Tasmania Department of Mines—Unpublished Report 1987/10

Geology, stratigraphy and petrography of the Mt Lloyd coalfield

by S. M. Forsyth and C. A. Bacon

Abstract

The stratigraphy of the Mt Lloyd area has been re-examined in the light of palynological investigations on the core of two holes drilled in 1959. The dominantly lithic sandstone sequence, containing the coal seams of note in the area, can now be subdivided into several units.

A geological sketch map of the area was compiled from previous work and a brief inspection of the area.

The coal from Mt Lloyd has been examined petrographically and found to be similar to other Late Triassic black coals in Tasmania.

GEOLOGY, STRATIGRAPHY AND PALYNOLOGY

S. M. Forsyth

INTRODUCTION

Previous reports on the geology of the Mt Lloyd coalfield (Burns, 1959; Gulline, 1959) indicate that the Upper Parmeener Supergroup rocks may be subdivided into a lower sequence of sandstone, similar to the Ross Sandstone, and an upper sequence of coal measure rocks approximately 230 m thick. Although the lower 30 m interval of the coal measures sequence remained untested, diamond drilling indicated that coal seams occurred from approximately 144 m to 180 m above the base of the coal measures sequence. The overlying interval of the coal measures sequence (180–230 m) was not tested for coal seams.

A cursory examination of road cuttings on the Plenty Valley Road outside of the ANM plantation area indicated the presence of rocks lithologically similar to rocks of the muddy floodplain sequence (Rm) mapped in the Oatlands Quadrangle (Forsyth *et al.*, 1976; Forsyth, 1984). These rocks seem to lie beneath the coal measures of Number 1 area (Gulline, 1959). By analogy with the Oatlands succession, the main coal-bearing volcanic-lithic arenite sequence could be expected to occur at a minimum of about 200 m above the horizon on the Plenty Valley Road. To determine the degree of similarity of the Mt Lloyd succession compared to the Oatlands succession, a brief inspection of the major road system within the ANM plantation area and the 1950s drill core from DDH Mt Lloyd 1 and 2 was carried out. The inspection of the drill core also involved reconnaissance palynology.

GEOLOGY

The accompanying geological map (fig. 1) is based on the maps of Burns (1959), Gulline (1959), and Bacon (1983) with revisions necessitated by the inspection of the road system. The revisions consist, in particular, of a large area of Lower Parmeener Supergroup rocks not previously reported from the area; separation out from the Ross Sandstone of a basal feldspathic sequence, probably a correlate of the Cygnet Coal Measures; and an upper lutite-rich sequence, probably a correlate of the muddy floodplain sequence (Rm) (Forsyth *et al.*, 1976; Forsyth, 1984). Dolerite boundaries have also been revised in some areas. In general, no mapping of natural exposures, road cuttings, or secondary tracks has been carried out, and some primary roads have not been fully inspected.

LOWER PARMEENER SUPERGROUP

Glaciomarine siltstone

An extensive area of glaciomarine siltstone crops out upstream of the confluence of the Puzzle River and Lobster Creek. The rock is bioturbated and contains dropstones but no fossils were observed. The rock is lithologically similar to the Ferntree Formation of the Hobart area and the Abels Bay Formation of the Kingborough Quadrangle (Farmer, 1981). In addition, an exposure on the Mt Lloyd Road was inspected [DN982588]. This exposure reveals very thinly interbedded to interlaminated fine-grained sandstone and mudstone which may represent the uppermost beds of the Lower Parmeener Supergroup.

UPPER PARMEENER SUPERGROUP

Feldspathic sandstone

Feldspathic sandstone, apparently overlying the glaciomarine siltstone, occurs on Puzzle Road (with shaly beds) and Trappers Hut Road. Although some small-scale faulting is involved, similar feldspathic sandstone and shale appears to overlie the Lower Parmeener Supergroup on the Mt Lloyd Road. The feldspathic sandstone is similar to that of the dominantly feldspathic sandstone and subordinate mudstone sequence (Pf) of Farmer (1981). The feldspathic sandstone has a maximum thickness of about 90 m but may be much thinner. Quartz sandstone overlies the feldspathic sandstone.

