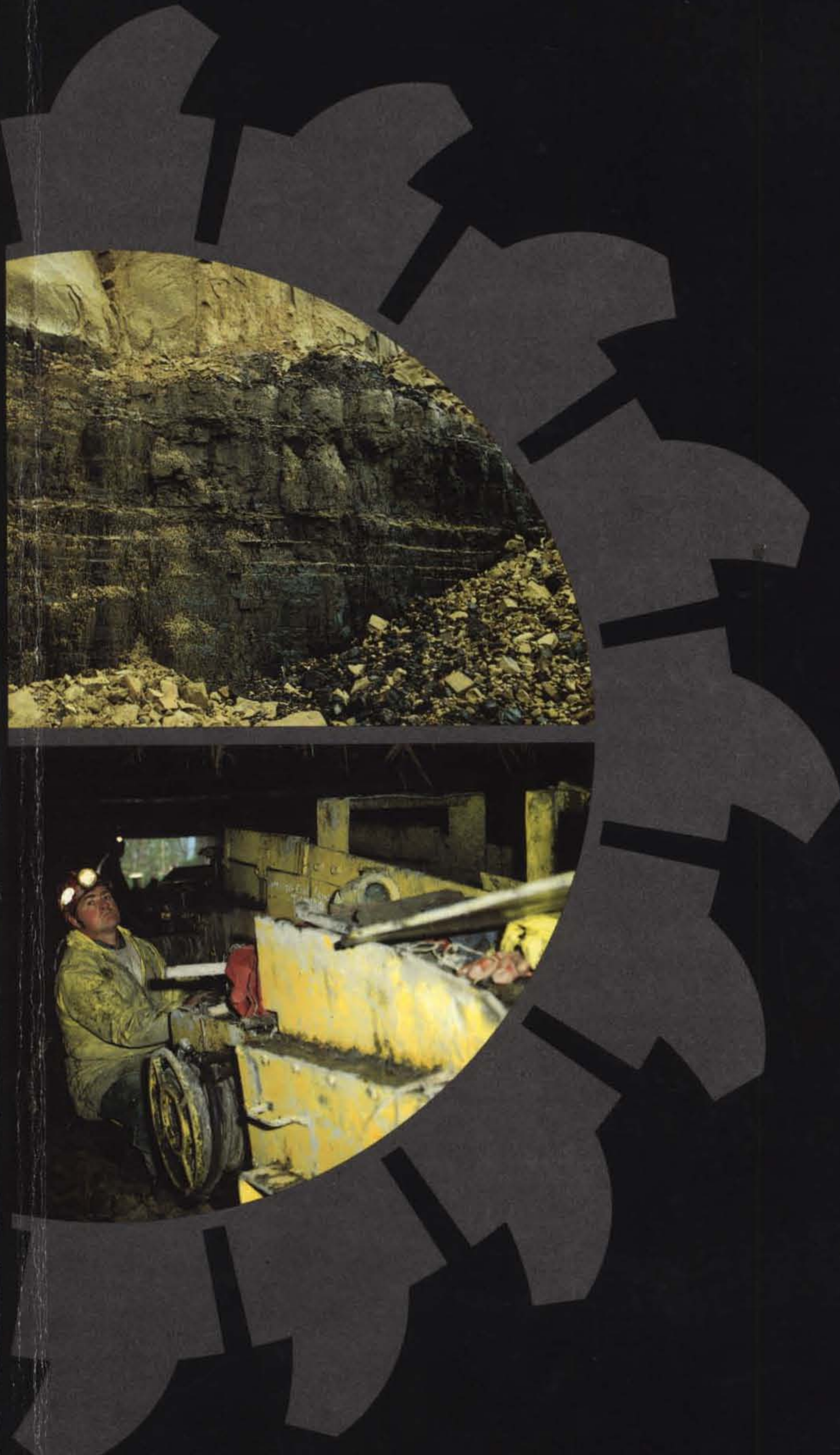
BULLETIN 64

THE COAL RESOURCES OF TASMANIA



BULLETIN 64 THE COAL RESOURCES OF TASMANIA

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DIVISION OF MINES AND MINERAL RESOURCES

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GEOLOGICAL SURVEY
BULLETIN 64

The Coal Resources of Tasmania

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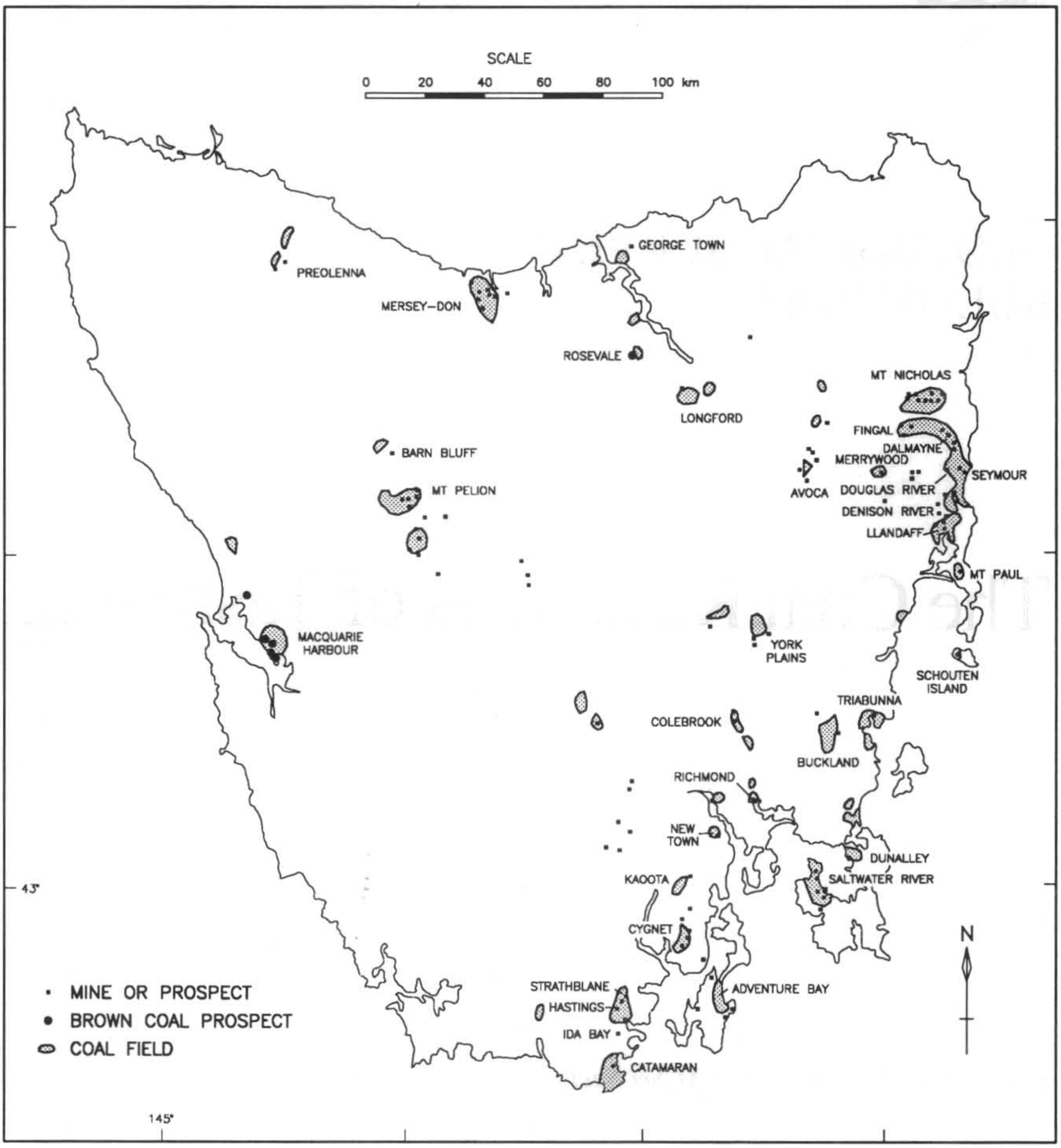
LOCATION OF COALFIELDS, COAL MINES AND PROSPECTS



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INTRODUCTION

The last detailed study of the coal resources of Tasmania was that of Hills *et al.* (1922). Since that time, data from the coalfields has accumulated in a variety of forms, not all of which is readily accessible to interested parties. In 1983 a study was started to document all the information gained from each coalfield since 1922 into a brief report on each area. These reports form the basis of this bulletin, together with much additional previously unpublished material on Tasmanian coal.

The aim of this bulletin is to provide a comprehensive review of the coal geology and coal resources of Tasmania. An outline is given of the geological settings and depositional environments of each of the three coal-bearing sequences, followed by a review of the geology of the major coalfields. The petrography of some Tasmanian coals, which are depositionally unique in Australia, is also discussed.

