DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

THE CORRELATION AND DEPOSITIONAL HISTORY OF THE LEIGH CREEK COAL MEASURES

By

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Rept.Bk.No. 78/140
G.S. No. 6101
D.M. No. 135/75

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THE CORRELATION AND DEPOSITIONAL HISTORY OF THE LEIGH CREEK COAL MEASURES

INTRODUCTION

Attempts have been made previously to correlate coal seams and interpret depositional environments and tectonics relative to the four Triassic coal deposits at Leigh Creek (Parkin 1953; Taylor 1954; Johns 1970, 1975; Johns and Townsend 1975). This note proposes a simple model incorporating two distinct periods of deposition to explain structural elements, coal composition and the distribution of coal measures in the four lobes denoted A (Copley), B (Telford) C and D (Northfield) (see Fig. 1).

CORRELATION OF COAL SEAMS

Initial correlations are made by coal quality using proximate analyses, and Table 1 shows that three groups of coals can be identified corresponding to the Lower Series (Group I), Main Seam (Group II) and Upper Series (Group III) of Telford Basin (Lobe B). The Main Seam appears more closely allied to the Lower Series than to the Upper Series coals (Table 1, Fig. 2), and coal quality overall improves upwards.

Other features of the coal measures, such as fossil content, maceral types and structural elements, support the grouping suggested in Table 1 and are elaborated below. Variations in sulphur content within and between seams do not relate systematically to the proposed correlations.

Using maceral analyses Taylor (1954) stated that Lobe D coals had no correlative, whereas this proposal incorporates Lobe D coals in the later period of deposition (Group III coals).

GROUPS I AND II coals

- Coals of Lobe C correlate well by proximate analyses with the Lower Series of Lobe B; the Main Seam of Lobe B is similar, but of slightly better quality.
- Maceral analyses (Taylor, 1954) show good correlations between Lobe C coals and the Lower Series of Lobe B, and suggest no correlative for the Main Seam coal.
- The shales above Lobe C and the Lower Series of Lobe B both contain abundant freshwater mussels (Unio eyrensis) which elsewhere are rare.
- Groups I and II coals show a marked structural asymmetry in present subcrop.
- Minor faulting occurs in Lobe C and is common in Lobe B displacing the Main Seam and the Lower Series.

GROUP III coals

- Coals of Lobe A, the Upper Series of Lobe B and Lobe D all exhibit similar proximate analyses, and are the best quality coals in the coal measures.
- Lobe A and Upper Series Lobe B coals have similar maceral contents (Taylor 1954) and are associated with sandy sequences.
- Shales overlying Lobe D coal and Upper Series Lobe B coal are palynologically similar (Playford & Dettmann, 1965).

THE DEPOSITIONAL MODEL

The Leigh Creek Coal Measures probably accumulated within a shallow intramontane basin related to Late Triassic faulting of Adelaidean rocks. It is assumed that the coal measures are swamp deposits associated with a river system. All sediments are non marine, as indicated by the occurrence of the fresh water mussel

Unio eyrensis. Overbank flooding, resulting in shale and sand deposition, episodically invaded this quiet swampy environment possibly during times of greater differential subsidence that produced higher river gradients.

Coal analyses and structural elements of the four remnant deposits are interpreted here as evidence of two main depositional phases (Table 1; Fig. 3):

Depositional phase I (Lower Series and Main Seam coals)

During the first phase of deposition Lobe C and Lower Series Lobe B coals were deposited; deposition continued with a slight shift of depocentre to the southwest when the Main Seam Lobe B coal and bounding shales were laid down (Figs. 3 and 4). A subsequent episode of local folding caused uplift and erosion between Lobes B and C (Fig. 4), and resulted in pronounced structural asymmetry. Faulting probably was more intense during this episode than during subsequent earth movements in the area.

