1 660 metres of drilling based on the initial proposal of M.N. Hiern (1973). Proposals were assisted greatly by the 16 drill holes (Parkin, 1953) positioned in the eastern third of the basin drilled in 1951.

GEOLOGICAL SETTING

General Geology

The Copley Basin is a depression in the Adelaidean System rocks filled with Triassic sediments. The surrounding sediments (bedrock) range from Sturtian tillite through Tapley Hill and Balcanoona formations up to the Marinoan Angepena and Amberoona formations (Coats 1973). Bedrock is apparently dominated in the subsurface by the Amberoona Formation, a pale green laminated siltstone.

The Triassic sediments consist of a lower sequence of grey carbonaceous shale with basal grit, a middle sequence of sand, sandy shale and coal, and an upper sequence of shale and minor sand.

The Triassic sediments are unconformably overlain by the Late Jurassic Algebuckina sandstone or more recent Quaternary deposits.

Depositional Environment

The environment deposition for the Triassic sediments resulted, according to Parkin (1953), from the downwarping of a near peneplain surface comprising Cambrian and older Adelaidean sediments. Triassic sedimentation was then initiated forming a centre of sluggish drainage and deposition. The gentle subsidence never exceeded the rate of deposition.

Depositional Basin Geometry

The Triassic sediments must certainly have covered a larger area than the present remnants show but probably did not extend much further north than the northern basin and no further south than the southern or Copley Basin. The intervening area however was probably covered during part of the depositional cycle. Springfield and Boolcunda basins in the southern Flinders Ranges would have been quite separate from the Leigh Creek depositional basin.

RESULTS OF DRILLING

Coal Seams

Ten holes were drilled in the Copley Basin during 1974 with a cumulative total of 1 364 metres. The individual statistics are listed in Table 1 and locations are given in Figure 1.

Six of these drill holes penetrated coal seams in excess of 50 cm thick but the other four contained none greater than 30 cm. This programme, along with 16 drill holes completed in 1951 (Parkin 1953) outlines an area where three coal seams occur in the subsurface. The lowest, seam 1, averages 3-4 metres and appears to be split in the central area and southeastern half of the basin. Between 15 and 20 metres stratigraphically above the top of seam 1 is coal seam 2, which is a little more than 1 metre in thickness. It contains a thin shale parting in the northern half of the basin. A third seam, seam 3 approximately 60 cm thick, occurs about 8-12 metres above seam 2 (see correlations, Figures 3, 4 and 5).

Other coal seams were intersected but were not as consistent nor as thick as the three seams described above.

Three cross sections have been drawn through the basin (Fig. 1) using the two main coal seams and the Triassic-bedrock contact to show the geometry of the Copley Basin. Figure 1 also contains the structural contours showing depths to the main seam (seam 1) which is about 150 m at its deepest point.

Stratigraphy

(a) Lithology

The lithology of hole CB1 is included to show the complete sequence of sediments intersected in the deepest hole drilled and it can be seen from this log (Fig. 2) the general sequence consists of surface sandy soil and clays followed by approximately 70 metres of predominantly shale, with minor sand horizons. The coal bearing sequence is more sandy than lobes B, C and D, particularly in the northern and western parts where caving sand terminated drilling on three occasions. This carbonaceous and sandy sequence is approximately 40 metres thick in CB1.

The lower section consists of approximately 135 metres of grey carbonaceous shale resting on pale green laminated shale (bedrock) of the Amberoona Formation.

The type of bedrock and the main coal seams intersected in all holes are listed in Table 1.

In Figure 3, the comparison between CB5 and CB8 shows clearly that the main seam in CB5 had not been reached when loose sand caused drilling problems and the hole had to be abandoned.

(b) Correlations

The correlation chart over the coal bearing interval drilled during this programme shows the consistent nature of the coal seams over much of the basin area. Only seam 2 is reduced to a carbonaceous sandy shale and coal shale interval

in the northernmost part of the basin in CB6 (Fig. 4). The drilling carried out in 1951 showed that seams 2 and 3 were less consistent than seam 1 in the eastern area (Figs. 5 and 6).

Neither seam 2 nor seam 3 could be expected in CB7 as seam 1 is too close to the erosional Triassic surface (7 m).

Cross sections of the earlier 1951 wells are presented in Figures 5 and 6, and a correlation of the non-coal intersecting drill holes of 1974 are shown in figure 7 in order to complete the record of available drilling data.

An old railway bore (Bore 5) drilled in 1918 near the dams at Copley cannot be located accurately and records do not give a complete log, only a statement that no coal greater than "one inch" in thickness was intersected in the Triassic sediments. The bore was drilled to "781 feet" and bedrock was intersected at "677 feet".

This information along with no coal of note in C61 (Fig. 6) has forced the interpretation of subcrop shown in Figure 1. This does not discount the northeastern sector entirely as a washout or minor faulting could remove the coal in these two bores.

CONCLUSIONS

1. It is clear from this programme that both the area and thickness of the coal seams are larger than first anticipated.
2. The basin is well outlined except in the north-east quadrant.
3. The "indicated" reserves are as follows:

The area of subcrop was measured using a planimeter and was found to be 2.4 square kilometres.

As all previous tonnages have been derived by

assuming 1 ton = 1 cubic yard all metric measurements have been converted to imperial units to arrive at a volume in million (MM) cubic yards.

2.4 square km = $2.4 \times (3.281)^2 \times 10^6$

= 25.84×10^6 (square feet)

Coal Volume = $\frac{25.84 \times 10^6 \times 15}{27}$ (estimated average of seams 1 and 2)

= 14.35 MM cu. yards

Assuming 1 ton per cubic yard the "indicated" tonnage for seams 1 and 2 for Copley Basin is 14 MM tons. (Approximately 14 MM tonnes).

