DEPARTMENT OF MINES & ENERGY
SOUTH AUSTRALIA

FAILURE IN OVERBURDEN AND COAL, LOBE D, LEIGH CREEK

by

I.J. TOWNSEND

Rept.Bk.77/141
G.S. No. G.S. 5960
DM. No. 135/75

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INTRODUCTION

In mid-1976 during the final stages of mining Lobe D at Leigh Creek (Fig. 1), overburden removal had been completed and the dragline shifted 10 km south to Telford Basin. While the coal was being mined by normal shovel and truck operation, tension cracks appeared in rehandled overburden comprising the dragline walkway (Fig. 2), and cracks and humps (heaving) appeared in the coal benches.

These signs of failure increased during the following week and complete collapse of the walkway was expected before the coal could be mined, thereby isolating 50 000 to 100 000 tonnes of coal, which would normally have been won.

This note describes the nature and cause of the failure in both coal and rehandled overburden, and the measures taken to allow extraction of the coal.

TYPES OF FAILURE

The following three main types of failure were observed.

1. Tension cracks and slippage in overburden dumps.

Multiple tension cracks extend for 300-400 m in the northern and eastern dumps. Previously, ETSA field engineers had noted individual slippages up to 50 m long in these dumps (Fig. 2). Maximum vertical collapse was 10 m.

2. Rotational shearing in walkway.

Arcuate, apparently concentric tension cracks, ranging from 50-300 m long in the dragline walkway, were interpreted as rotational shears. Similar failures were probably obscured by the dumps to the north.

3. Heaving and cracking of coal benches.

In the pit floor domes of coal up to 20 m across with vertical relief of 0.2-1.0 m, exhibited brittle fractures and well developed blocky dislocations. Heaving, most pronounced in the northern bench immediately below the shearing in the walkway, diminished with increasing distance from the walkway. Minor cracks paralleled the gully along the southern margin of the unmined block of coal (Fig. 2).

PREVENTIVE ACTION

One week after the first sign of failure in the coal floor, heaving, buckling and cracking affected all three benches and arcuate tension cracks developed in the dragline walkway near the base of old dumps. If not retarded, the failure was expected to be of gigantic proportions. Generally, slow, creeping failure is not dangerous to workmen, but can threaten the extraction of already uncovered coal.

The main cause of failure was considered to be the inadequate compressive strength of the shales underlying the uncovered coal seam. Once the overburden, up to 50 m thick, had been removed from above the coal, the shales failed to withstand the combined load pressure from the dumps and the hydraulic pressure. Coffey and Partners (1975) attributed earlier failures in Lobes B, C & D to slippage along clay bands which became plastic when wet. In Lobe D, a 150 mm thick clay band occurs 5 m below the lower seam. This, or similar clay bands may have contributed to the instability of the underlying shales.

A trench 2-3 m deep was bulldozed in the exposed shale on the up-dip northern side of the coal in the area most affected by failure (Fig. 3) to encourage shallow collapse of the walkway into the trench and to dewater both the rehandled overburden and the underlying shales, thereby relieving both the hydraulic pressure and reduce the load pressure within the shales.

Additional precautions suggested by Mr. D. Stapledon (Coffey and Partners), included the drilling of a line of holes, 20 m deep, on the southern down-dip side of the coal, 3-6 m apart in the affected area, to dewater any pressured shales or clays between the trench and the gully (Fig. 3). He also recommended that this series of related failures be documented, as it is rare to be able to trace their progressive development from the outset.

RESULTS

The measures suggested were undertaken and successfully retarded such that it was restricted to overburden-collapse only. There was no further buckling of the coal benches during mining thus allowing recovery of the remaining coal. Over a period of one month, the dragline walkway, collapsed completely (Fig. 2), although the debris did not extend beyond the trench. The collapse comprised a series of arcuate failures which may have progressed into the dumps behind the walkway had preventive action not been taken (Plate (b)).

CONCLUSIONS

The preventive measures implemented were successful in retarding soil creep in the rehandled overburden under the walkway. Dewatering of the underlying shales appears to have been a significant factor in limiting the extent of the failure. Once hydraulic pressures were reduced, the shales retained sufficient compressive strength to withstand the load pressure and eliminate further major slippage or buckling.