Depositional phase 2 (Upper Series coals)

Subsidence recurred in Lobe B, and was initiated in Lobe A and D areas (Fig. 4). Swamps developed in these locations and may have extended between Lobes A and B. Coal deposition episodically was interrupted by the influx of coarse clastics in Lobes A and B, and finer sediments (shales) in Lobe D. Coal quality at Lobe D is similar to that of Lobe A coals and Upper Series Lobe B coals, although Lobe D coals are shale bounded whereas other Group III coals are sand/shale bounded. It is assumed that greater distance from the sediment source and a quieter depositional environment in Lobe D, caused by slower subsidence, can account for the accumulation of finer clastics and for the different array of flora that produced Lobe D macerals which differ from other Group III coals at Leigh Creek.

The deposition of carbonaceous sediments continued into Mid-Jurassic time (Hos, 1978) when minor renewed earth movements terminated deposition.

The Group III coal sequences occur in essentially symmetrical structures that are largely unfaulted, although minor? post-depositional movement has affected the Telford Basin Upper Series margin.

Intermittent deposition and erosion occurred during Mesozoic, Tertiary and Holocene time.

CONCLUSIONS

Coal measure correlations at Leigh Creek (Fig. 2) are proposed on the basis of proximate analyses, coal maceral content, fossil content, lithological character of associated sediments and structural styles.

These correlations show that three groups of coals of different qualities were deposited in two depositional phases, with intervening uplift and erosion.

Subsequent minor earth movements which occurred probably during Mid-Jurassic time terminated deposition of the coal measures. Erosion and intermittent sedimentation occurred from Mid-Jurassic to Holocene times.

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TABLE 1

Typical Proximate Analyses of Leigh Creek Coals (Johns & Townsend 1975)

COAL MEASURES	MOISTURE	12% MOISTURE BASIS						
BASIN/AREA LOBE	%	Volatiles %	Fixed C %	Ash %	Cal.Val. Mj/Kg	Sulphur %		
COPLEY A	36.8	28.2	42.6	17.2	21.2	4.0	GROUP III	Depositional Phase 2
TELFORD B (Upper Series)	37.3	30.0	43.5	14.5	19.6	0.5		
NORTHFIELD D								
(upper seam)	36.1	32.2	45.6	10.2	21.6	0.5		
(lower seam)	36.0	29.4	41.7	16.9	19.9	5-9.0		
Range of acceptable analyses	(35-40)	(28-32)	(40-46)	(10-17)	(19-22)	-		
TELFORD B (Main seam)	32.5	27.5	39.9	20.7	20.6	0.5	GROUP II	Depositional Phase I
Range of acceptable analyses	(28-35)	(24-28)	(34-40)	(18-26)	(18-22)	-		
TELFORD B (Lower series)	27.7	24.9	33.5	29.6	16.8	N.A.		
NORTHFIELD C	29.3	27.0	34.0	27.0	16.6	3.7	GROUP I	
Range of acceptable analyses	(26-32)	(24-27)	(33-38)	(22-30)	(14-18)	-		