Quartz sandstone

Fine to medium-grained, sparkling, cross-bedded sandstone is the most widespread Upper Parmeener Supergroup rock type occuring in the area. The lower beds are marginally coarser (up to coarse-grained sandstone with occasional granules). Some interbedded siltstone occurs in the quartz sandstone sequence [DN928558]. The quartz sandstone sequence resembles the Mountain Lodge Member of the Springs Sandstone (Banks and Naqvi, 1967) and quartzose sandstone in the Oatlands Quadrangle (Rp, Forsyth *et al.*, 1976; Forsyth, 1984) and Kingborough Quadrangle (Rs, Farmer, 1981).

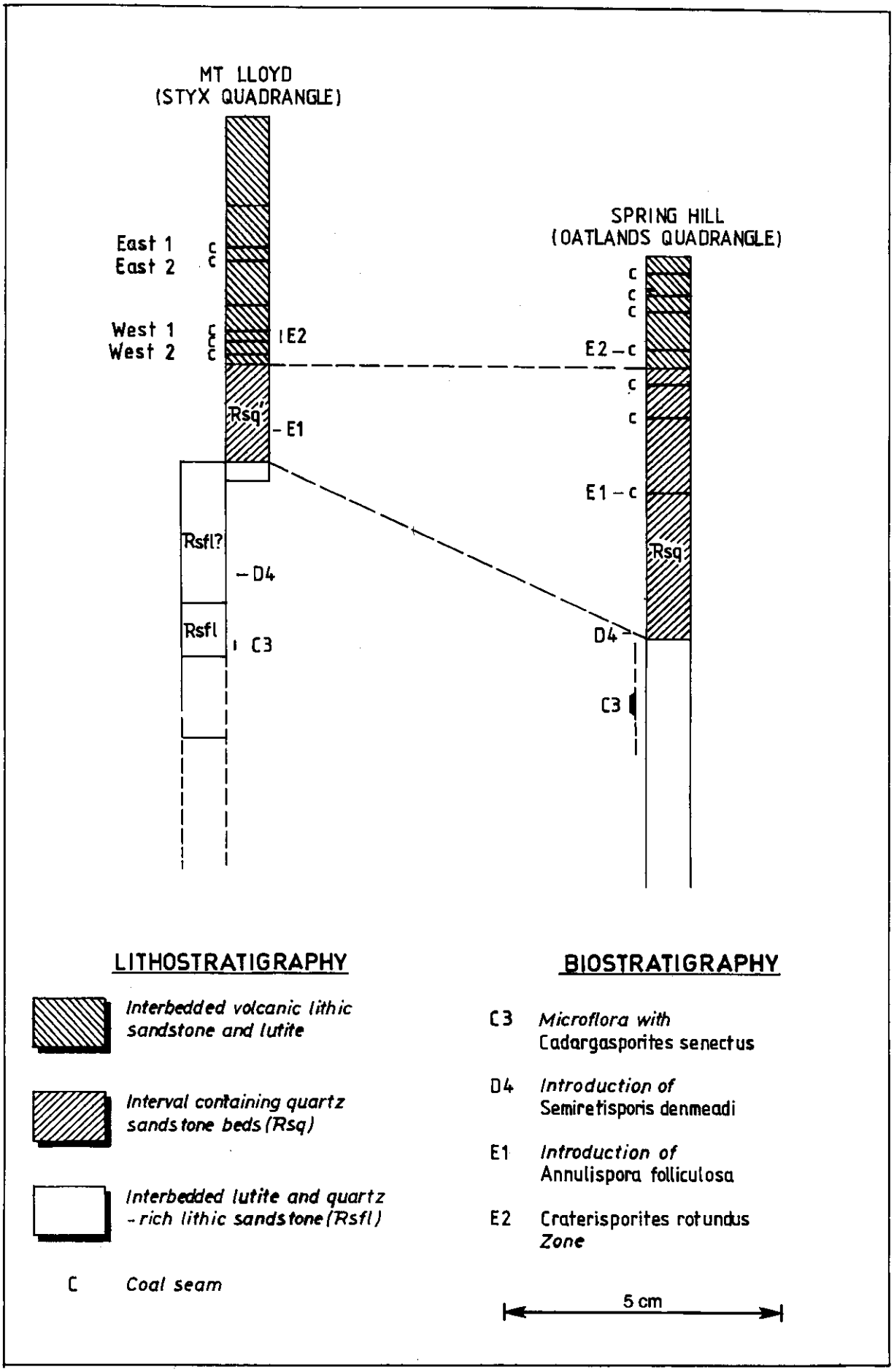

Figure 2. *Comparison of lithostratigraphic and biostratigraphic relationships at Mt Lloyd and Spring Hill.*

Micaceous lutite with interbedded quartz sandstone

A predominance of massive and micaceous shaly lutite, micaceous rippled sandstone with more massive quartz sandstone occurs along the Plenty Valley Road [DN918580 to DN930588] and possibly further north between 300 m and 370 m above sea level. Some micaceous carbonaceous mudstone with sphenopsid fossils is also present. These rocks appear to overlie the quartz sandstone sequence and grade up into the coal measures of Gulline's (1959) Number 1 area. Similar rocks occur east across the Plenty River valley between 300 m and 330 m a.s.l. on Leesons Road and side tracks. These rocks are lithologically similar to, and occupy a similar stratigraphic position to, the muddy floodplain sequence (Rm) of the Oatlands area (Forsyth *et al.*, 1976; Forsyth, 1984). Additional outcrops occur on Puzzle Road (560–580 m a.s.l.), where the presence of partly silicified bioturbated fine-grained sandstone further indicates similarity with the Rm sequence. Other possible outcrops include siltstone on Plenty Valley Road [DN903565] and shaly beds on the quarry access road [DN885541], however these horizons may be within the quartz sandstone sequence.

Coal measure sequence