RECOMMENDATIONS

Additional Drilling

The basin structure is now well outlined except in the northeast quadrant which in the first instance was assumed to be barren of the two thicker seams intersected in previous drilling (C61 and the old Bore 5). Results from holes CB6 and CB7 have extended the area of coal subcrop to the north and thrown some doubt on the northeast area. It is therefore recommended that 3 more holes, be drilled in the northeast area. Two locations are shown in Figure 1. The third will depend on the results from the first two holes. The reasons for drilling three more holes are listed below.

1. To outline the northeastern subcrop of seam 1.
2. To outline the Triassic-bedrock margin which is covered by younger sediments.
3. To test the lower band of seam 1 for coal quality. Two of the drill holes should be drilled to bedrock.

18th February, 1975
IJT:ST

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Taylor, H.G. 1954. The petrology of Leigh Creek Coal in relation to its utilization - Progress Report No. 3. Min.Rev. Adelaide 97:110-116.

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TABLE 1

HOLE	TOTAL DEPTH (m)	DEPTH TO SEAM FROM SURFACE (m) SEAM 1 (Thickness)	SEAM 2	SEAM 3	THICK-NESS SEAMS (1+2)	DEPTH TO TRIASSIC (m) SEDIMENTS FROM SURFACE	DEPTH TO BEDROCK (m)	COLOUR AND BEDROCK FORMATION	OVERBURDEN RATIO AT WELL LOCATION	R.L.	REMARKS
*CB 1	283	109.99 (2.97+ .83)	88.90 (1.30)	87.50 (.50)	5.2	7 m	262	Pale green AMBEROONA	22	265.40	To test full sequence of Basin & reach Bedrock.
CB 2	156.18	-	-	-	-	17.87	153.68	Pale Pink	-	274.90	To test marginal areas and depth to bedrock.
CB 3	134.38	-	-	-	-	12.00	126.00	Pale green AMBEROONA	-	272.08	
*CB 4	73.76	56.37 (3.49)	39.80 (1.11)	32.2 ?(1.05)	4.6	8.2	-	-	13	265.59	To locate the coal seams, southern extensions.
*CB 5	151.50	Not reached assumed 156 (4)	137.0 (1.43)	114.47 (.62)		6.5	-	-	"27" Estimated from correlation chart.	265.97	Holes terminated because of difficulty caused by caving sands.
*CB 6	108.48	73.27 (2.87)		58.84 (.41)	2.87	8.5	-	-		265.93	Holes CB5 & CB7 did not reach their objectives.
*CB 7	134	25.2 (5.15)	-	-	5.15	16.0	Uncertain whether bedrock reached		5.9	265.01	
*CB 8	102.2	94.7 (4.18)	71.24 (1.76)	58.3 (.54)	5.94	12.5	-	-	17	267.76	To locate the coal seams, western extension
CB 9	3976	-	-		-	19.5		Pale grey TAPLEY HILL	-	277.29	To test northwest margin and reach bedrock
CB 10	80	-	-		-	-		Pale grey AMBEROONA	-	265.5	To test eastern margin & reach bedrock
TOTAL	1363.25 m										