One chapter is devoted to the history of coal discoveries and mining in the State, with comment on the effect that the opening and closing of mines had on the social fabric of a region. The bulk of the work comprises a detailed description of each coalfield — in terms of location, access, geology, mining history, recent exploration, coal quality, and potential for further work. Sketch maps are provided for most of the coalfields.

The first "mining" of coal in Tasmania was probably done by members of the household of Robert Knopwood, who gathered coal from the Coal River in 1805. Tertiary coal (lignite) was unsuccessfully worked on the shores of Macquarie Harbour in 1822 for a short time. The first successful coal mine in the State was opened in 1834 at Saltwater River and run initially by convict labour, before being leased out in 1848.

These early mining attempts were by no means the first in Australia. Coal was discovered in 1791 in the vicinity of the Hunter River (New South Wales), when escaping convicts picked up pieces for their fire (Ellis, 1969). The discovery was not reported for some time, as the convicts successfully escaped to Java. Labillardière discovered coal on the south coast of Tasmania in 1793, the first recorded Tasmanian find.

Further discoveries in NSW continued; a fishing boat picked up pieces of coal from a bay near Port Stephens in 1796, and in 1797 shipwreck victims were rescued from near Coalcliff, where they had found large quantities of coal and had been able to light a fire "to warm their starving forms". Governor Hunter sent a boat to bring a load of the coal to Sydney. The same year coal was found washed down the Grose and Tench Rivers, and a Lt Shortland noticed coal at Nobbys Island (at the mouth of the Hunter River) and shipped some back to Sydney (Ellis, 1969).

The first action towards establishing a coal mining industry in Australia was made in 1798, when the Colonial Secretary (the Duke of Portland) instructed Governor Hunter to send loads of coal to the Cape of Good Hope, after hearing of the Coalcliff find. In 1799 Australia's first export of coal was made — from Nobbys Island to Bengal (Ellis, 1969).

Another find of coal was made inadvertently by a Captain Reid, who had been sent by Hunter to fetch a load of coal from Nobbys Island. Reid sailed his boat into Macquarie Harbour (a good way south of Nobbys Island) and loaded up with coal from a spot in the vicinity of modern Belmont. The mouth of Macquarie Harbour is known as Reids Mistake in memory of this event (Ellis, 1969).

Mining in various parts of NSW began in earnest around 1800. A shaft was sunk inland from Coalcliff by the government (finding only thin seams), while the merchant Simeon Lord loaded up his boats with the Nobbys Island coal, some of which was exported to India. Having no luck at Coalcliff, the government miners were redeployed to the Hunter River, and coal won by their efforts was soon reaching the Sydney market. The first government mine opened on Signal Hill during this year, and Governor King introduced fees and dues for coal mining. In 1801 the mine superintendent Mason made plans to open a second mine at Freshwater Bay, while crews of various boats enthusiastically mined from the cliffs of Nobbys Island and Colliers Point (Signal Hill) (Ellis, 1969).

Discoveries continued and new mines opened, and a rich chapter of our mining heritage was begun. Eloquent and knowledgable accounts of some of the history may be found in Ellis (1969), Branagan (1972) and Martin *et al.* (1986).

The title "first coal mine", either in NSW or Tasmania, is problematical. Is surface picking "mining"? If so then there were no less than than eight attempts at mining or harvesting coal in NSW before Knopwood's household took home their first bag of Tasmanian coal, and some years were to elapse before Tasmania's first successful mine (Saltwater River) began operation.

ACKNOWLEDGEMENTS

Many people have assisted in various ways in the compilation of this work. The author would like to thank especially Dr M. R. Banks for useful discussions, particularly on the historical aspects of coal mining and exploration; Associate Professor C. F. K. Diessel for assistance with, and most interesting discussions on, the various aspects of coal petrography, and Mr V. M. Threader who was most supportive of the project and always willing to discuss problems relating to coal geology and mining. Dr R. G. Richardson and Dr D. E. Leaman were very helpful in discussing gravity data. Fellow Department of Resources and Energy geologists, D. J. Jennings, C. R. Calver, K. D. Corbett, and S. M. Forsyth generously allowed use of their unpublished mapping for several areas.

Mr L. Whitham kindly escorted me over the Catamaran and Dalmayne coalfields, to view mining relicts, and provided information on the Catamaran and Kaoota coalfields. I am grateful to Mr I. Brand for allowing me to read, and quote from, his unpublished manuscript on the Saltwater River mine. Mr C. Peck, Commercial Manager of the Cornwall Coal Company, loaned archival photographic material for inclusion in this bulletin.

Department of Resources and Energy draftsmen, D. Burgess, G. Thomas and C. Perry assisted greatly in location of old mine lease records, whilst Miss S. Bennett and the Records staff retrieved many ancient and dusty archived files from most unusual places.

Messrs P. Ruzicka and M. Triffett accompanied the writer on many trips as field assistants, while maps resulting from these outings were drafted by Messrs A. Hollick, G. Dickens, J. Ladaniwskyj, J. Clarke and A. McGuiness.

The text was typed from scruffy pages by Mesdames Claire Humphries, Anne Taylor, Jan Howie and Miss Lisa Doran, and the report was edited by Michael Dix, who also provided useful details on operations, particularly relating to railways, at some old collieries.

THE GEOLOGY OF THE COAL-BEARING FORMATIONS

Introduction

Coal was first discovered in Tasmania by French explorers in 1793. After settlement in 1803, coal was found and mined on a small scale in many places over the eastern half of the State. The first mine, opened in 1834, was at Saltwater River on the Tasman Peninsula, where convicts were employed to mine the coal. There are currently two collieries operating in Tasmania to supply coal to a number of local secondary industries.

Although coal has been found at three stratigraphic intervals within the Tasmania Basin, all the economically important coal reserves are hosted in the Late Triassic coal measures. Two smaller intervals of coal-bearing strata are of Early Permian and Late Permian age.

The Late Triassic black coals formed in a dry forest environment, and are predominantly composed of oxidised woody tissue. The coals are banded with mudstone and claystone, attesting to frequent inundation of the peat. The coals have an ash content of 25–30%, a low sulphur content (0.5%), and a specific energy value of 22–24 MJ/kg.

The Late Permian coals are similar to the Late Triassic coals, but the Early Permian coals are quite different. The latter coals are high in sulphur (up to 5%), low in ash (8–12%), and have a high specific energy (29–30 MJ/kg), but the seams are very thin.

Small deposits of brown coal of Tertiary age, and localised developments of oil shale (Late Carboniferous age), are also known from Tasmania.

Geological Setting

Coal seams have been found in three stratigraphic intervals within the Tasmania Basin. The term Tasmania Basin refers to a structural basin (fig. 1) which contains the remnants of a thick sequence of flat-lying rocks ranging in age from Late Carboniferous to Late Triassic, and known as the Parmeener Supergroup (Banks, 1973). The Parmeener Supergroup is up to two kilometres thick, and has been further subdivided into two divisions (Forsyth *et al.*, 1974); the Lower Division, being predominantly marine; and the Upper Division, being wholly of freshwater origin. In north-east Tasmania the Parmeener Supergroup overlies a folded basement of granite and Siluro-Devonian metaquartzite and greywacke. Elsewhere the basement is varied, being composed of a suite of rocks ranging from Precambrian to Devonian in age.

The Lower (Division of the) Parmeener Supergroup is Late Carboniferous to Permian in age, and often commences with a thick basal tillite followed by mostly marine and glaciomarine rocks. The Lower Parmeener Supergroup contains one freshwater interval—the Early Permian coal-bearing strata (the Preolenna and Mersey Coal Measures and equivalents). This interval is known as the Lower Freshwater Sequence (LFS). The marine rocks underlying this sequence are known as the Lower Marine Sequence, whilst the series of marine rocks overlying the LFS are called the Upper Marine Sequence (fig. 2).