Very few exposures of this sequence were observed during the road system traverse. Lithic sandstone was inspected near the intersection of Leesons Creek and Mt Lloyd Road [DN957573, DN957572]. Similar rocks were observed but not inspected on the access road from Trappers Hut Road to Crosswells Flat. Time did not permit traverses along the portions of Trappers Hut Road and Wiltons Road which may be expected to intersect the coal measure sequence.

The coal measures sequence is best known from stratigraphic drill holes DDH Mt Lloyd 1 and 2. The lithological logs, interhole correlation, and stratigraphic summaries of these holes are given by Burns (1959), but little description of the sandstone composition was presented. Brief inspection of the core indicates that quartz sandstone, quartz-rich lithic sandstone, and volcanic lithic sandstone are present. Burns noted the green colour of all rocks below 54 m in Bore 2. This 29 m interval is closely comparable to the quartz-rich lithic arenite and lutite sequence (Rsf, lower) of the Oatlands Quadrangle (Forsyth, 1984). The succeeding 40 m of strata contains quartz-rich lithic sandstone, and is similarly compared with the sequence Rsf, lower. Coaly material found in this interval appears to consist chiefly of coalified logs and pieces of wood rather than coal seams. Sandstone found in the poorly cored top 10 m of the drill hole is probably volcanic lithic arenite. This interval was equated with sandstone at the base of Hole 1 (Burns, 1959). The succeeding interval in Hole 1 (from about 62–94 m) includes white quartz sandstone and significant black carbonaceous shale, and is closely comparable to the sequence of quartz sandstone and lutite with carbonaceous beds and some lithic sandstone and coal (Rsq') of the Oatlands Quadrangle. The interval from 36–62 m contains coal seams but no very thick beds of massive volcanic lithic sandstone. It is therefore not equated with the volcanic lithic arenite and coal measures sequence (Rg) of the Oatlands Quadrangle. This interval includes lithic sandstone but without microscopic investigation the type of lithic sandstone cannot be indicated.