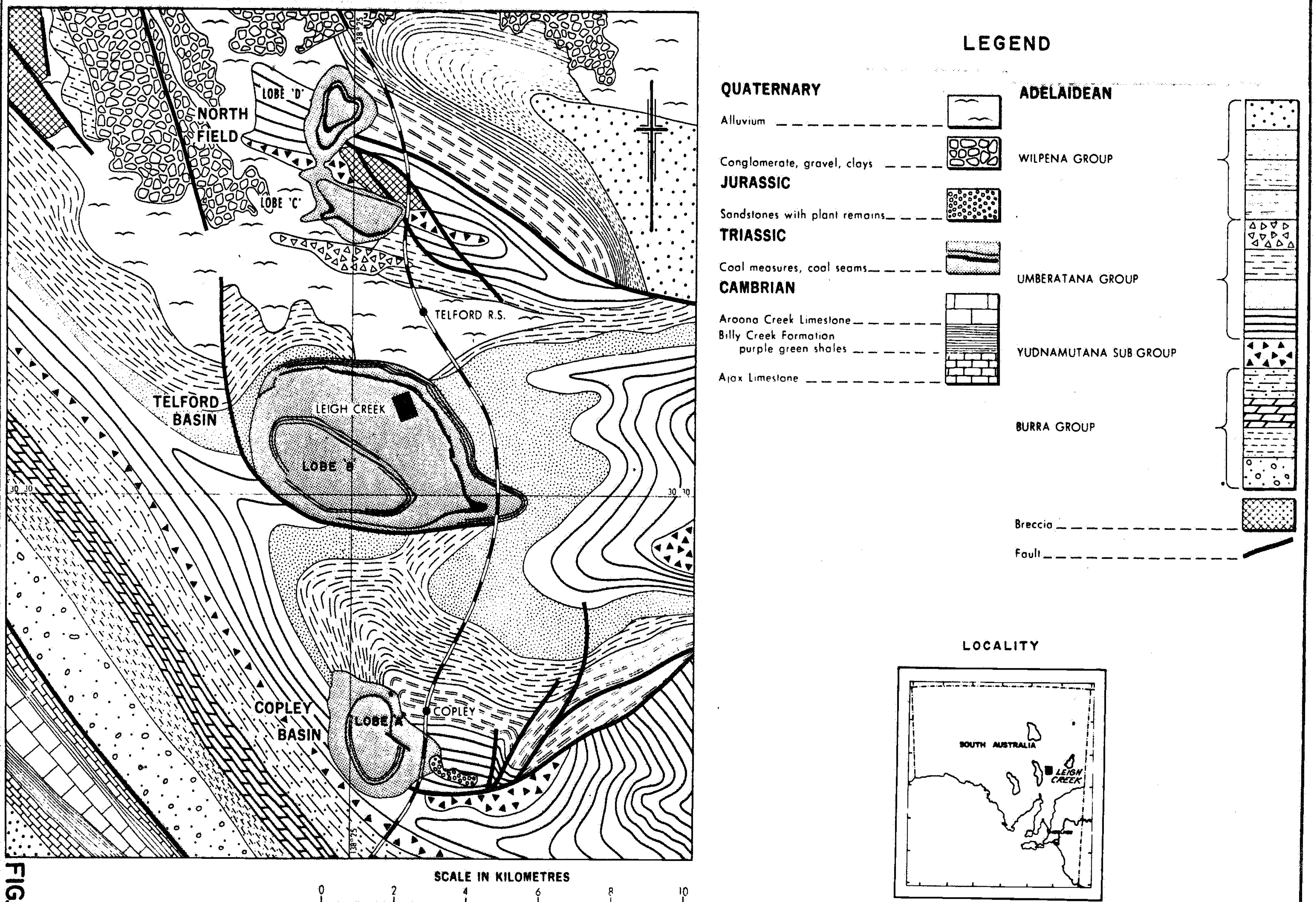

FIG.1

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LEIGH CREEK COALFIELD
REGIONAL BEDROCK GEOLOGY

COMPILED: I.J.Townsend

DRN. I.M.

CKD.