The Upper Parmeener Supergroup is of fluvial origin and is composed of Late Permian to Late Triassic clastic rocks, and overlies the marine rocks of the Lower Parmeener Supergroup. A conformable relationship generally exists

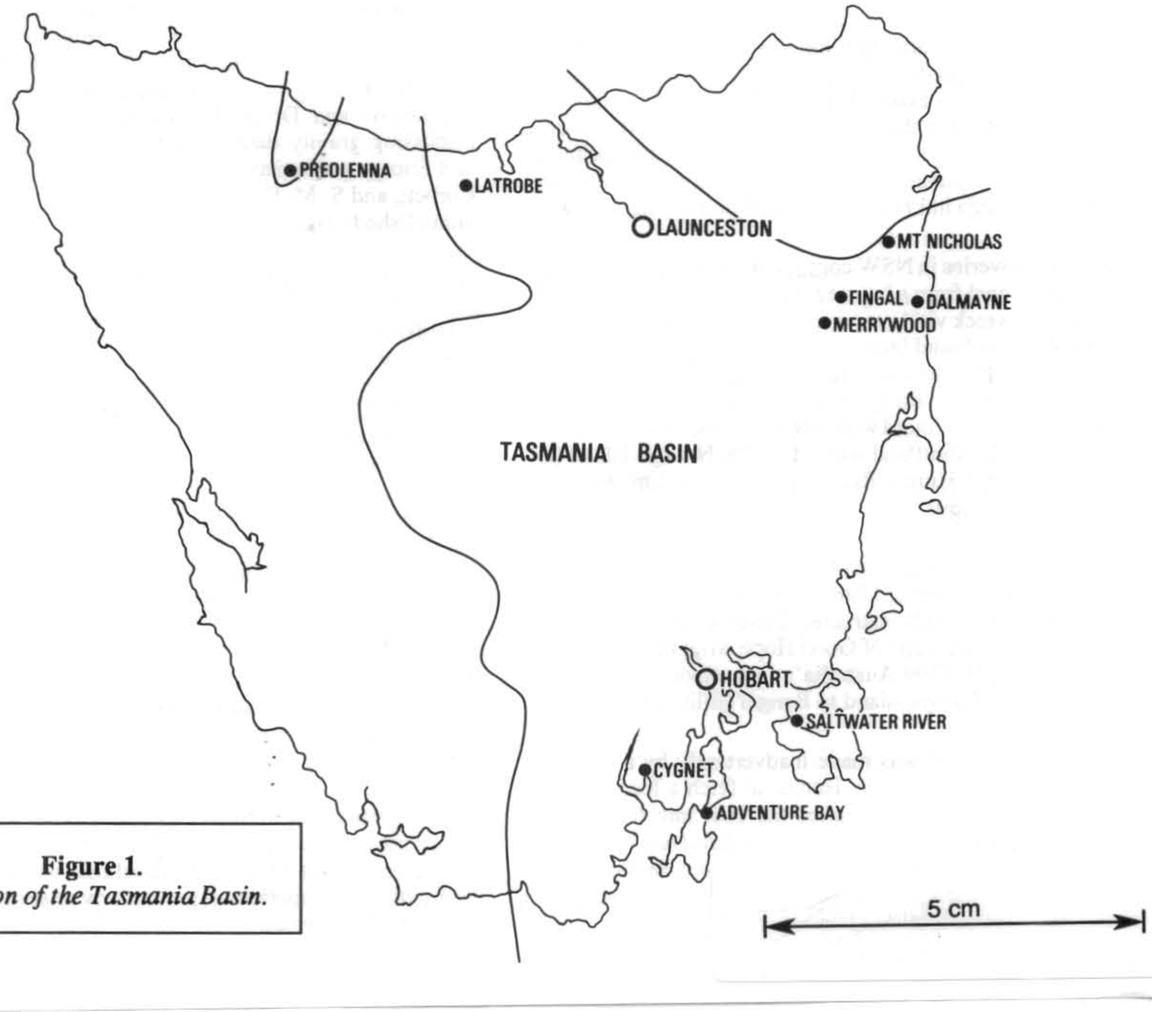


Figure 1.
Location of the Tasmania Basin.

between the Upper and Lower divisions of the Parmeener Supergroup, but in north-eastern Tasmania the boundary is slightly disconformable, coinciding with a Late Permian to Middle Triassic hiatus. Thus the base of the Upper Parmeener Supergroup is Middle Triassic in age in north-eastern Tasmania. The Permian–Triassic boundary lies within siliceous clastic rocks which form the lower portion of the Upper Parmeener Supergroup in central and southern Tasmania, and in these areas the lowest unit is the Late Permian Cygnet Coal Measures and correlates. The Cygnet Coal Measures and correlates are overlain by a sequence of non-coal bearing siliciclastic rocks succeeded by a sequence with lithic and/or quartz sandstone with minor coal occurrences. The upper part of the Upper Division is a lithic sandstone sequence hosting all the economically important coal occurrences known in Tasmania. This lithic sandstone sequence is partly included in the lithic sandstone (upper) facies of the Brady Formation (McKellar, 1957) at Poatina, and elsewhere is known under a variety of largely informal names, e.g. New Town Coal Measures, Langloh Coal Measures, Mt Nicholas Coal Measures and Kaoota Coal Measures.

The stratigraphic position of the coal-bearing lithic sandstone sequence is indicated in Figure 3. Whereas over much of the basin the coal measures occur several hundred metres above the Cygnet Coal Measures, capping the intervening interval of predominantly quartzose sandstone, in the economically important north-eastern (Fingal Valley) area the Cygnet Coal Measures are absent, and only a thin lenticular (0–60 m thick) Middle Triassic quartz sandstone sequence separates the lithic sandstone sequence from the underlying glaciomarine strata of the Lower Parmeener Supergroup. This quartz sandstone sequence is similar in lithology, and approximately in age, to the youngest quartz sandstone horizons found elsewhere in the basin, and in particular is a palynocorrelate of the basal Brady Formation.

The Parmeener Supergroup was deposited in a largely stable environment. Banks (1962) suggested that the sheet-like formation of the Lower Parmeener Supergroup indicates deposition in a shelf environment, with the rate of deposition being 0.003 mm/year. Poor sorting of the Lower Parmeener Supergroup, an unusual feature for shelf sediments, may be partly due to deposition from drifting icebergs. Some tectonic instability is recorded in the Lower Parmeener Supergroup in Middle or Upper Artinskian time, coinciding with a major orogenic movement in New South Wales (part of the Hunter–Bowen Orogeny). The instability resulted in uplift and downwarping, and movement of the zone of maximum thickness.

The Parmeener Supergroup was extensively intruded by tholeiitic magma during the mid Jurassic. Parts of these intrusions have been dated at 170 Ma (Schmidt and McDougall, 1977). More than 8000 km^3 of magma formed a nearly continuous body through the Permian and Triassic sediments over almost the whole island. The dolerite occurs most commonly as discordant sheets or sills although dykes are also seen. Structural features of dolerite intrusion are given in Leaman (1972*a*, 1975*a*). The sheets reach a maximum thickness of around 500 m, and being resistant to erosion dolerite tends to dominate the landscape of the eastern part of the State, capping all of the high mountains and underlying the Central Plateau (Spry, 1962).

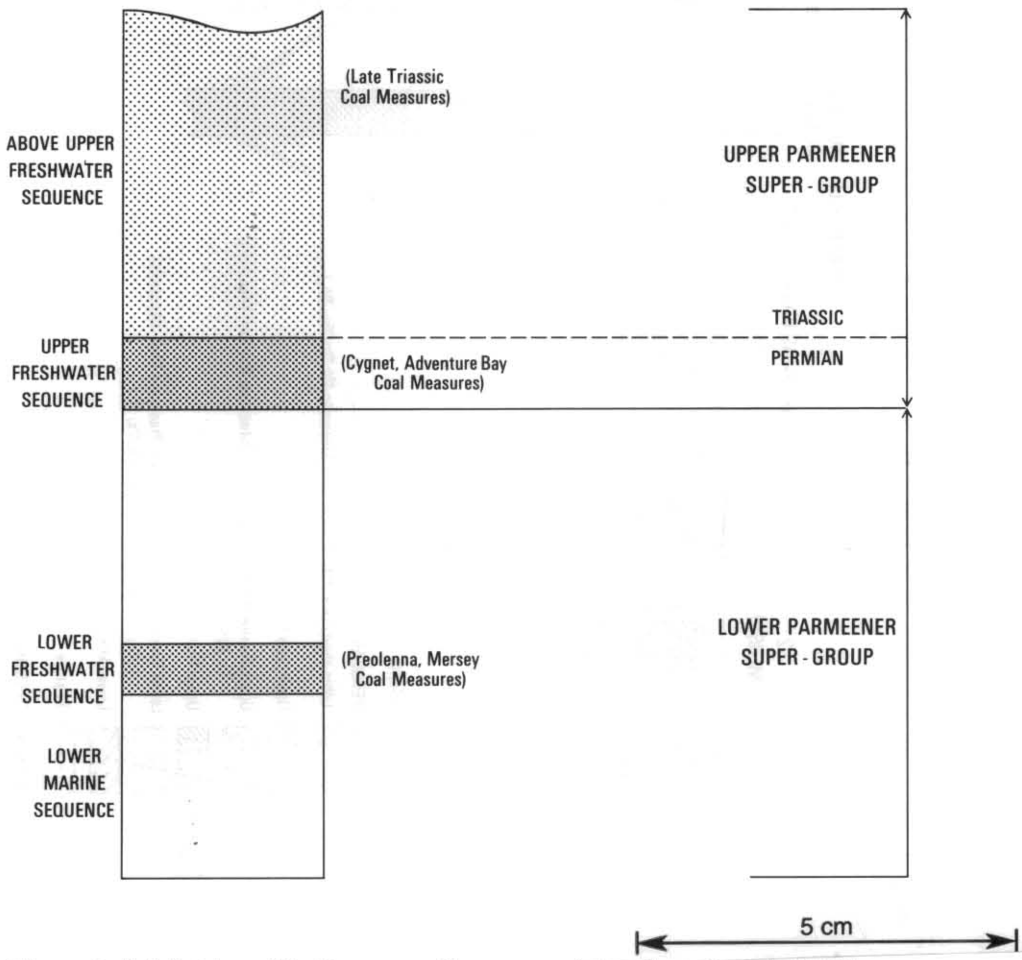


Figure 2. *Subdivision of the Parmeener Supergroup (after Forsyth et al., 1974).*