*COAL INTERSECTED

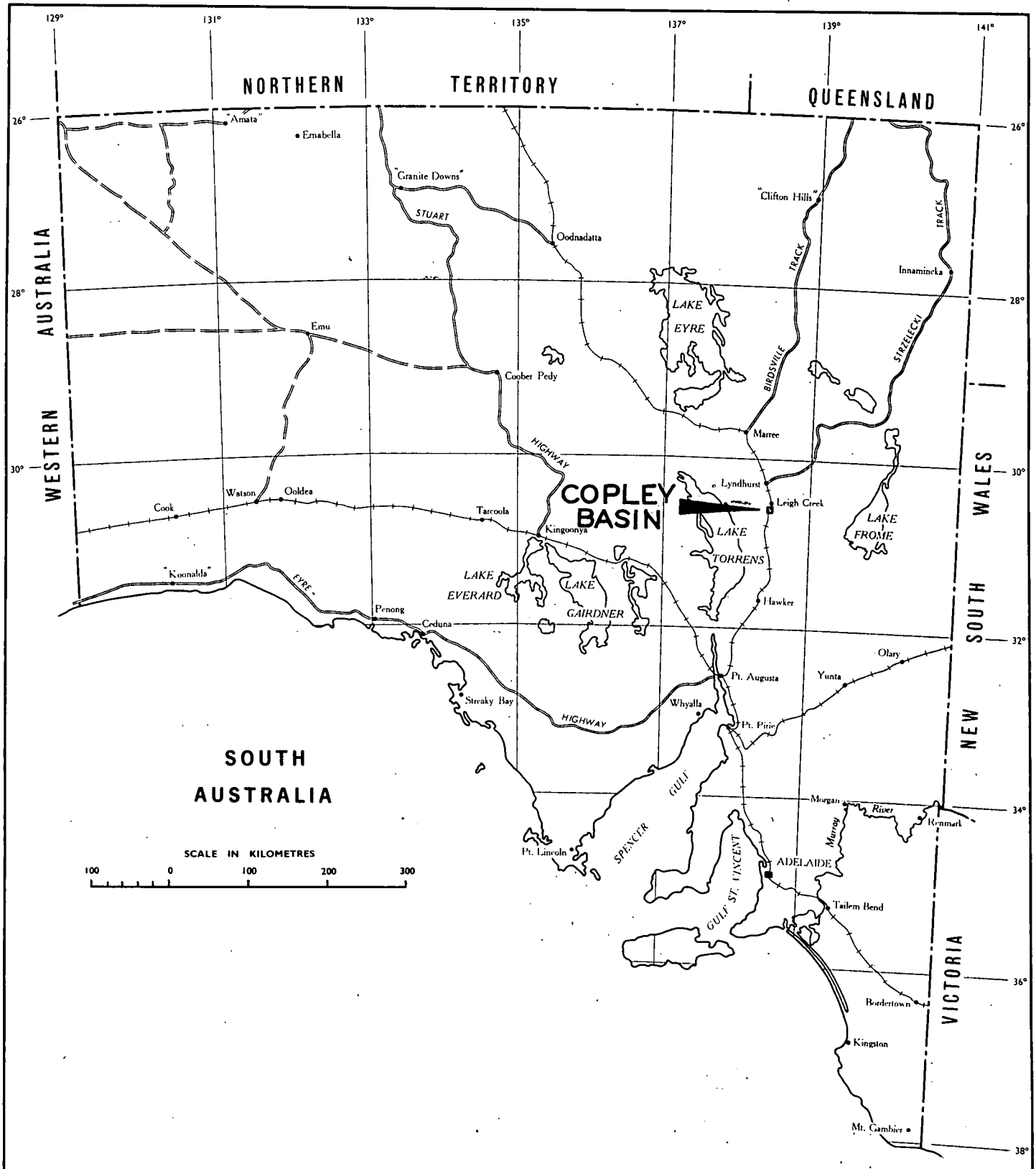
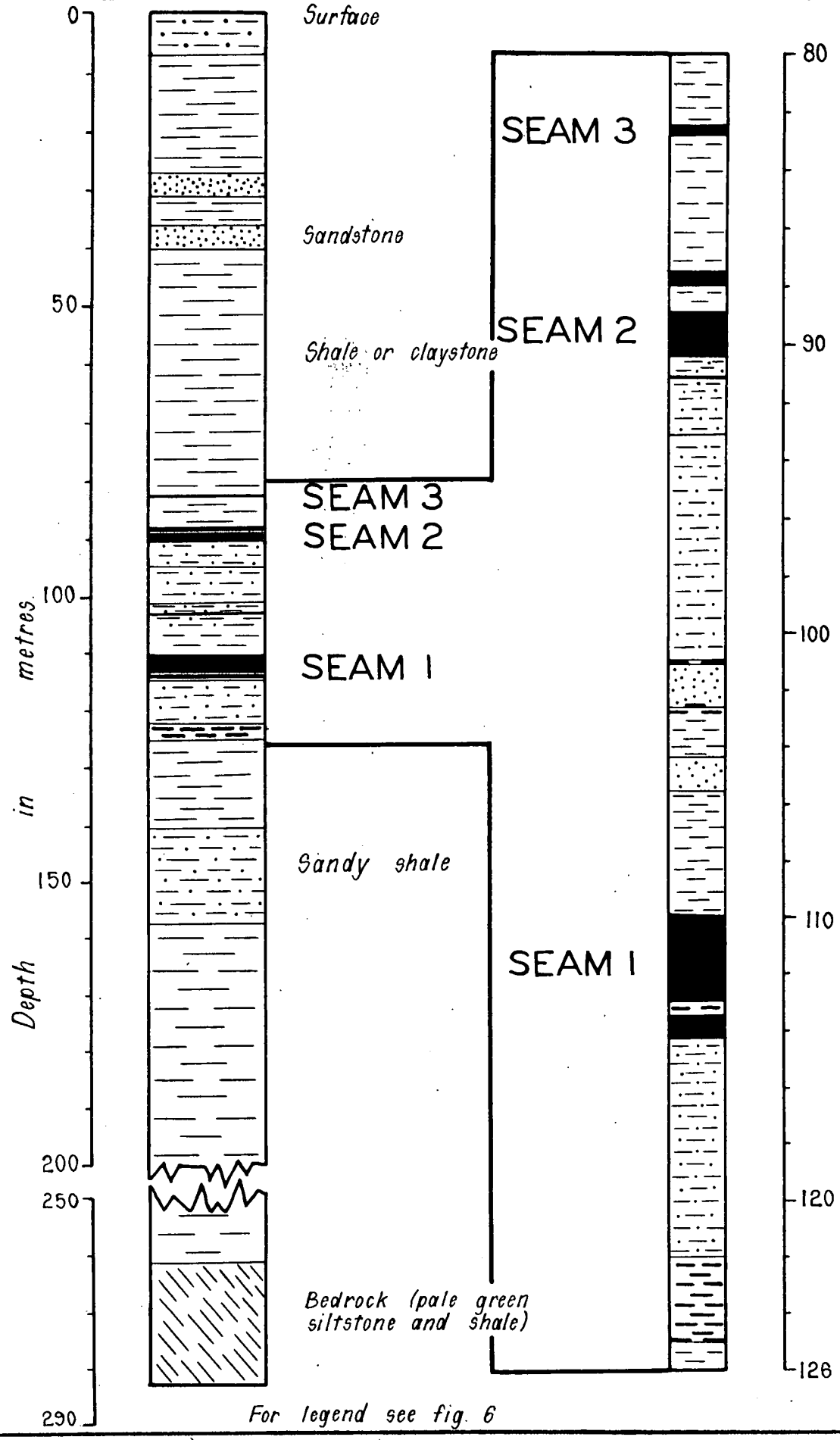


FIG.1A

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Compiled. I.J. TOWNSEND	COPLEY BASIN LOCALITY PLAN	Date: 19 NOV. 1974
Drn. B.D.W. Ckd.		Drg. No. S11127 Cc