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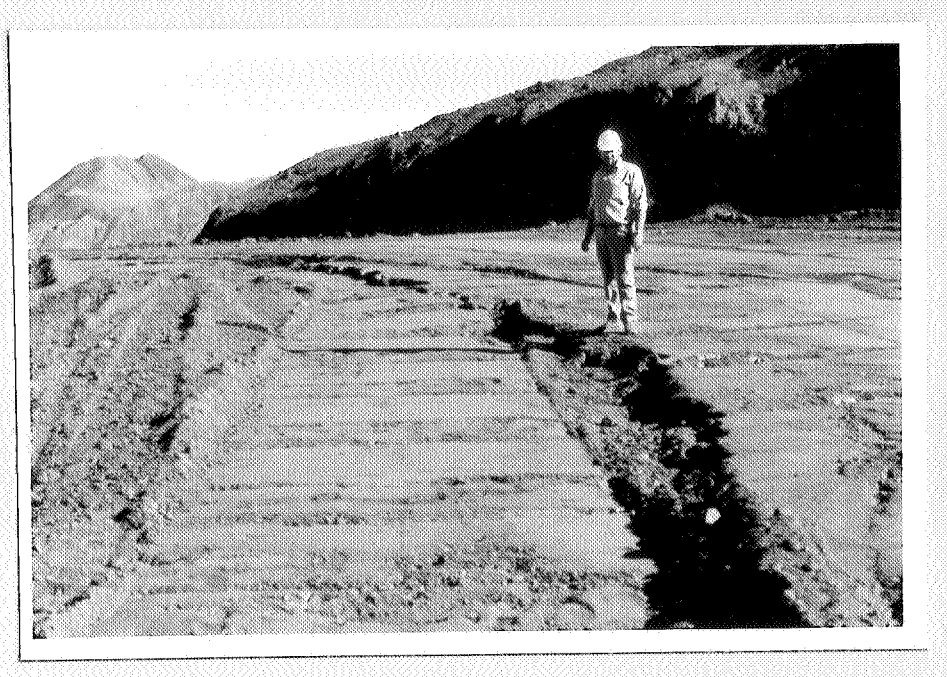
REFERENCE

Coffey & Partners, 1975. Report on Geotechnical Studies for slope design; Leigh Creek Coalfield, Lobe B, southeast margin.
(Report written for the Electricity Trust of South Australia - unpublished).



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a

29894-b.

b

The photographs taken 1 month apart, show the dragline walkway looking west:

(a) tension cracks showing first signs of failure.

(b) complete collapse of reworked overburden comprising the dragline walkway.