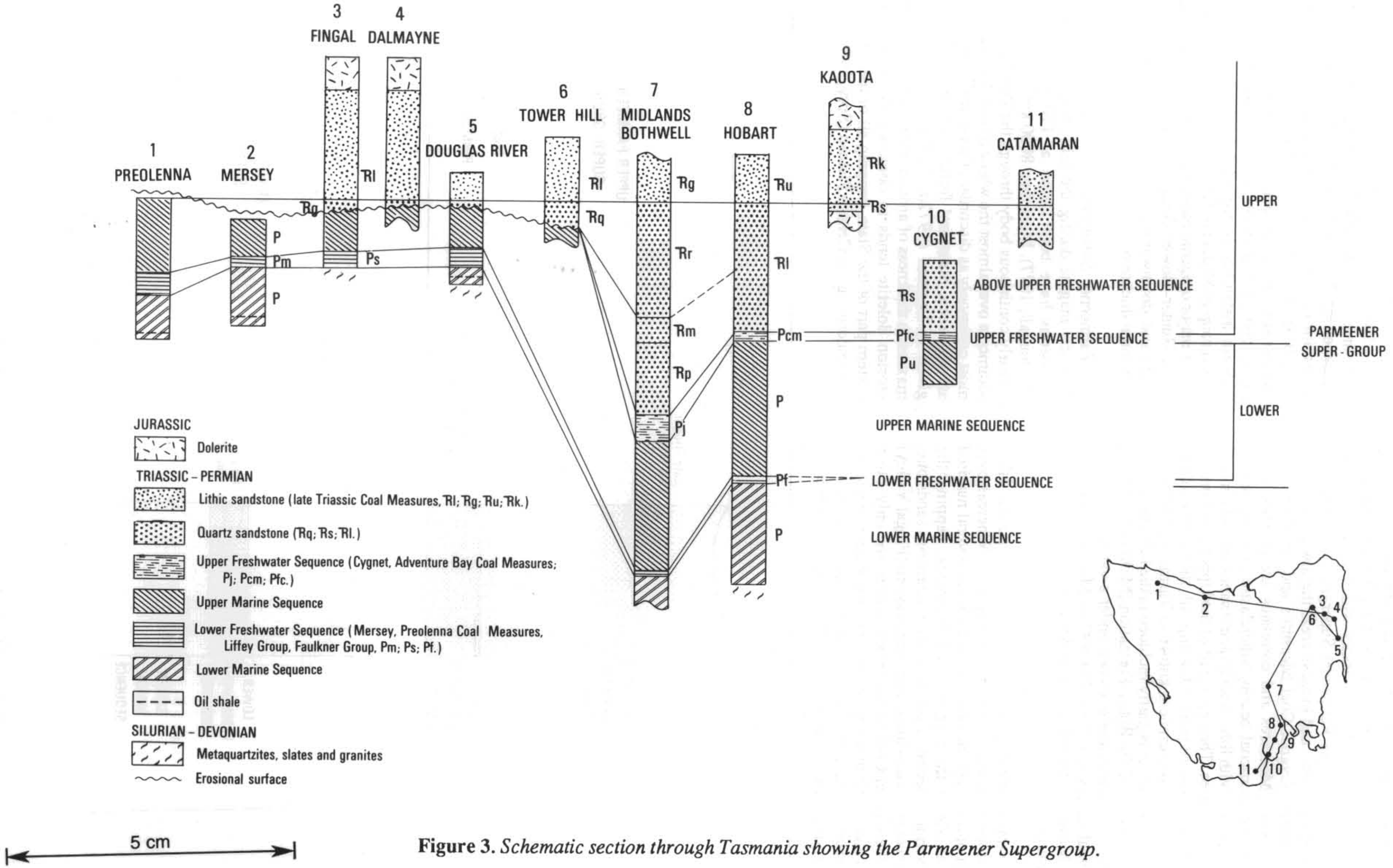


Figure 3. *Schematic section through Tasmania showing the Parmeener Supergroup.*

The East Coast coalfields are covered by an eroded dolerite sheet 100–300 m thick. A regional gravity survey (Leaman and Richardson, 1981) has helped define target zones for coal exploration by delineating faults, dolerite feeders, areas where the coal-bearing section is thickest, and areas where dolerite intrusion has foreshortened or terminated the section.

From the cessation of Triassic sedimentation until Recent times Tasmania has been subject to normal faulting with a NNW trend (Solomon, 1962). Horst and graben structures of major dimensions developed during the late Cretaceous to early Tertiary. As a result of this faulting the coalfields have been fragmented and dislocated. In southern Tasmania there were two phases of faulting; a compressional event in the Mesozoic which was active both before and after the intrusion of dolerite, and a later phase during Early to Middle Tertiary time (Berry and Banks, 1985).

Depositional Environments

EARLY PERMIAN (MERSEY, PREOLENNA COAL MEASURES AND EQUIVALENTS)

The Mersey Coal Measures and equivalents were deposited as a thin sheet of fluviatile sand which covered both earlier Permian highland areas and the earlier Permian sea floor. The sheet ranges from 6–50 m in thickness, with marked local thinning out against residual basement highs (Banks and Clarke, 1987). Some syndepositional faulting has been recognised in the Latrobe area (Banks, 1979). The dominant rock type is a well-sorted siliceous, micaceous, cross-bedded or ripple-marked sandstone with either no marine invertebrate fossils or worm castings and some coaly debris. The distribution of these rocks is shown in Figure 4.

Interbedding with grey siltstone is common. Thin coal seams were deposited around the margins of the depositional basin (Banks, 1962). The environment of deposition of the sand sheet is considered to be a wide sandy coastal plain. Further into the basin strongly bioturbated siltstone with dropstones, presumably glaciomarine deposits and rarely with a shelly fauna, occur interbedded in the sand sheet. In these areas, for example near Goulds Sugarloaf, Bothwell, Ross and areas further south, no coal seams are known. At Ross the sand sheet cross-bedding sets are usually no more than 100–500 mm high, suggesting that they are not the deposits of a major river. At some localities some poorly-sorted beds in the sequence are considered to be littoral deposits, representing beaches where deposition was comparatively rapid.

In south-eastern Tasmania the non-marine sequence contains a thin marine intercalation which produces two cyclothems.

The flora of this period is represented by the plants *Glossopteris*, *Gangamopteris*, and *Cordaites*. Where sampled, the Mersey Coal Measures yield a Substage 3b microflora, which means that these coal measures are significantly older than the Greta Coal Measures of New South Wales and the Collinsvale Coal Measures of Queensland.

The alga *Reinschia* occurs in coals and carbonaceous shales, and at Mt Pelion is common enough to form torbanite (Banks, 1962).

LATE PERMIAN (CYGNET, ADVENTURE BAY COAL MEASURES AND EQUIVALENTS)

The Cygnet Coal Measures and correlates are considered by Banks and Clarke (1987) to have been deposited in fluviatile or upper delta plain conditions. These rocks are overlain by sandstone containing the Early Triassic *Kraeuselisporites saeptatus* Assemblage (Forsyth, 1984*a*).

The Cygnet Coal Measures and equivalents are absent from the north-eastern part of the basin and may be discontinuous elsewhere, possibly due to pre-Triassic erosion (fig. 5).

The dominant rock type is a well-sorted siliceous to arkosic cross-bedded and ripple-marked sandstone, which is pebbly in places. Carbonaceous and siliceous siltstones are commonly interbedded with the sandstones, and are often micaceous (Banks, 1962). During the Late Permian a sandy plain extended across part of the Tasmania Basin, the basin being flanked on the east and west, and also broken up, by hills. Whilst initially sandy, the overall general fining-upwards suggests a gradual lowering of the source area.

The flora at this time evidently consisted of the scouring rush *Phyllotheca*, and the plants *Schizoneura*, *Gangamopteris*, *Glossopteris* and *Vertebraria*. The vegetation preserved is dominantly pteridospermatous but there is evidence of rushes and larger woody gymnosperms (Banks, 1962). The only animal remains are worm tubes and castings.