PALYNOLOGY

The occurrences of selected palynomorphs are indicated by Figure 3. The oldest microflora was obtained from Bore 2 (70–87 m) and contained *Cadargasporites senectus* de Jersey and Hamilton, 1967 which indicates assignment to the upper part of the *Aratrisporites parvispinosus* Assemblage Zone (Helby, 1973). The assignment to the *A. parvispinosus* Assemblage Zone is supported by the presence of *Protohaploxypinus* sp. cf. *P. jacobi* (Jansonius) Plate 3, Figure 1, Helby, 1973 and *Neoraistrickia picketti* Helby, unpublished thesis 1970. The microflora is similar to that occurring in the upper half of the sequence Rsf, lower, of the Oatlands Quadrangle, for example in the occurrence of *Equisetosporites* sp. *A*, and *E* sp. *B*, and the occasional dominance of *Circulisporites* sp. (Forsyth, 1984).

As in the Oatlands Quadrangle *Semiretisporis denmeadi* (de Jersey) de Jersey, 1970, *Foveosporites* sp. cf. *F. moretonensis* de Jersey, 1944, and *Aratrisporites parvispinosus* (Leschik) emend. Playford and Dettmann, 1965, appear approximately coevally. In contrast, at Mt Lloyd, these three species appear within the quartz-rich lithic sandstone sequence (Bore 2, 50 m) and not at the base of the sequence with quartz sandstone (Rsq') as in the Oatlands Quadrangle (Forsyth, 1984). The next significant species to appear is *Annulispora folliculosa* (Rogalska) De Jersey, 1959 (Bore 1, 83 m). *A. folliculosa* appears in Bore 1 towards the base of the interval 62–94 m with quartz sandstone. In the Oatlands Quadrangle *A. folliculosa* was first recorded about midway up the lithologically similar sequence (Rsq).

In Queensland (de Jersey, 1975) *S. denmeadi* and *A. folliculosa* first appear in the Carnian *Craterisporites rotundus* Zone, however *S. denmeadi* has been recorded from the Arisian *Staurosaccites quadrifidus* Zone in Western Australia and *A. folliculosa* is a rare component of New Zealand microfloras (de Jersey, pers. comm.).

Several species occur first at Hole 1 (47.9 m), and in particular *Rogalskaisporites cicatricosus* (Rogalska) Danze-Corsin and Laveine, 1963, *Annulispora microannulata* de Jersey, 1959, and *Apiculatisporis globosus* (Leschik) Playford and Dettmann, 1965, and *S. denmeadi* indicate assignment to the *C. rotundus* zone. Microfloras recovered from the upper sequence of lutite, coal and quartz-rich lithic sandstone (Rsf, upper) of the Oatlands Quadrangle have also been assigned to the *C. rotundus* Zone (Forsyth, 1984).

DISCUSSION

A similar sequence of lithological and palynological changes occurs at Mt Lloyd and near Oatlands above the introduction of lithic sandstone in the Upper Parmeener Supergroup. Rocks similar to the quartz sandstone, lutite, lithic arenite with carbonaceous beds sequence (Rsq') of the Oatlands Quadrangle are much thinner at Mt Lloyd (30 m compared to 100 m at Oatlands). The palynological zones and datums appear to occur at similar depths below a datum taken at the introduction of the *C. rotundus* Zone in both the Mt Lloyd and Oatlands areas. As a consequence, quartz-rich lithic sand appears to have been deposited at Mt Lloyd for a considerable period after quartz sand deposition commenced at Oatlands. Alternatively quartz-rich lithic sandstone with *S. denmeadi* was eroded prior to the deposition of quartz sand at Oatlands. Although some thin coal seams occur beneath the *C. rotundus* Zone at Oatlands the main coal occurrences lie above the base of the *C. rotundus* Zone in both districts.

The occurrence of quartz sandstone within the lithic sandstone sequence at Mt Lloyd may provide a useful datum for coal exploration. White quartz sandstone overlain by black lutite occurs immediately beneath the coal seams at Crosswells Flats (Mr Teakle, pers. comm.).