P.F. No. S5850 994.2



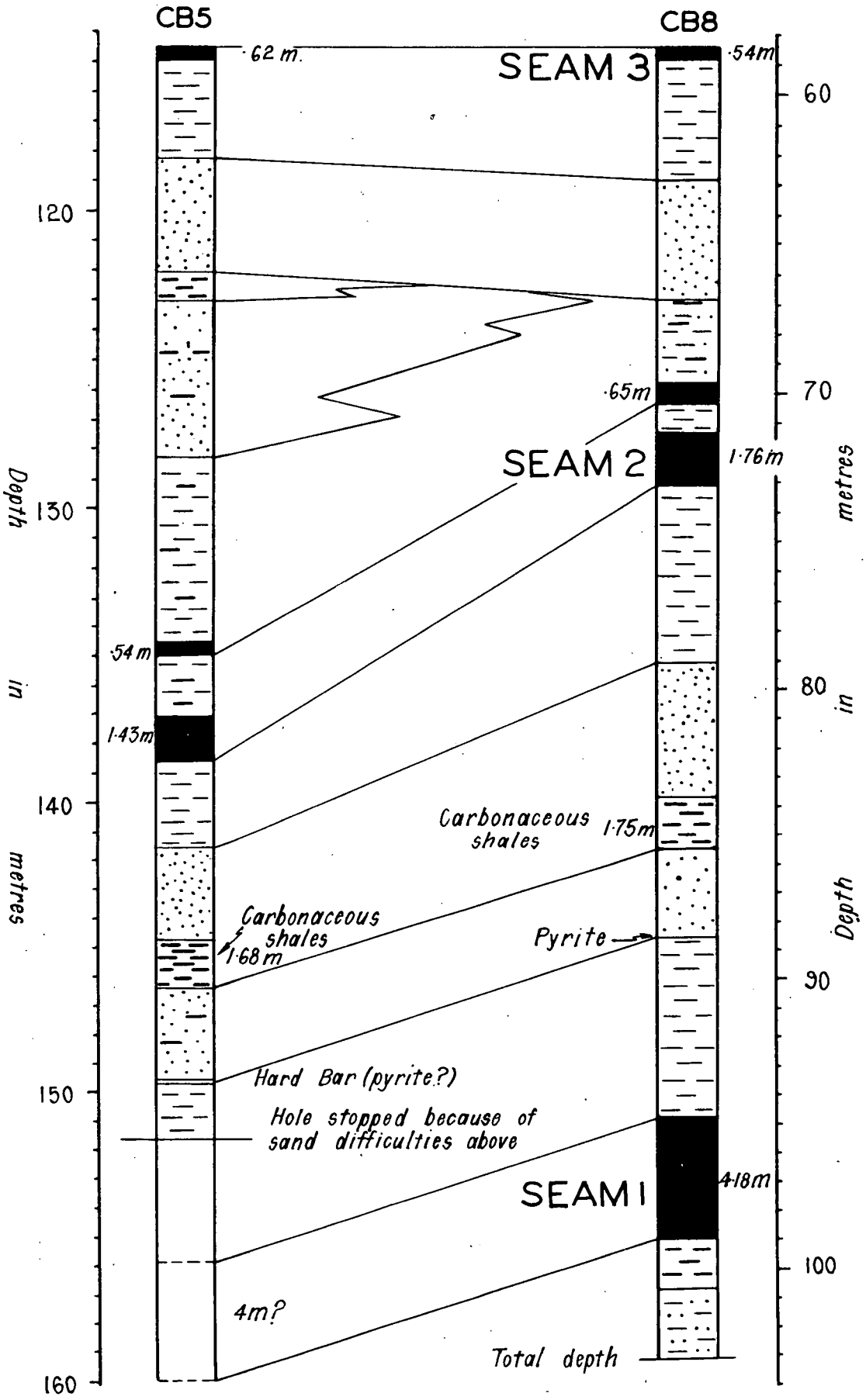
For legend see fig. 6

FIG. 2

DEPARTMENT OF MINES — SOUTH AUSTRALIA

PETROLEUM SECTION	Drn. I.J.T.	COPLEY BASIN LOG OF DRILLHOLE NO. CBI.	SCALE: 1 : 200 Vert.
I. J. TOWNSEND GEOLOGIST	Tcd. B.W.		S 11129 Co
	Ckd.		DATE: 19 NOV. 1974
	Exd.		