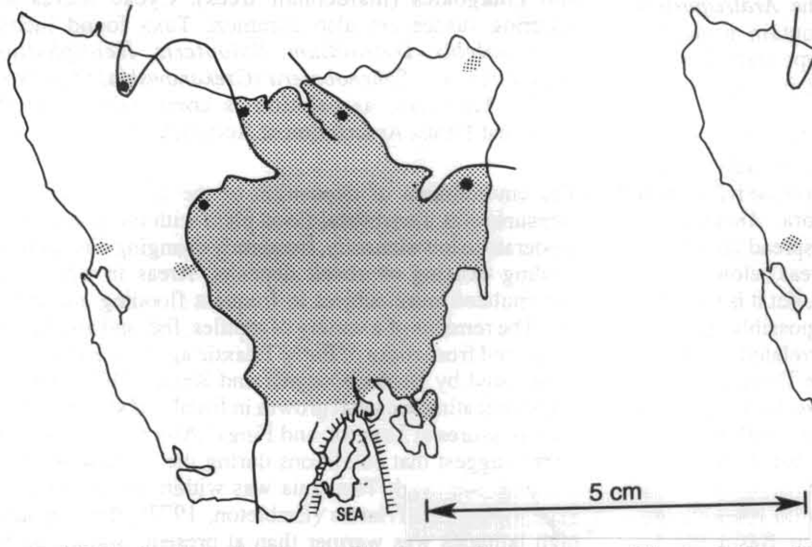


Figure 4. *Distribution of the Lower Freshwater Sequence (Mersey Coal Measures and equivalents); Coal occurrences indicated by a solid circle.*

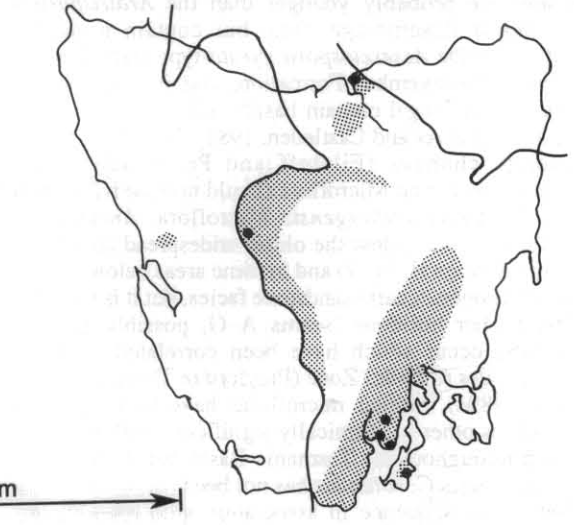


Figure 5. *Distribution of the Upper Freshwater Sequence (Cygnet Coal Measures and equivalents); Coal occurrences indicated by a solid circle.*

LATE TRIASSIC COAL MEASURES

Although usually obscured by a thick cover of dolerite, the Late Triassic coal-bearing lithic sandstone sequence is found discontinuously over most of eastern and southern Tasmania (fig. 6). Alluvial fining-upwards cycles were noted in drill core by Threader (1968), suggesting that the lithic sandstone is of fluvial origin. Bacon (1979) suggested, from Markov chain analysis of the cycles, that a meandering stream fluvial system of moderate to high sinuosity existed during the deposition of the lithic sandstone sequence. The arenite is thought to represent a channel deposits, and the lutite and coal overbank deposits on extensive floodplains. Intraformational breccias and pebbly horizons represent channel lags.

The sequence has a higher ratio of arenite to lutite than is usually found in classical high-sinuosity meandering streams. This may be attributed to repeated erosion of upper (overbank) parts of cycles formed during channel migration, producing common, relatively thick (>20 m) sections composed only of channel sandstones, in which incomplete fining-up cyclicity may still be discerned. Lateral and vertical changes in the relative abundance of arenite and lutite suggest temporal and spatial variation in the fluvial regime, with lutites more significant in the lowermost and uppermost parts of the sequence.

Age of the Late Triassic coals

There is a gradual reintroduction of coal into the Upper Parmeener Supergroup following the dearth of coal seams through the early Triassic quartz sandstone, which occurs immediately above the Cygnet Coal Measures. Coalified logs, but no coal seams, are found in the Tiers Formation and correlates. A gradual but intermittent appearance of coal seams occurs in the Brady Formation or correlates, often in association with quartz sandstone, culminating in generally thicker and economically more important coal seams in the lithic (upper) facies of the Brady Formation or correlates, and in younger unnamed strata.

Palynology

Palynology indicates that at least the upper part of the Tiers Formation and correlates are referable to the *Aratrisporites parvispinosus* Assemblage Zone (Helby, 1973) and the *Asseretospora gyrata* Microflora (de Jersey, 1975; Playford *et al.*, 1982; Forsyth, 1989*a*). The basal Brady Formation and correlates are probably younger than the *Aratrisporites parvispinosus* Assemblage Zone but contain a similar microflora to the *Asseretospora gyrata*-type microflora of the upper Moolayember Formation, and in addition the correlates near Fingal contain basalt radiometrically dated 233 ± 5 Ma (Calver and Castleden, 1981). Following recent taxonomic changes (Filatoff and Price, 1988), the *Asseretospora gyrata* Microflora should now be referred to as the *Striatella seebergensis* Microflora. *Annulispora folliculosa* appears below the oldest widespread coal seam near Fingal (seam H, fig. 7) and in some areas below the top of the diachronous quartz sandstone facies, but it is not until slightly higher horizons (seams A–G, possibly H) that microfloras occur which have been correlated with the *Craterisporites rotundus* Zone (Playford *in* Threader, 1968; Forsyth, 1989*a*). Similar microfloras have been obtained from various other economically significant coal measures scattered throughout the Tasmania Basin but in detail the nominate species *C. rotundus* has not been found until near the top of the sequence in association with *Annulispora densatus* (Forsyth, 1989*a*). In the Bowen Basin the *C. rotundus* Zone is considered to be Karnian in age (de Jersey, 1975), thus the main coal-bearing lithic sandstone sequence is considered to be Karnian (early Late Triassic) in age. So far known from only one locality, the coal measures sequence passes up into strata with microflora attributed to the lower *Polycingulatisporites crenulatus* Zone (de Jersey, 1975, Helby *et al.*, 1987) of probable Norian age.

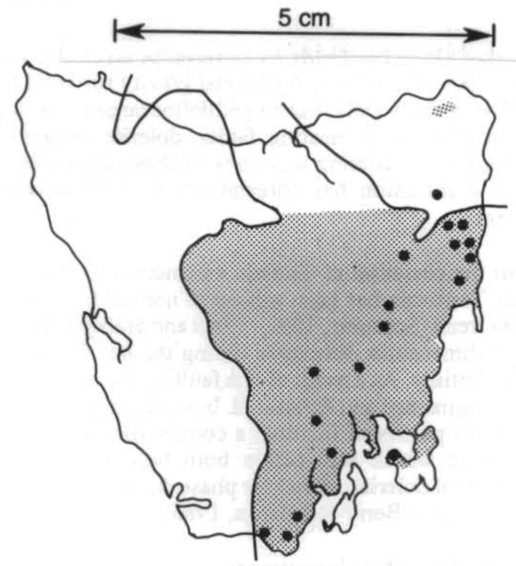


Figure 6. *Distribution of the Late Triassic lithic sandstone sequence. Coal seams >1.5 m thick indicated by a solid circle.*

Biotite extracted from a Triassic tuff exposed in the Denison Rivulet has been radiometrically dated at 214 ± 1 Ma (Bacon and Green, 1984), approximating the 215 ± 5 Ma Karnian/Norian boundary age proposed by Webb (1981). This tuff crops out in the upper part of the lithic arenite sequence. Similar acid tuffs on Fingal Tier are restricted to that part of the sequence above the 'B' seam. A spore assemblage from about 50 m stratigraphically below the dated tuff also belongs to the *Craterisporites rotundus* zone (Forsyth, 1984*b*). A further assemblage from immediately below the tuff contains *Semiretisporis denmeadii*, and probably occurs within the *C. rotundus* Zone (Forsyth, 1989*a*).

Macroflora

Coalified plant remains of fair preservation are quite common in the coal-bearing sequence. The flora is dominated by filicales (ferns), pteridosperms (seed ferns) and ginkgoales (maidenhair trees). Cycad leaves and scouring rushes are also common. Taxa found include *Cladophlebis, Dicroidium, Xylopteris, Heidiphyllum, Ginkgoites*, and *Sphenobaiera'(Czekanowskia)* (Townrow, 1962). The plant association is comparable with the Broadleaf Forest Association of Retallack (1977).

The environment of deposition of the Late Triassic coal measures was a terrestrial flood plain with many streams of moderate to low sinuosity, frequently changing direction and eroding existing overbank deposits. Areas in which peat accumulated were subject to frequent flooding and drying out. The remains of a variety of reptiles, fish and amphibians recovered from rocks of Early Triassic age near Hobart have been listed by Banks, Cosgriff and Kemp (1978). Growth rings indicating seasonal growth in fossilised wood from the coal measures at Langloh and Fingal (Morrison and Bacon, 1986) suggest that conditions during the Triassic were not freezing. Although Tasmania was within 20° of the South Pole during the Triassic (Embleton, 1973), the climate at high latitudes was warmer than at present. Studies on the distribution of fossil flora (Barnard, 1973), the range of some species of the lamellibranch *Monotis* (Westermann, 1973), and examination of oxygen and deuterium isotope compositions in cherts in central U.S.A. (Knauth and Epstein, 1976) all conclude that Triassic temperatures were globally warmer than at present.