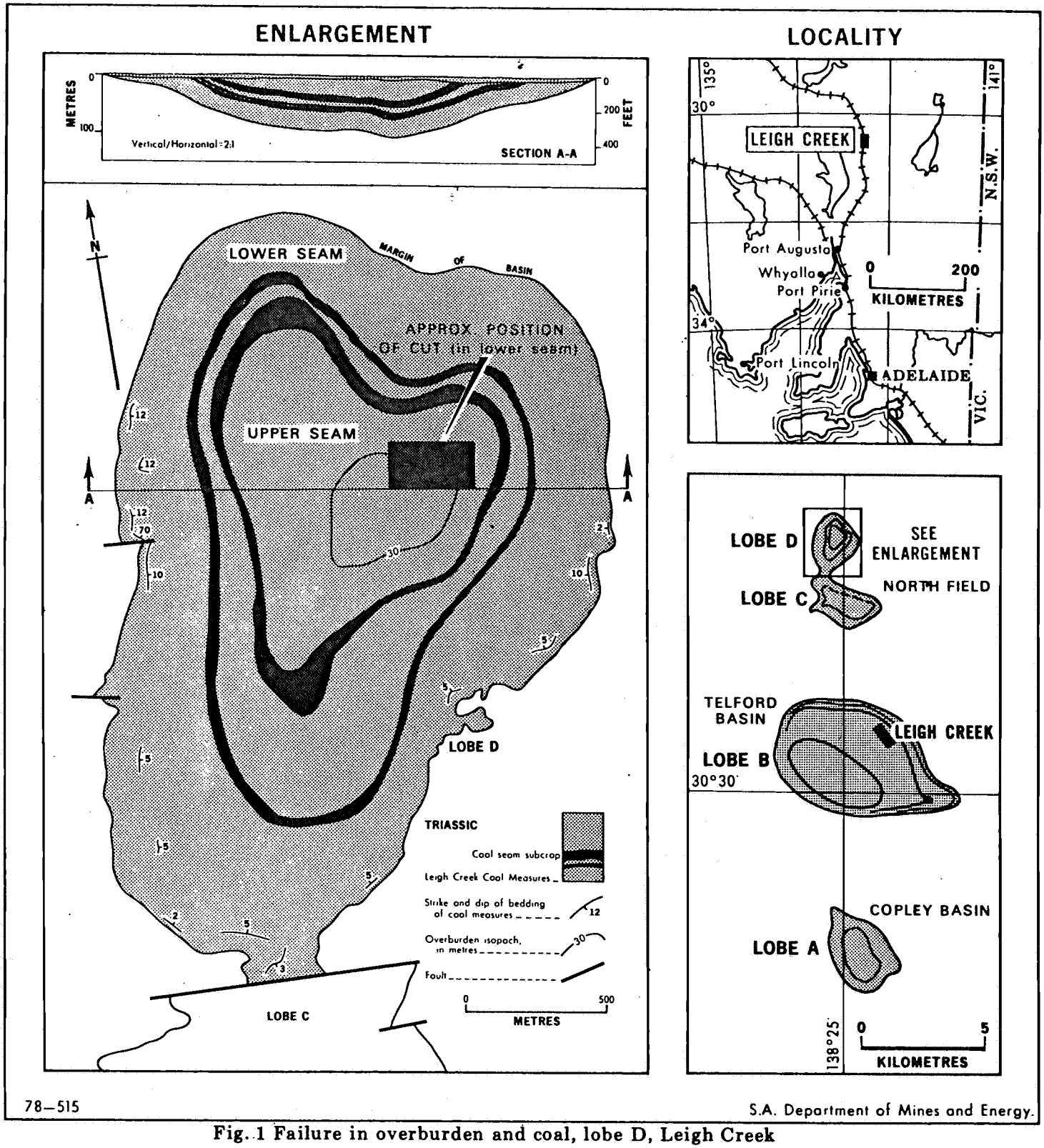

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Fig. 1 Failure in overburden and coal, lobe D, Leigh Creek