500—2.69 665

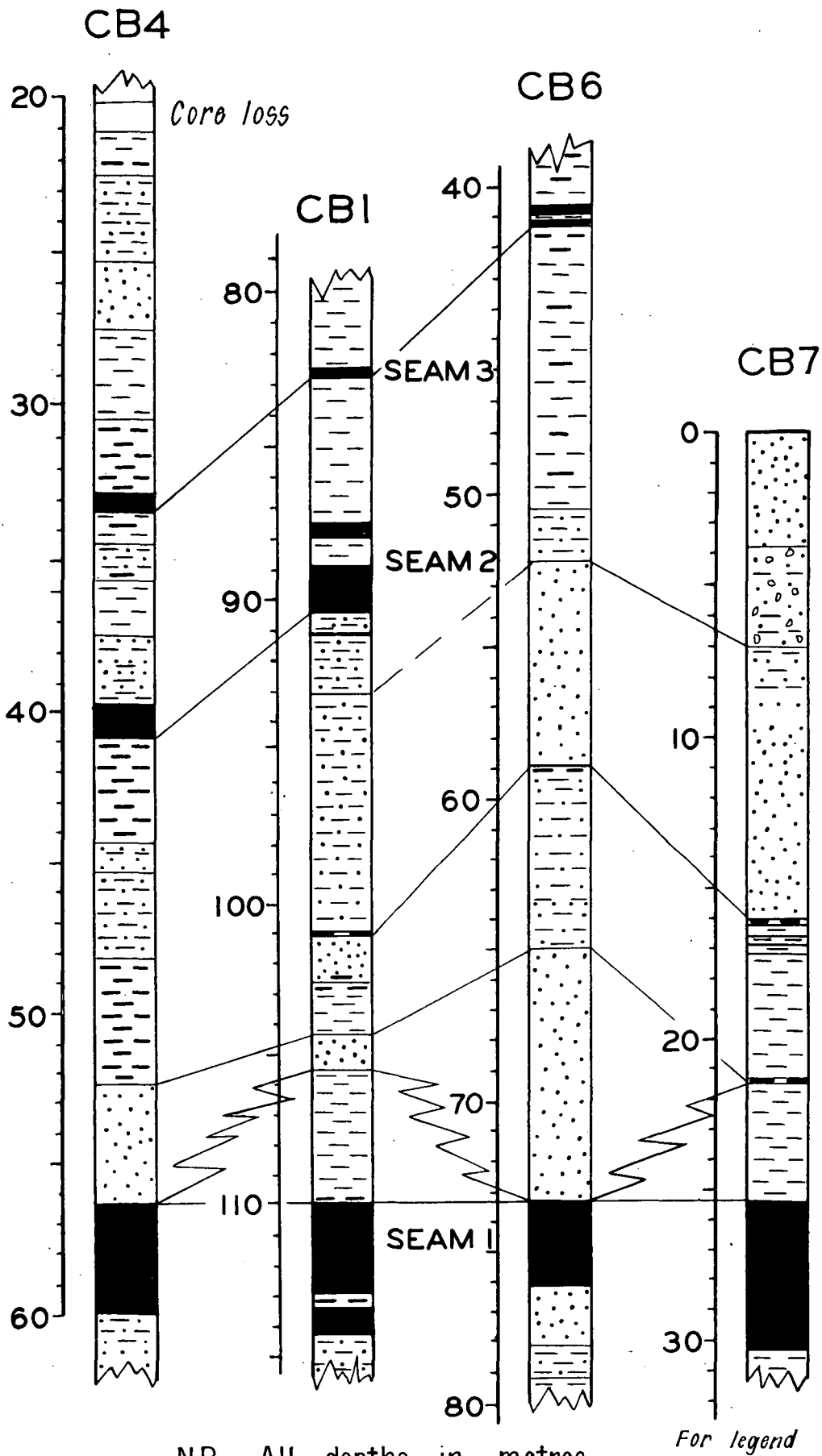


For legend see fig. 6

FIG.3

DEPARTMENT OF MINES — SOUTH AUSTRALIA

PETROLEUM SECTION	Drn.	COPLEY BASIN CB8 AND CB5 DRILLHOLE CORRELATION COAL INTERVALS ONLY	SCALE: 1 : 200 Vert.
	Tcd.		S 11128 Cc
I. J. TOWNSEND GEOLOGIST	Ckd.		DATE: 19 NOV. 1974
	Exd.		



N.B. All depths in metres

For legend see fig. 6

FIG.4

DEPARTMENT OF MINES — SOUTH AUSTRALIA

PETROLEUM SECTION	Drn.	COPLEY BASIN CB4,CB1,CB6,CB7 DRILLHOLE CORRELATION COAL INTERVALS ONLY	SCALE: 1 : 200 Vert.
	Tcd.		S11135
I.J.TOWNSEND GEOLOGIST	Ckd.		Cc
	Exd.		DATE: 27 NOV. 1974