The Tasmanian Triassic coal measures were deposited in a cold temperate environment which supported a broadleaf forest. Coal swamps were laterally restricted and short-lived, giving rise to thin, discontinuous coal seams.

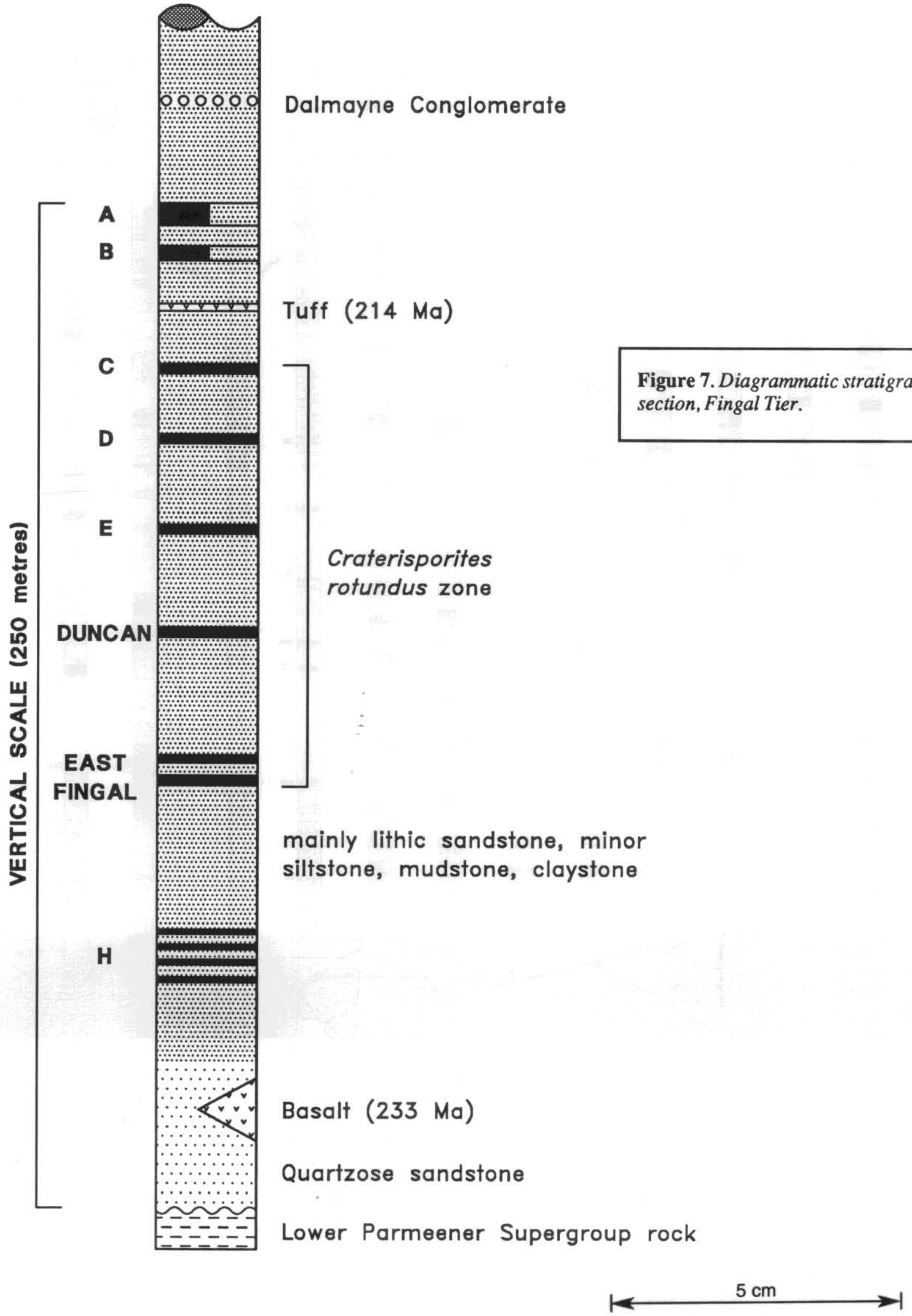
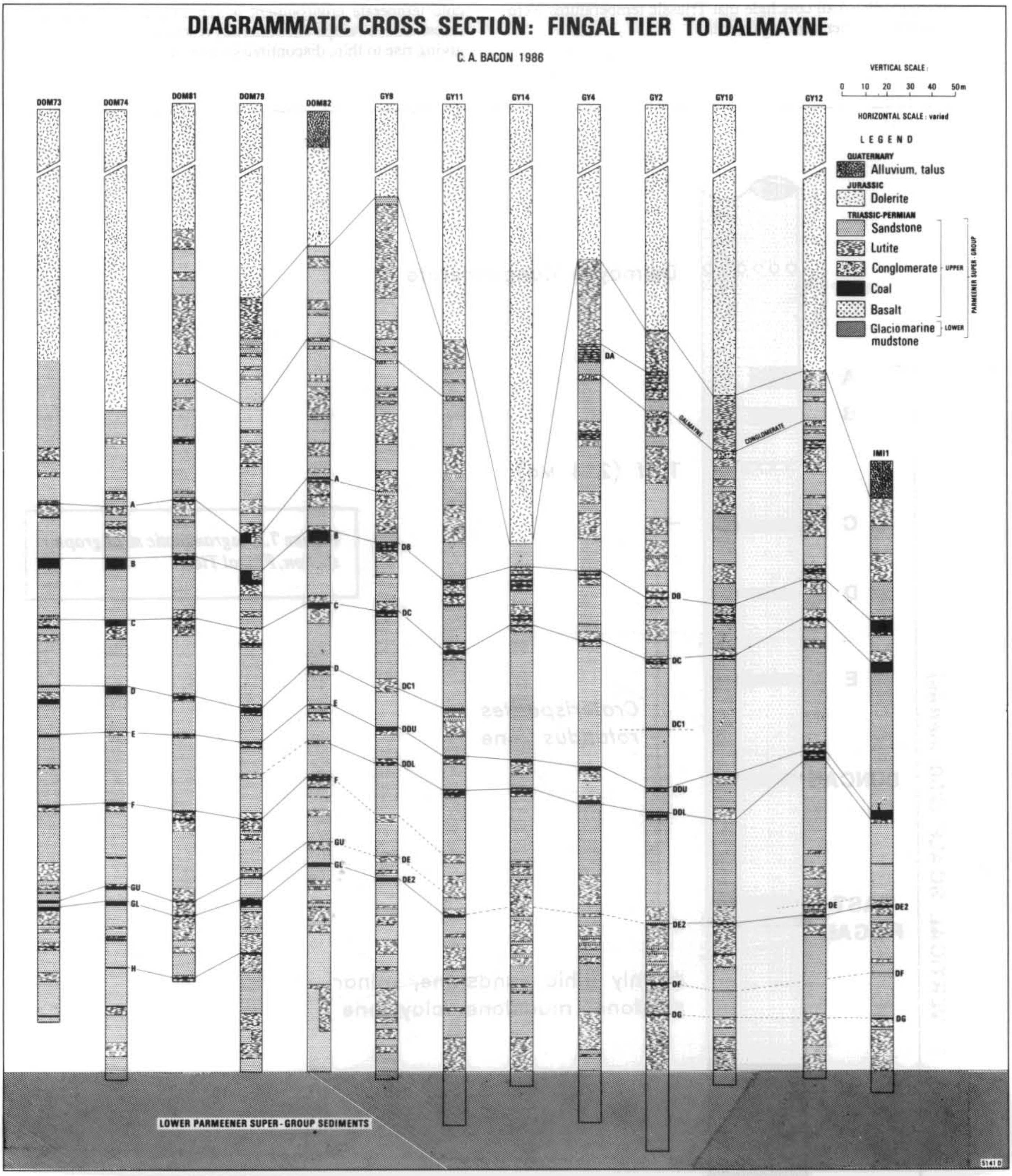


Figure 7. *Diagrammatic stratigraphic section, Fingal Tier.*



DIAGRAMMATIC CROSS SECTION: FINGAL TIER TO DALMAYNE
C. A. BACON 1986
VERTICAL SCALE:
0 10 20 30 40 50m
HORIZONTAL SCALE: varied
LEGEND
QUATERNARY
Alluvium, talus
JURASSIC
Dolerite
TRIASSIC-PERMIAN
Sandstone
Lutite
Conglomerate
Coal
Basalt
Glaciomarine mudstone
UPPER
LOWER
PARMEENER SUPER-GROUP
DOM73
DOM74
DOM81
DOM79
DOM82
GY9
GY11
GY14
GY4
GY2
GY10
GY12
IMI1
A
B
C
D
E
F
GU
GL
H
DA
DB
DC
DC1
DDU
DDL
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DE2
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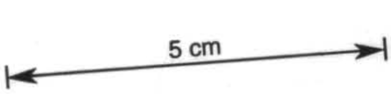
DG
DALMAYNE
CONGLOMERATE
LOWER PARMEENER SUPER-GROUP SEDIMENTS
5141 D

Figure 8.