SCALE

DATE: 24-10-78

PLAN NUMBER

S13688

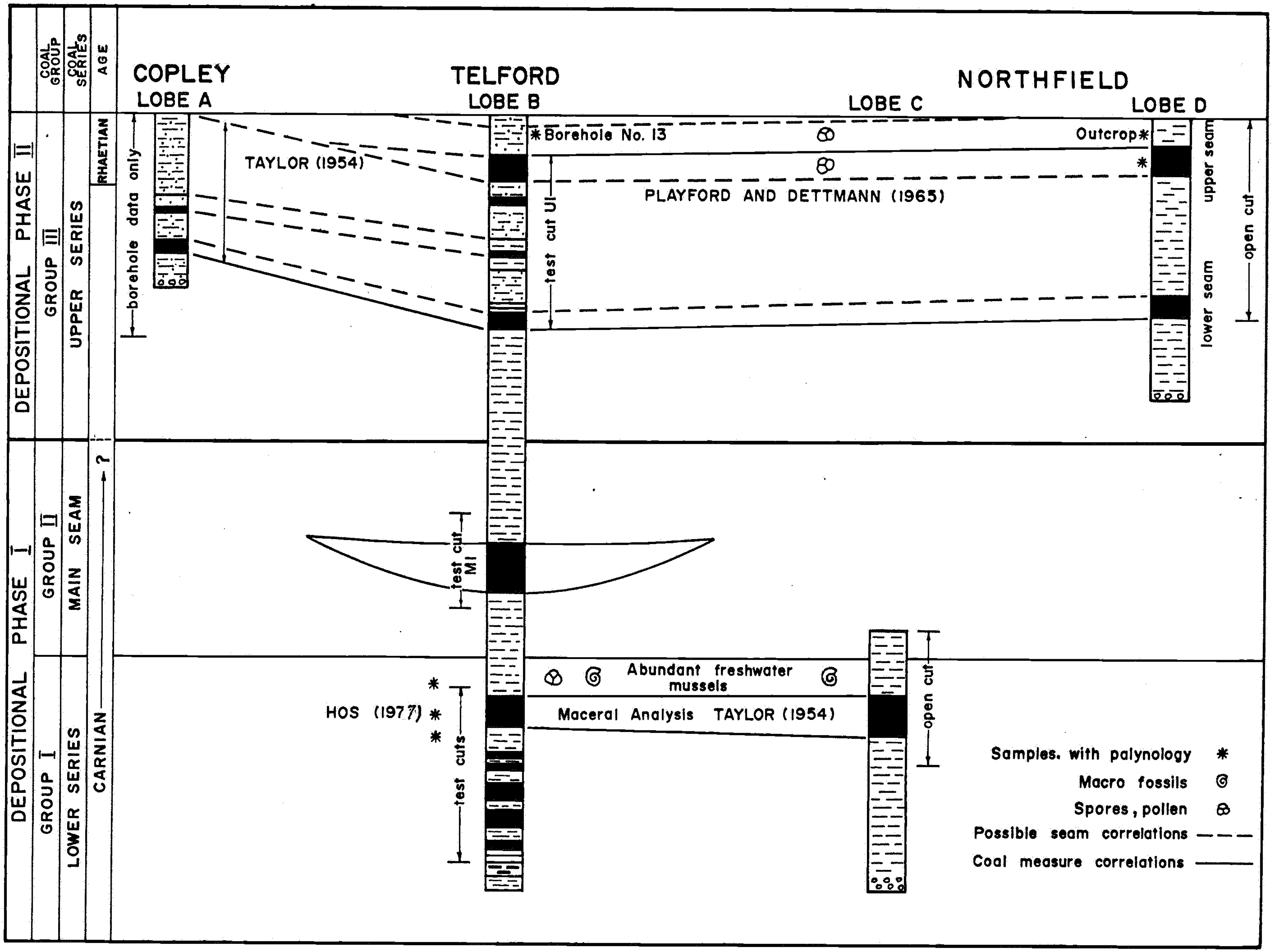

FIG. 2

DEPARTMENT OF MINES AND ENERGY
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LEIGH CREEK COALFIELD
CORRELATION DIAGRAM

COMPILED: L.J. Townsend

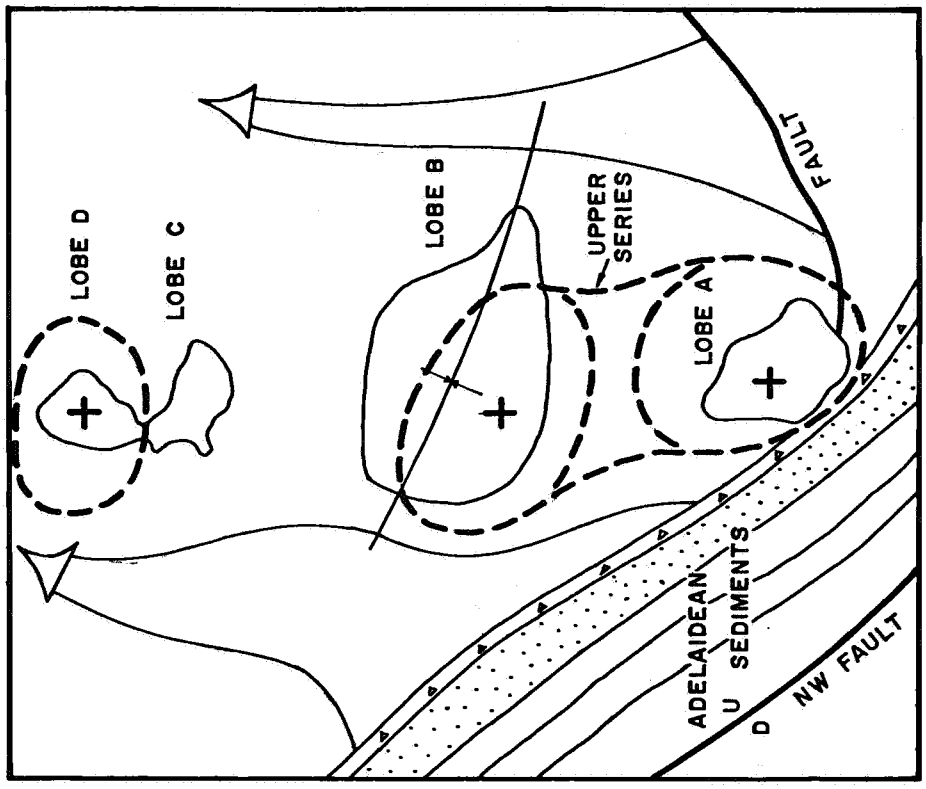
DRN: I.M. CKD:

SCALE:

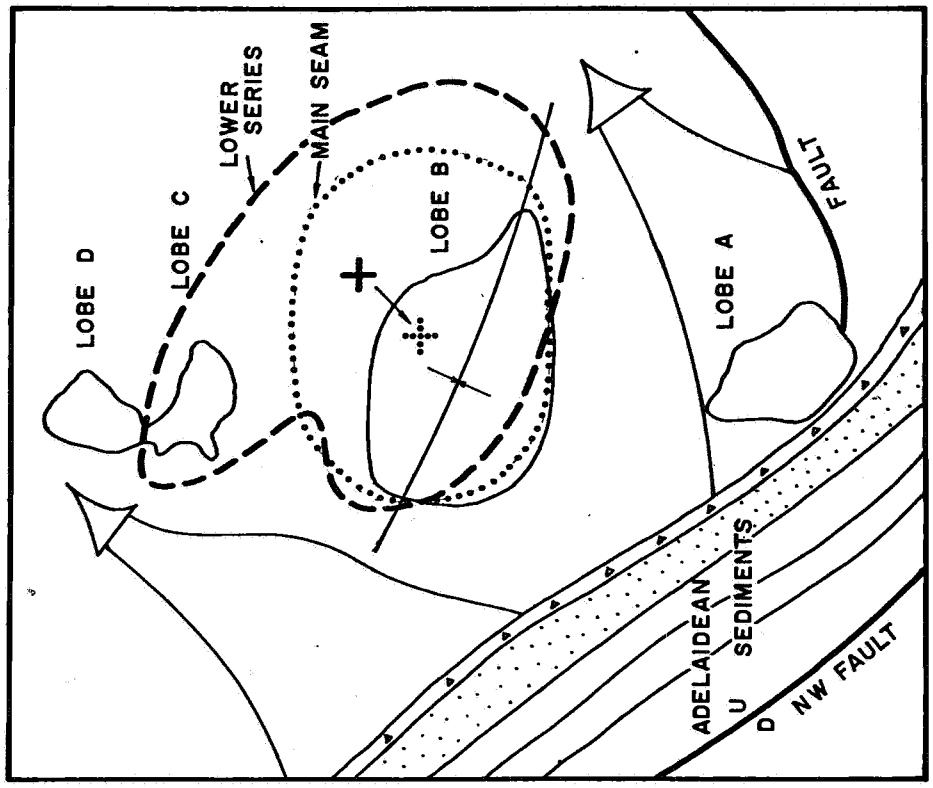
DATE: 24-10-78

PLAN NUMBER

S13689



DEPOSITIONAL PHASE 2



DEPOSITIONAL PHASE 1

LEGEND

Depocentres

Interpreted area of deposition

Inferred palaeocurrents

Present synclinal fold axis

FIG. 3

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE:
COMPILED: I.J. Townsend	LEIGH CREEK COALFIELD	DATE: 24-10-78
DRN: I. M. CKD:	INFERRED PALAEOCURRENT DIRECTIONS AND DEPOSITIONAL EXTENT OF COAL MEASURES	PLAN NUMBER S13690