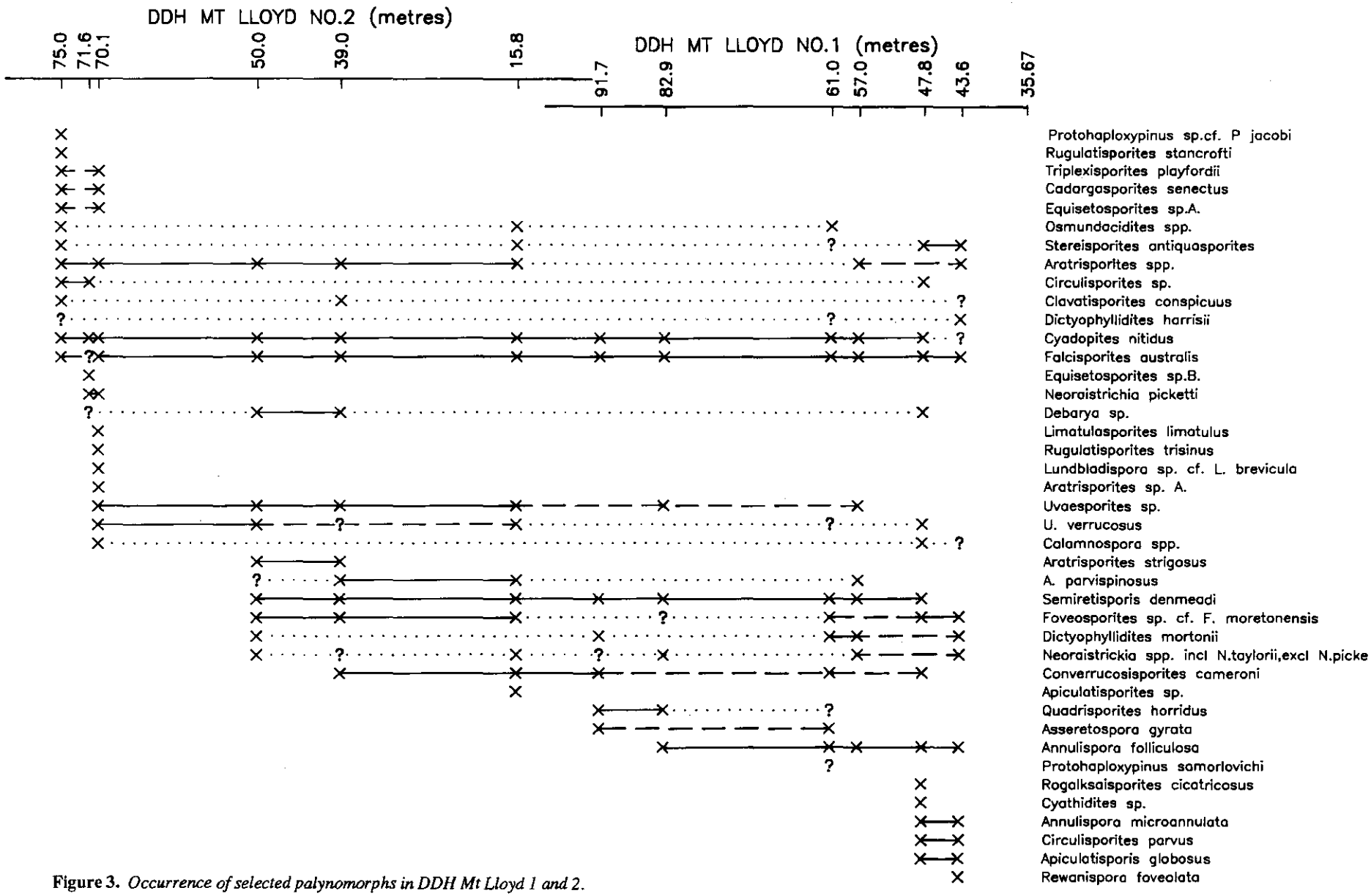

Figure 3. *Occurrence of selected palynomorphs in DDH Mt Lloyd 1 and 2.*

PETROGRAPHIC ANALYSES OF COAL FROM MT LLOYD

C. A. Bacon

INTRODUCTION

The Triassic black coal from Mt Lloyd is similar in quality and petrographic character to most other Tasmanian coals. Part of one seam has a lower than average ash content. The seams are thin, discontinuous and faulted, limiting the potential of the area for future exploration.