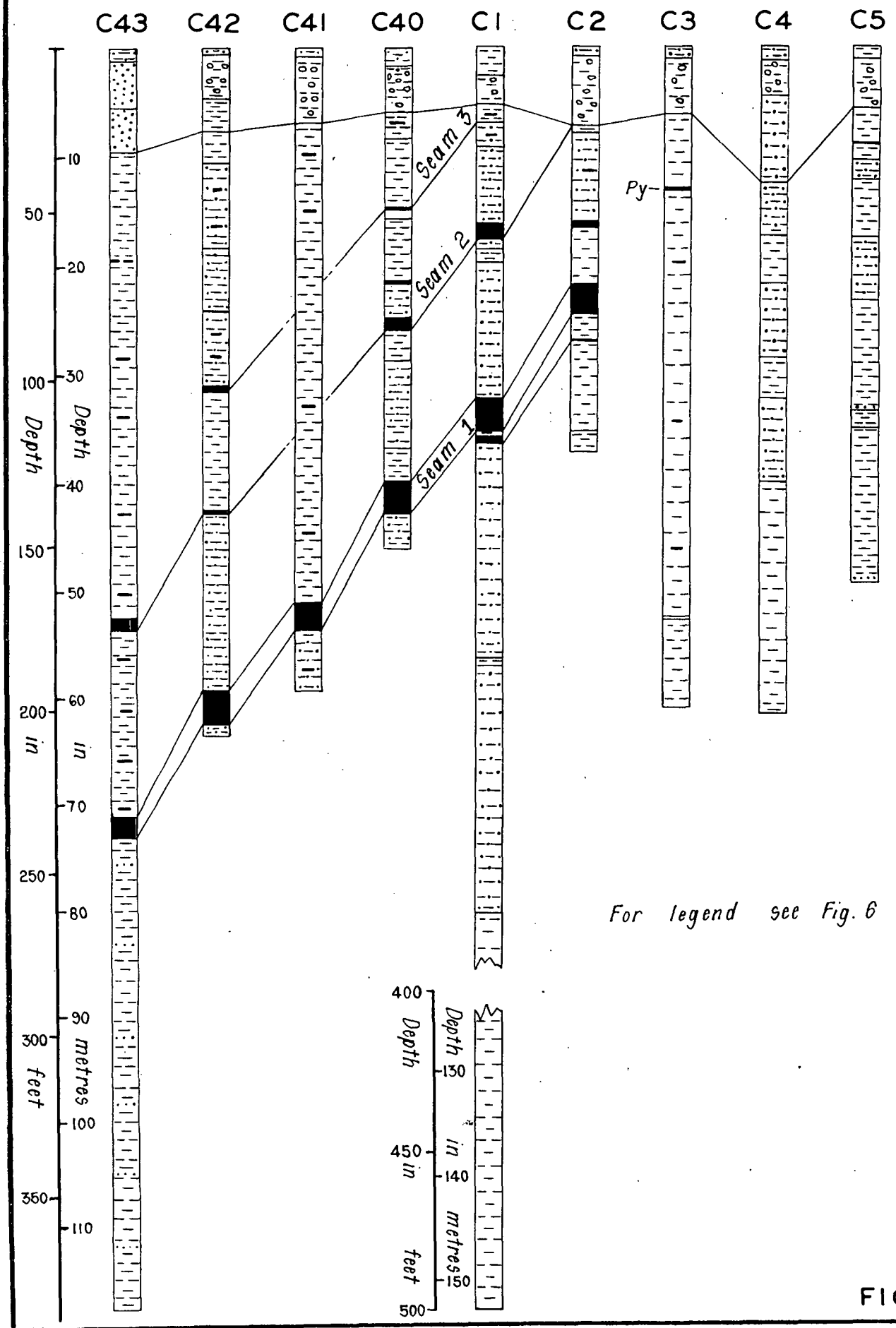


FIG. 5.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

PETROLEUM SECTION	Drn.	COPLEY BASIN 1951 DRILLHOLES	SCALE: 1 : 500 Vert.