LEIGH CREEK COALFIELD DEPOSITIONAL HISTORY

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SCALE:
DATE: 24-10-78
PLAN NUMBER
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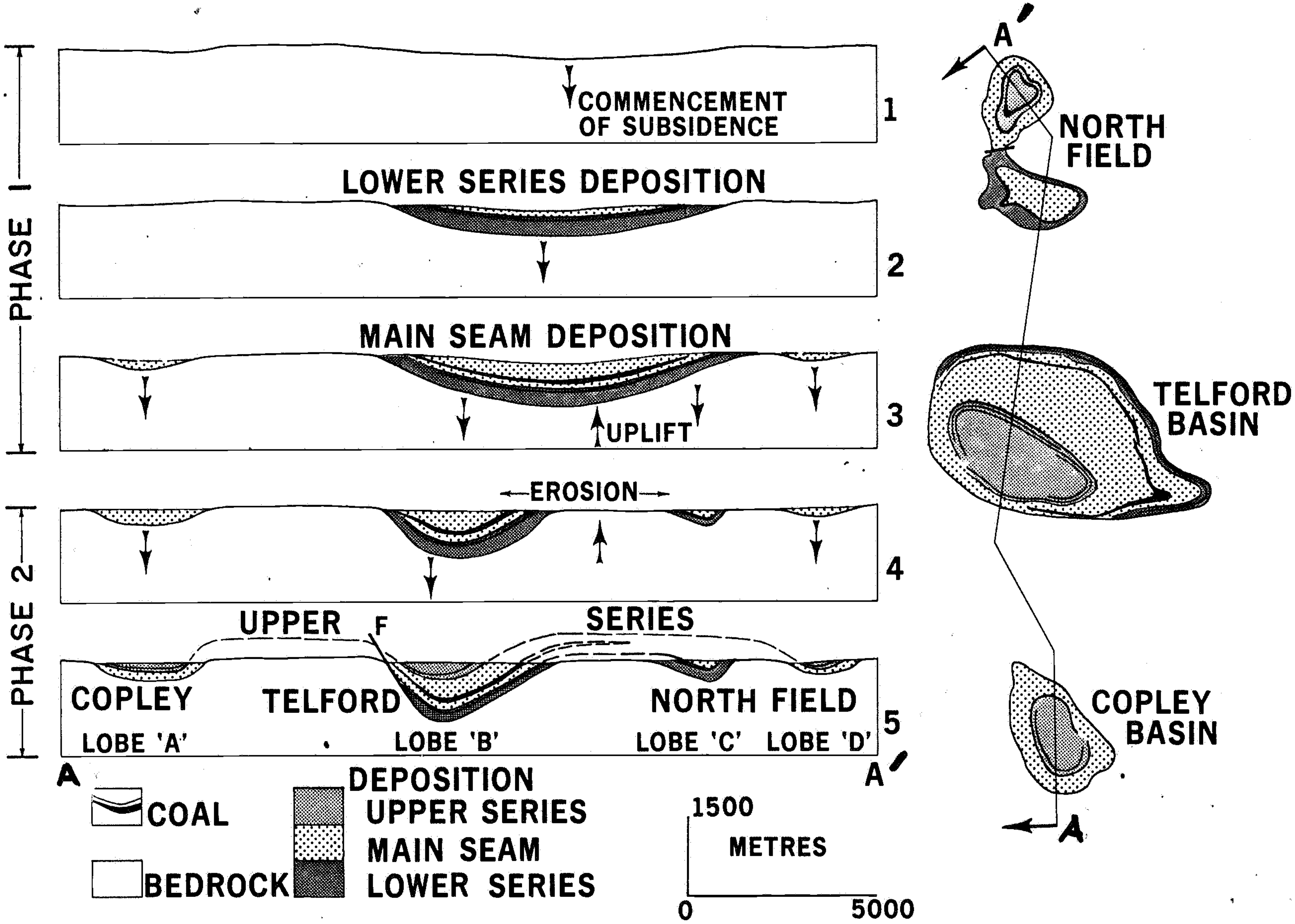

FIG. 4