LOCATION

The Mt Lloyd Coalfield is located on the western flank of Mt Lloyd [DN967562] about 13 km south-west of New Norfolk. A coal mining lease has been held over part of the coalfield since 1953. Work carried out in the lease area has consisted of prospecting activity and sporadic small scale mining of some coal outcrops. Samples from two seams (West 1, West 2) were given to the Department by the leaseholder. Petrographic and proximate analyses were done on these samples by CCI, Newcastle, in October 1984.

GEOLOGICAL SETTING

The coal seams occur in a fluviatile sequence of interbedded lithic sandstone, mudstone and siltstone which overlie a quartzose sandstone sequence. Recent field inspection and a re-examination of the cores of the two holes drilled by the Department of Mines in 1959 has shown that the lithic sandstone unit can be further subdivided to differentiate the coal-bearing lithic sandstone from underlying quartz-rich sub-lithic arenite sequences which are either devoid of or poorly endowed with coal resources (S. M. Forsyth, this report).

COAL QUALITY

The coal from Mt Lloyd is of approximately the same quality as other Tasmanian Triassic black coals, with a raw ash content of 25–30%. However, part of one seam, the top one metre or so of the West 1 seam, has an ash content of less than 10%. This low ash content is probably not constant throughout the seam, as previous analyses of the West 1 seam show a much higher ash content (Table 1).

Table 1. *PROXIMATE ANALYSES (AIR-DRIED BASIS)*

Sample	*1*	*2*	*3*
Moisture (%)	2.0	1.7	3.1
Ash (%)	9.3	31.4	29.5
VM (%)	20.1	17.6	15.0
FC (%)	68.6	49.3	52.4
TS (%)	0.38	-	0.27
Seam	West 1	West 2	West 1
SE (MJ/kg)	-	-	23.0

1. Sample collected by leaseholder, raw coal, top of West 1 seam, vicinity of Crosswells Flat

2. Sample collected by leaseholder, raw coal, whole seam section, West 2 seam, vicinity of Crosswells Flat.

3. Whole seam sample, West 1 seam (Burns, 1959).

PETROGRAPHY

Petrographically the coal from both the West 1 and West 2 seams is rich in inertinite and depleted in vitrinite and exinite. The intertinite component of both seams is dominantly semifusinite and inertodetrinite. This suggests that the peat was oxidised during the early stages of coalification. The petrographic composition of the seams is shown in Figures 4 and 5 and in Table 2.

Table 2. *MACERAL ANALYSES*

Seam	*West 1*		*West 2*	
VITRINITE		(11)		(18)
Vitrinite A	3.6		8.8	
Vitrinite B	6.8		8.8	
EXINITE		(1)		(2)
Sporinite	1.0		0.8	
Cutinite	0.4		0.6	
Resinite	-		0.4	
INERTINITE		(82)		(59)
Micrinite	1.2		0.8	
Macrinite	1.4		2.4	
Semifusinite	58.8		32.3	
Fusinite	4.8		4.2	
Inertodetrinite	15.8		19.4	
MINERALS		(6)		(21)

To determine the environment of deposition the Tissue Preservation Index (TPI) and Gelification Index (GI) (Diessel, 1986) were calculated.

	TPI	*GI*
West 1 seam	2.80	0.14
West 2 seam	1.48	0.36

The TPI (wood ratio) indicates that a substantial proportion of the coal macerals are derived from wood, while the GI (moisture index) indicates a fairly dry environment. The West 2 seam has less wood and formed in a slightly wetter environment than the West 1 seam. However both seams formed in a dry terrestrial forest swamp environment, similar to other Late Triassic Tasmanian coals.