	Tcd.		S 11130 a Co
I.J TOWNSEND GEOLOGIST	Ckd.		DATE: 27 NOV. 1974
	Exd.		

500—2.69 665

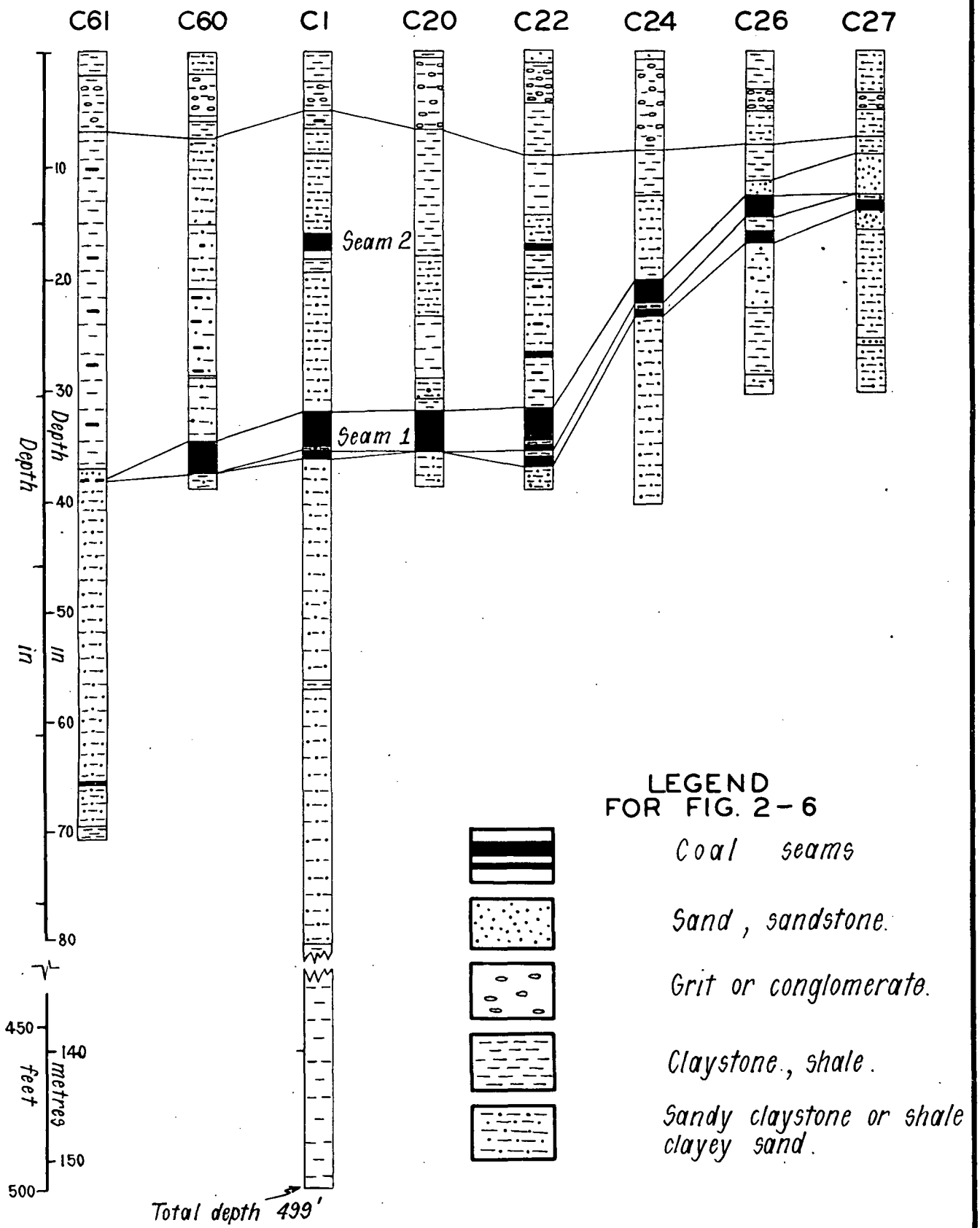
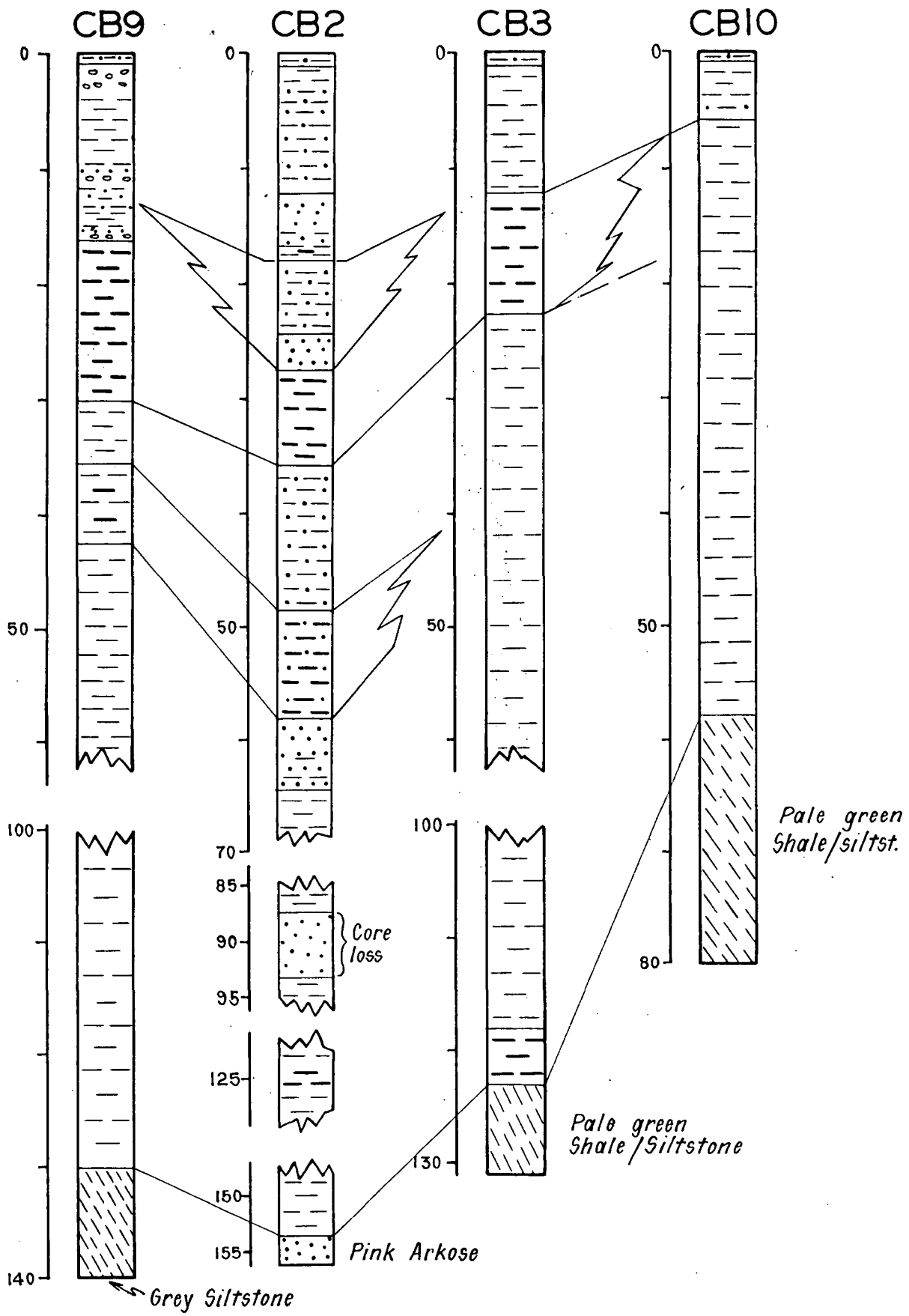