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GEOLOGY OF THE COALFIELDS

Fingal–Mt Nicholas–Dalmayne Coalfields

The bulk of the State's coal reserves are in the north-eastern part of the State, in the Fingal–Mt Nicholas–Dalmayne coalfields.

The basement rocks in this area are Devonian granite and folded and cleaved Siluro-Devonian quartzwacke turbidite. These are unconformably overlain by the largely marine Lower Parmeener Supergroup, which is about 120 m thick around Fingal and Dalmayne but of variable thickness due to erosion prior to the deposition of the freshwater Upper Parmeener Supergroup.

At the base of the Upper Parmeener Supergroup is a thin unit of dominantly quartz arenite, which is only 2–3 m thick over most of the area. The rest of the Triassic sequence, about 350 m thick, consists dominantly of medium-grained lithic arenite, interbedded with mudstone, carbonaceous mudstone, and coal. The lithic arenite is typically thick-bedded, often showing trough cross-bedding. Intraformational breccia, with rip-up clasts of mudstone and coal, is common at the base of sandstone beds.

Seams can be correlated across Fingal Tier into the adjoining Dalmayne coalfield to the east, although some seams split and in parts are represented by mudstone intervals; faulting is common (fig. 8).

There are eight major coal seams on Fingal Tier; these have been designated seams A–H. Some, notably the A and B seams, are better described as carbonaceous intervals, as they consist of plies of coal less than 0.5 m thick, interbedded with carbonaceous mudstone and claystone over intervals of 5–10 metres. All the seams are characterised by a high inherent ash content, and have only a small (10%) component of bright coal. The coal is of medium rank, with a high ash and low sulphur content, and is suitable for steam-raising purposes.

No satisfactory marker horizons have been recognised in the fluvial sequence on Fingal Tier. In order to obtain a reliable correlation of coal seams it has been necessary to drill to the glaciomarine sequences of the Lower Parmeener Supergroup. This basement dips gently to the east and forms a known horizon from which correlation of coal seams may be more confidently undertaken. Drill holes must commonly be 500–600 m deep in order to reach the glaciomarine basement.

On parts of Fingal Tier a conglomerate horizon (1–3 m thick) has proved to be a reasonably good marker where present. The conglomerate band (informally called the Dalmayne Conglomerate) is composed of well-rounded pebbles and cobbles of green and white quartzite, acid pryoclastic rocks, and slate, elongate to spherical in shape, and set in a matrix of coarse-grained lithic sandstone. The conglomerate band is, however, too patchy in areal distribution to be a significant marker bed.

A number of tuff intersections have been recorded in the eastern part of Fingal Tier. The tuff is an acid, air-fall vitric tuff, with the intersections one metre thick. The patchy areal distribution of the tuff makes it of little use as a marker horizon.

The two seams which are of greatest economic interest on Fingal Tier are the Duncan (seam F) and the East Fingal (seam G). The Duncan Seam is currently mined at the Duncan Colliery, and is the only seam to have been extensively worked. Typically the seam consists of 2–3 m of dull coal with minor clay and mudstone partings. The raw ash content is approximately 30%, and the specific energy 22–24 MJ/kg.

The East Fingal Seam is about 30 m stratigraphically below the Duncan Seam, and is commonly split. The Upper and Lower Splits (Gu and Gl) of the East Fingal Seam are commonly 1–2 m thick, with the intra-seam sediments 0–10 m thick. The coal quality is similar to that of the Duncan Seam.

A thick sill of dolerite covers the coal-bearing sediments of the Dalmayne and Fingal Tier coalfields. This dolerite is commonly 100–300 m thick, and forms an extensive plateau, part of the central Eastern Highlands.

The Mt Nicholas coalfield, north-east of Fingal Tier, is confined to the Nicholas Range, which like Fingal Tier is capped by dolerite. The sedimentary sequence is equivalent to that of Fingal Tier and Dalmayne, although the coal seams are found in three intervals within the lithic sandstone sequence on Mt Nicholas.

The upper group of seams are of poor quality coal interbedded with claystone and mudstone. The middle and lower groups of seams contain the seams which have been previously mined. The lower group of seams on Mt Nicholas are equivalent to the East Fingal interval further south.

The Minor Coalfields

EARLY PERMIAN COALFIELDS

Preolenna

The Preolenna coalfield is located 20 km south-west of Wynyard. The Preolenna Coal Measures are equivalent to the Mersey Coal Measures further east, and overlie a marine siltstone (the Inglis Siltstone and correlates) in which is found a Tasmanite Oil Shale horizon. The Preolenna Coal Measures reach a maximum thickness of 50 m, and are overlain by a marine sandstone sequence, the Flowerdale Sandstone.

The coal measures have been extensively faulted. Four thin seams of coal 0.2–0.6 m thick are known from the area and dip at 14–25°. Historic mining activity was unsuccessful due to the nature of the seams, which frequently thin out and are disrupted by faulting.

Mersey–Don

Coal has been won intermittently from the Mersey Coal Measures in the area between the Mersey and Don Rivers. A total of 21 small collieries worked in this field between 1850 and 1962.

The coal measures in this area are 19–29 m thick, and are underlain by siltstone and mudstone (Spreyton Beds) and overlain by the Kelcey Tier Beds. The seams are thin (<1.0 m thick) and are not laterally extensive. Mining was done by hand using both bord and pillar, and longwall methods of extraction.

LATE PERMIAN COALFIELDS

The Cygnet Coal Measures is the lowest unit of the Upper Parmeener Supergroup, and is underlain by glaciomarine mudstone of the Lower Parmeener Supergroup and overlain by quartzose sandstone.

At Cygnet the coal measures sequence is about 30 m thick and crops out along the slopes of Mt Cygnet and Heeneys Bluff, near the township of Cygnet. Two seams, each less than 1.0 m thick, have been mined from a number of adits driven in on outcrops. The small area of the Cygnet Coal Measures at Cygnet is badly disrupted by faulting. Jurassic dolerite caps Mt Cygnet and is faulted against the sedimentary sequence to the east of Heeneys Bluff.

These coal measures also crop out at Adventure Bay on Bruny Island, where they were mined briefly in the 1880s.

LATE TRIASSIC COALFIELDS

Triassic coal has been mined from a large number of places in the eastern part of Tasmania. At Saltwater River the Colonial Government ran a mine using convict labour. The coalfield here is confined to a small downfaulted wedge-shaped block of lithic sandstone, surrounded by barren quartzose sandstone.

South of Dalmayne, near the Douglas River, Triassic coal was mined from shafts sunk into the coastal plain in the 1850s. Coal was also mined from shafts further north at Seymour in the 1880s.

Shafts were sunk at New Town, near Hobart, in the 1880s. These shafts were all sunk directly into lithic sandstone.

At Kaoota, south of Hobart, and at Langloh in the Upper Derwent Valley the coal has been mined from adits driven from outcrop. The coal-bearing section, around 100 m thick at both locations, rests on a dolerite floor. The area of these two coalfields is quite small—one square kilometre for Kaoota and ten square kilometres for Langloh. Both have been formed by the rafting-up of the lithic sandstone sequence by intrusive dolerite.

Significant finds of coal in Late Triassic rocks have been made near Ben Lomond (Stanhope–Mt Christie coalfield), in the Midlands area, and in the south of Tasmania around Catamaran.

HISTORY OF COAL DISCOVERIES AND COAL MINING IN TASMANIA

Development of the Various Coalfields

The household of the Reverend Robert Knopwood evidently used coal from the Coal River as a domestic fuel as early as 1805. Knopwood records in his diary on 14 October 1805, and subsequently on a number of occasions, how coal was brought home from the Coal River.

The mining of coal did not start properly until some years later. A find of Tertiary coal near Macquarie Harbour was unsuccessfully worked for a short time. The confession of the convict/cannibal Alexander Pearce (after whom the Pieman River is named as he was a pieman by trade) to Lt Cuthbertson, mentions having to call at the "miners hut" for Robert Greenhill, who was to accompany the escapees as navigator. Pearce, who escaped on 18 September 1822, when interrogated by the Reverend Knopwood, also mentions the coal mining:

> "....seven prisoners forcibly seized two boats at Kelly's Basin, where they were employed in cutting timber under the charge of an overseer, and proceeded to the coal works where they were accompanied by Robert Greenhill...." (Sprod, 1977).