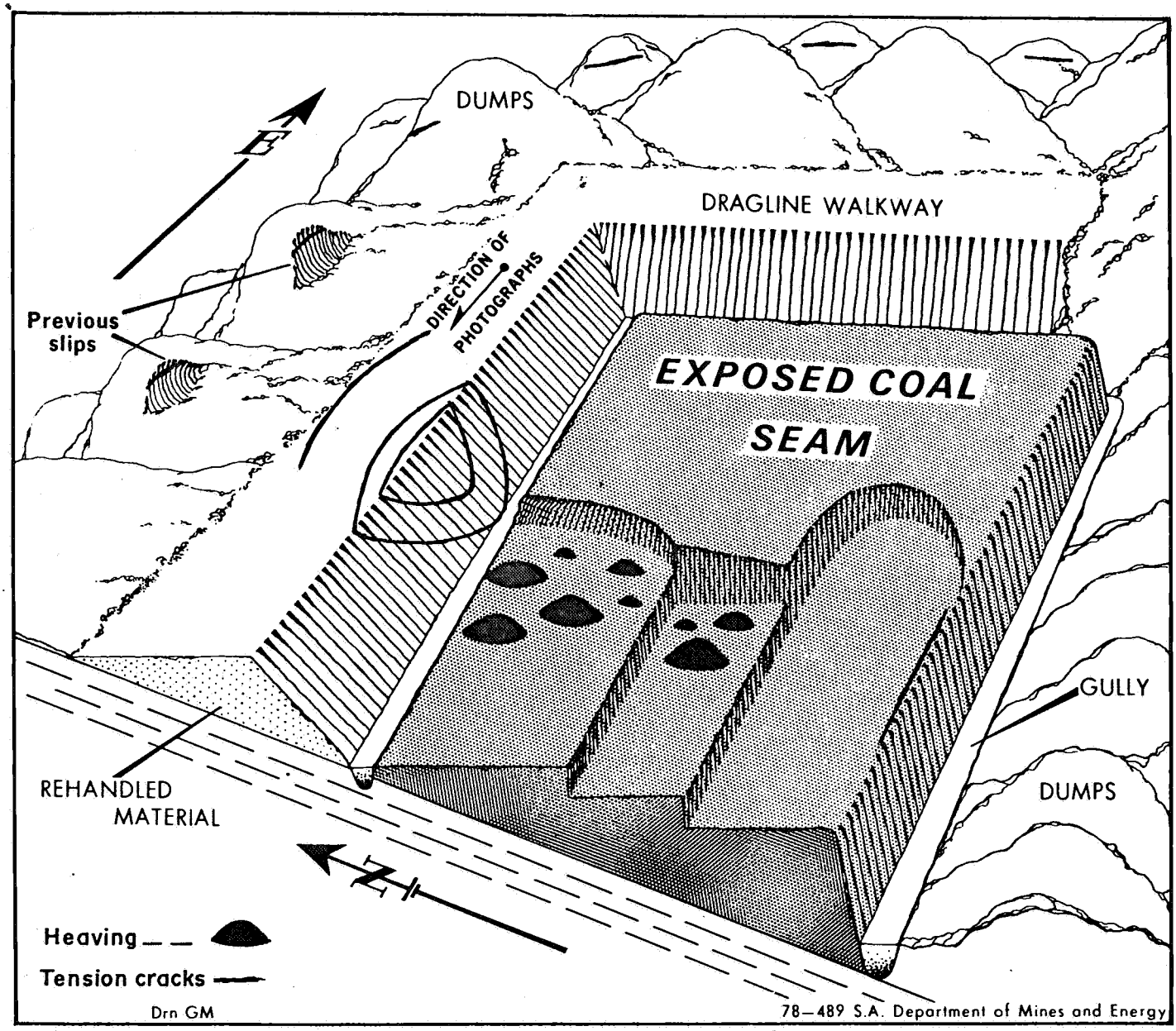

Fig. 2 Diagrammatic sketch of lobe D cut showing signs of failure in overburden and pit floor

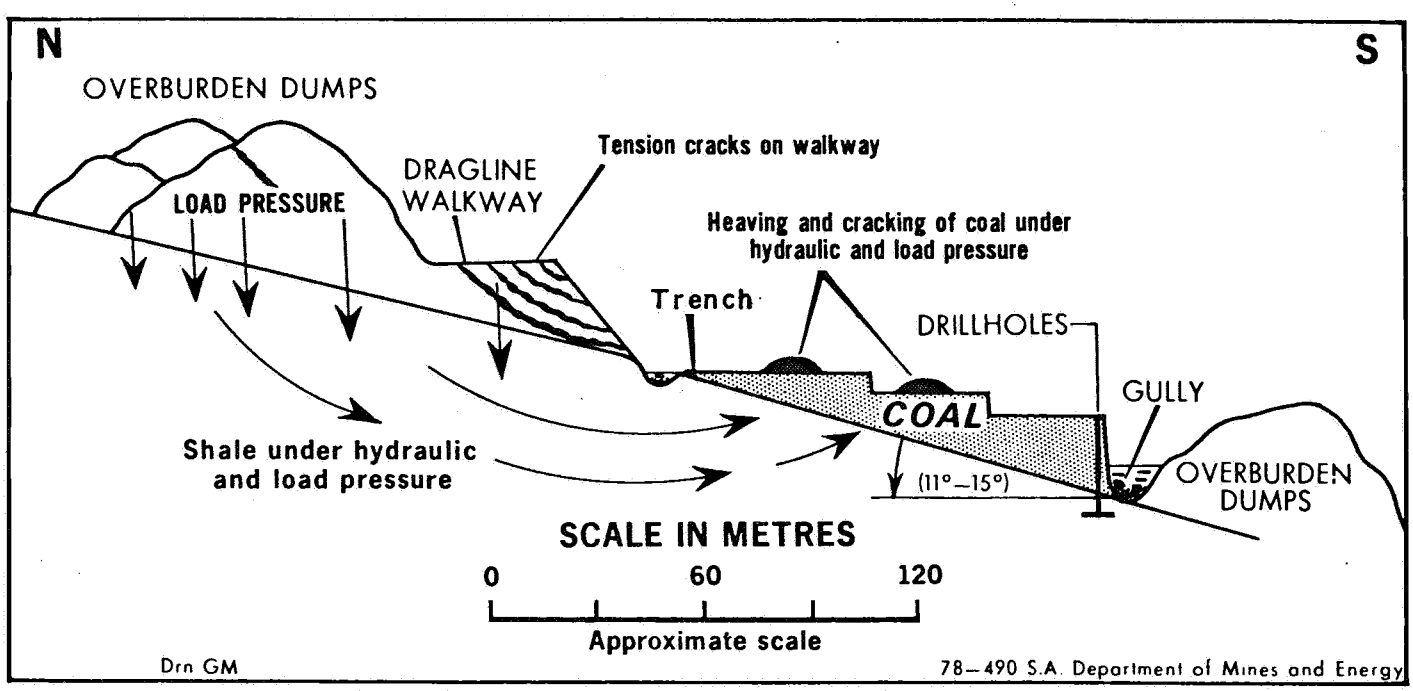

Fig. 3 Diagrammatic north–south section showing cause of failure and preventive measures taken