FIG. 6

DEPARTMENT OF MINES — SOUTH AUSTRALIA

PETROLEUM SECTION	Drn. I.J.T.	COPLEY BASIN 1951 DRILLHOLES	SCALE: 1:500 Vert.
I. J. TOWNSEND GEOLOGIST	Tcd. B.W.		S11130b Co
	Ckd.		DATE: 26 NOV. 1974
	Exd.		

500—2.69 665



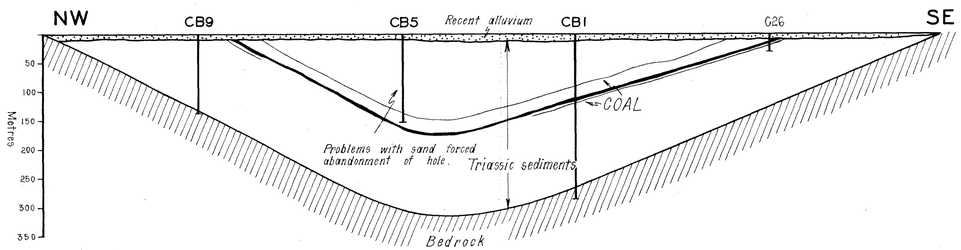
NB. All depths in metres.
For legend see fig 6.

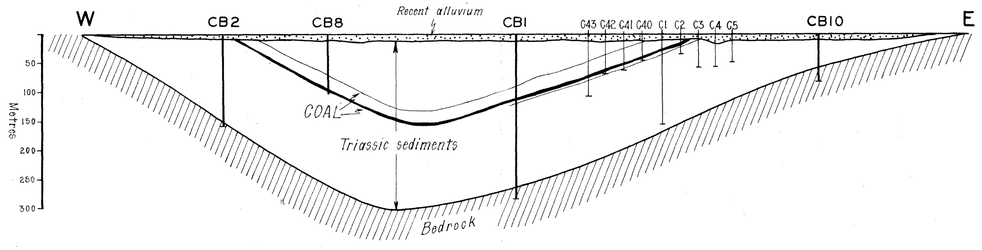
FIG. 7

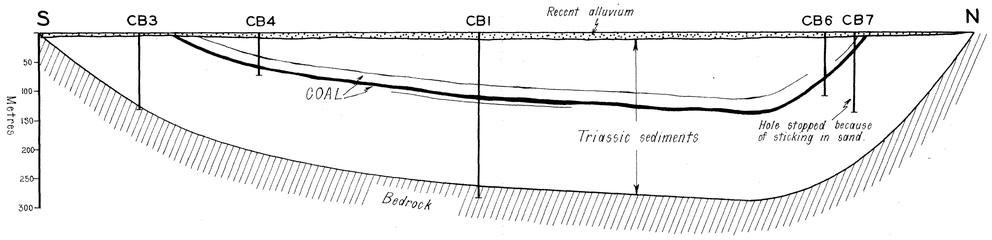
DEPARTMENT OF MINES — SOUTH AUSTRALIA

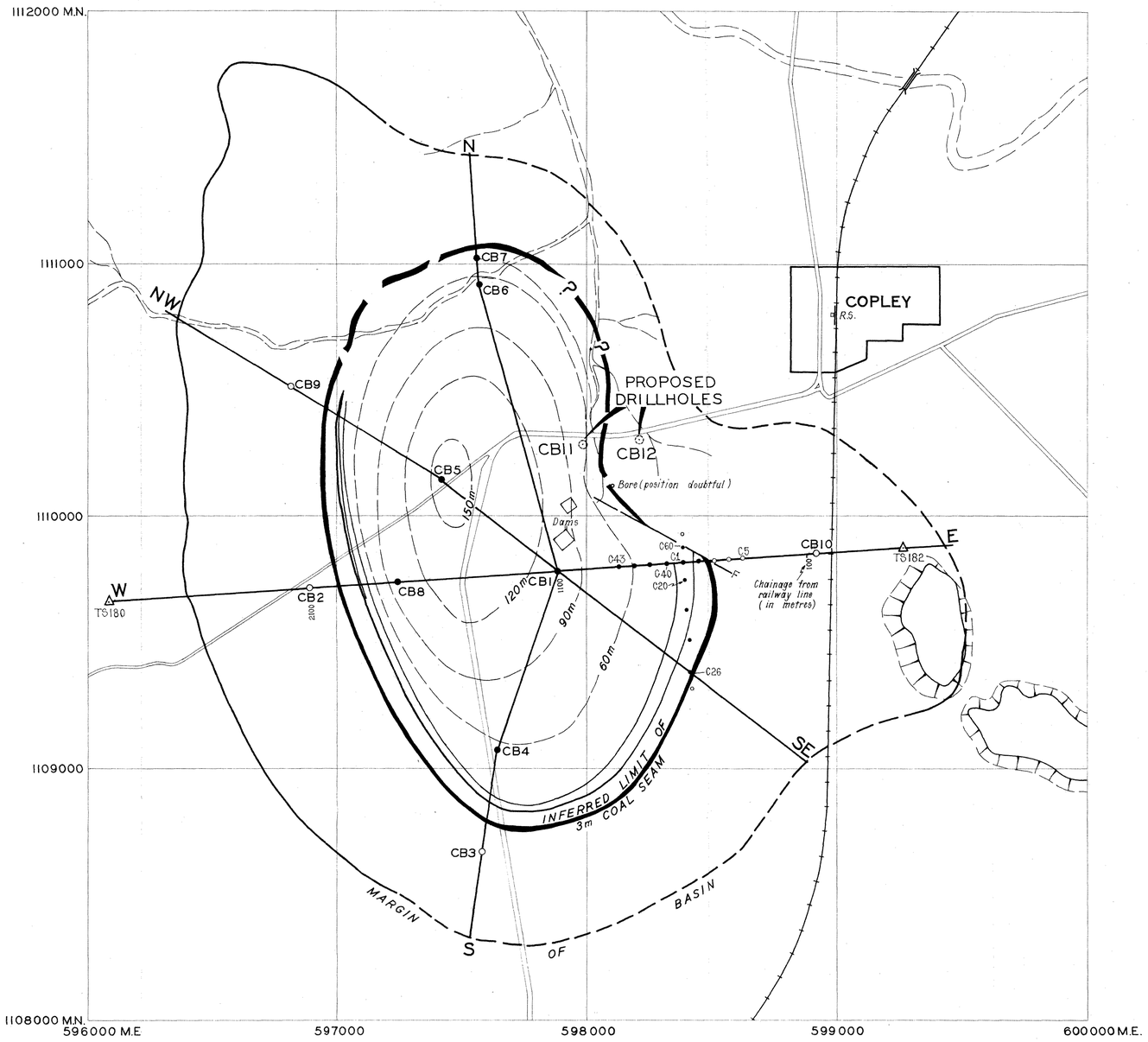
PETROLEUM SECTION	Drn. I.J.T.	COPLEY BASIN CORRELATION OF 1974 MARGINAL DRILLHOLES - NO COAL	SCALE: 1 : 500 Vert.
	Tcd. B.W.		S11139 Cc
I.J. TOWNSEND GEOLOGIST.	Ckd.		DATE: 29 NOV 1974
	Exd.		

500—2.59 665









SCALE
0 500 1000 metres

Modified after E.T.S.A. plan no. LC3524

LEGEND

- ● CB1 1974 Drillhole (COAL)
- ○ CB9 1974 Drillhole (NO COAL)
- • C1 1951 Drillhole (COAL)
- ○ C5 1951 Drillhole (NO COAL)
- Drainage channels
- 90m Contour (30 metre interval)

FIG. 1

DEPARTMENT OF MINES — SOUTH AUSTRALIA

COPLEY BASIN

BORE LOCATIONS AND CROSS SECTIONS

PETROLEUM SECTION	I. J. TOWNSEND GEOLOGIST	Compiled I. J. T.	Scale: 1 : 10 000
			Date: 18 NOV. 1974
Director of Mines		Drn. B.D.W.	Drg. No. 74-978
		Ckd.	Cc