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[22 April 1987]

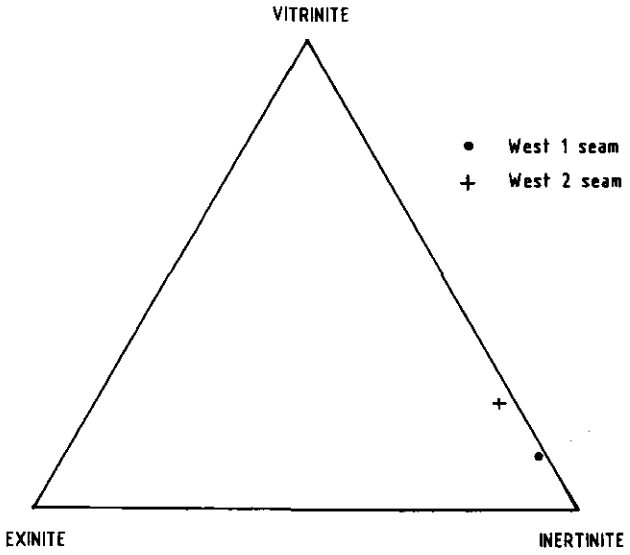


Figure 3. *Petrographic composition of Mt Lloyd coal.*

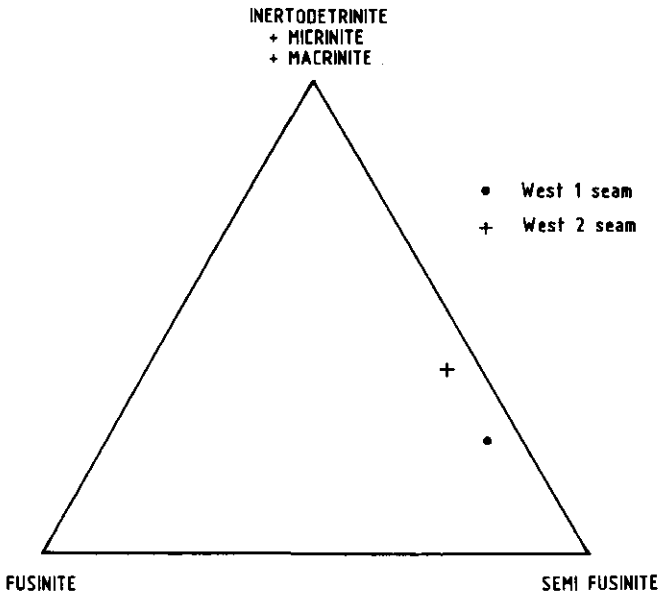
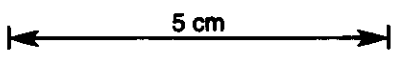


Figure 4. *Composition of the inertinite content of Mt Lloyd coal.*



REVISED RECONNAISSANCE GEOLOGICAL MAP OF THE
MT LLOYD — UPPER PLENTY RIVER AREA

LEGEND

QUATERNARY *Note: Quaternary deposits, such as extensive talus deposits, have not been indicated, except where talus contains basalt clasts.*

Qtb — *Talus of predominantly dolerite with minor basalt clasts.*

Erosional surface.

TRIASSIC

Rl — *Rl: Sequences of lithic sandstone and lutite with minor quartz sandstone. (Commonly obscured by Quaternary deposits and possibly basal part of Jurassic dolerite sills).*
Upper sequence ('Rl') dominantly of volcanic lithic sandstone, with lutite and coal seams.
Lower sequence ('Rl'') dominantly of lutite and quartz-rich lithic sandstone with quartz sandstone near base and quartz sandstone and coal seams near top. Area with lithic sandstone outcrops or displaced strata indicated Rl #

UPPER PARMEENER

Rp — *Predominantly quartz-sandstone; interbedded lutite indicated in some areas ('Rp').*

PERMIAN

Pc — *Feldspathic sandstone, quartz sandstone and lutite. Correlate of Cygnet Coal Measures.*

Pa — *Poorly sorted, bioturbated siltstone and sandstone. Correlate of Abels Bay Formation.*

LOWER PARMEENER

IGNEOUS

JURASSIC

Jdl — *Dolerite. Fine-grained dolerite indicated by.*

× × × × — *Country rock metamorphosed by dolerite indicated by cross overprint.*

Geological boundary position approximate.

Geological boundary inferred.

Fault, down thrown side indic ated.

5 cm

DOM1 — *Approximate position of Department of Mines bore hole.*

RDH 02 — *A.N.M. Rotary drill hole, Jan 1985.*

●C — *Approximate position of known coal occurrence*

Roads traversed.

Compiled by S.M.Forsyth