Coal was discovered on the western bank of Norfolk Bay (near Plunkett Point) in February 1833 by two surveyors, Woodward and Hughes (Governor's Office records (GO) 33/16/265*). In 1834 a mining operation was commenced by the Colonial Government to extract the coal. This was the first successful mining venture to be started in Tasmania. The initial mine development was supervised by a convict named Lacey, who gained his freedom from the successful planning and operation of the mine. Coal was being sold in Hobart for 10/- to 19/- ($1.00 to $1.90) per ton by June 1834 (Colonial Secretary's Office records (CSO) 412/9273, 13 June 1834).

A steam engine, designed and erected by Alexander Clark, was installed in 1842. Prior to this, coal was raised up shafts by a winch which used convict labour (Ford, 1932), and two pumps for removing water from the workings were also manned by convicts. The mine headings were only 1.2 m high and the ventilation was poor. The roof, which was composed of shale, was supposed to be left, but was often taken to make the working conditions easier (*Advertiser*, 9 August 1839, p. 3).

Until 1840 convicts were sent to work at the coal mine as punishment, although only a small number of those at the mine actually worked underground. From 1840 to 1848 the convicts working at the mine were those on probation, and were released at the end of their probationary periods (Booth, 1962).

From 1848 to 1877, when the mine closed, the operation was leased out to private individuals, with the terms of the lease stipulating that a certain tonnage of coal at a given price was to be supplied to the Colonial Government. The first lessee (1848–1851) was Alexander Clark, who was forbidden to use convict labour underground (Comptroller General's Files (CGF) 10591/4, 30 September 1848).

From 1851 to 1854 the mine was leased to James Fulton, then from 1854 to 1856 to William Nicholas and John Thomas, who lost their lease because they could not supply any coal from the mine. The last, and probably most successful lessee was James Hurst, who held the lease from 1858 until his death in 1877, by which time he was becoming interested in the Sandfly coalfield. The coal was used as a domestic fuel in Hobart although throughout there were constant complaints regarding the quality of the coal. All extraction was done using the bord and pillar method.

The Macquarie Harbour mining venture was unsuccessful and short-lived, as a despatch from Lt-Governor Sorell to Under Secretary Horton dated 29 November 1824 reads:

> ".... At the penal settlement of Macquarie Harbour where the indications of coal were so strong as to induce the Deputy Surveyor-General (Evans) to report its existence there, the want of professional research had deprived the local Government of the

* Records held in the Archives Office of Tasmania.

means of working it." (Historical Records of Australia (HRA) III, p. 583).

A venture into coal mining was made in 1840 by Charles Swanston and eight others, who formed a syndicate and approached the Government of the day for assistance in sinking a shaft near Southport. The targets of this venture were seams in the Cygnet Coal Measures of Permian age. Governor Franklin granted a lease for 21 years (Franklin to Secretary of State, 13 June 1840). Overseer Lacey and four experienced miners from the Saltwater River mine were instructed to go to Southport and sink a shaft (Forster to O'Hara Booth, 13 May 1840; CSO/224/5707), even though O'Hara Booth protested that such an action would leave the Saltwater River Mine understaffed and lead to coal shortages during the coming winter (O'Hara Booth to Forster, 5 June 1840; CSO/224/5707).

The proposal by Swanston was that the Government provide the labour for sinking the shaft and operating the mine, with the company to provide materials, and if successful, the company (The Van Diemens Land Coal Company) would lease the mine for 99 years at a cost of 2½% of the profits (Executive Council Minutes, 19 May 1840). The scheme was proposed again in 1841 and 1842 (Hartwell, 1954).

The Government partly agreed with the proposal, and a shaft was sunk in 1842. Some 1300 tons of coal were brought to the Hobart Market (*Colonial Times*, 17 May 1842). The Government Surveyor, Jones, claimed that most of this coal was obtained from the outcrop on the foreshore, and not from any regular winning, so the coal was dirty (CSO 8/108/2279, 13 July 1844).

The mining operation was not profitable and collapsed, the syndicate owing the Government £4,316 ($8,632) for the services of convict miners, an overseer, and for tools and stores supplied by the Government (GO 1/54, 9 May 1844, p. 90).

The company had a brief period of paper prosperity in 1840, when the shares rose from ten shillings ($1) to £10 ($20) each. However, on the collapse of the company, the shareholders could not be traced and the Government was forced to forfeit the sum owing (GO 33/78, 31 March 1853, p. 713–717). The affair became known as the "Southport Swindle" (Booth, 1962). Swanston was, at the time, one of two Attorneys General, and was later involved in coal mining on Schouten Island as well as many other industrial ventures.

An outcrop of coal was opened by a James Bonney on his property near Richmond, and the mine offered for sale in 1840 (*True Colonist*, 20 March 1840). Bonney repeatedly asked for the loan of Government equipment and workers to work his coal (CSO 8/2/295, 22 June 1841; 10 August 1841; 13 August 1841), and even offered the mine to the Government (CSO 8/2/295, 23 September 1841). However this was rejected.

Government Surveyor Jones visited this mine and additional prospecting workings at Jerusalem (now Colebrook) in January 1844, with a view to the Government taking over the workings. Bonney's Mine at Richmond was described as a drift driven for six metres on the dip of the seam, now full of water. The coal was only 150 mm thick, with 1.2 m of shale above the coal (CSO 8/108/2279, 2 January 1844).

James Clarke rediscovered coal near Jerusalem in 1841 (Records Lands and Surveys Department (LSD) 1/28/458, 1 August 1841) and was employed to sink a trial shaft there on behalf of the Government (CSO 22/47/190, 5 December 1841).

Government Surveyor Jones inspected the Jerusalem workings in 1844, and recorded one 1.2 m thick outcrop in Wallaby Creek (a tributary of the Coal River) and another outcrop 790 mm thick into which an adit had been driven for 90 metres. Two shafts had also been sunk, both of which intersected the coal seam (CSO 8/108/2279, 15 January 1844).

As a result of Jones' inspection, the Government decided to open up the Jerusalem mine, and work started in March 1844 (CSO 8/10/2279, 11 March 1844). Jones reported that two more seams had been opened up by August 1844 (CSO 8/108/2279, 10 August 1844) but the quality of the coal was apparently too poor to warrant further investigation and the operation closed later that month (CSO 8/108/2279, 21 August 1844).

Governor Franklin granted to Jesse and Isaac Garland a lease to mine coal on Schouten Island for six months from 16 September 1843 (CSO 22/84/1807, p. 149). The lease was extended for an additional six months, but a further extension was refused on the grounds that the Government planned to set up a probation station on the island (CSO 22/84/1807, p. 165–167). However the probation station was never built. Some 200 tons of coal from Schouten Island were on sale in Hobart in September 1844 (*Colonial Times*, 27 August 1844).

The Australasian Smelting Company was formed in August 1848 by Charles Swanston (of the Southport coal venture), with the object of procuring copper or other ore from Adelaide to be refined in or near Van Diemens Land. The company had a local board of directors and a committee in Adelaide (*Hobart Guardian*, 3 July 1850). In 1848 offers were made by South Australian smelting companies to take 25,000 tons of coal per year for 21 shillings ($2.10) per ton (Denison to Grey, 18 May 1849).

Swanston's smelting company formed the Schouten Island Coal Company in response to this offer, and began mining even before a lease was issued. Sixty tons of coal from Schouten Island were unloaded in Hobart in November 1848 (CSO 24/78/2496). A lease to mine coal for 21 years on payment of a royalty of two pennies/ton was issued in December 1848. Interest in the venture declined, and no mining operation actually started in earnest.

With the offer from the Adelaide smelting companies, enquiries were made about coal found south of the Douglas River by the Garlands in 1843. Governor Denison offered this coal on the same terms as the lease for the Schouten Island coal (Denison to Grey, 18 May 1849).

Dr Joseph Milligan, who had inspected the Tasmanian coalfields in 1848 (Milligan, 1849), set up the Douglas River Coal Company in May 1849 to exploit the seams south of the Douglas River. Under the terms of the lease, the payment of two pennies/ton royalty was to be used by the Government to erect a wharf at Bicheno and lay a tramway to the mine (CSO 24/104/3280). Work commenced close to the Denison Rivulet, about 1.6 km from the sea. Two seams were mined from two shafts for a short time. Transporting the coal to Bicheno (a distance of 6.5 km) was very costly, and after 800 tons had been raised, interest was transferred to an area closer to the cost (near Old Mines Lagoon), where four shafts and a number of bores were sunk. These workings were known as the Outer Mines (Gould, 1861*b*). Coal from this area was on sale in Hobart in 1850, when ten tons were sold by auction (*Hobart Town Courier*, 30 October 1850).

The company spent large sums building the tramway from Bicheno to the mines, as the Government failed to complete the job. The tramway was opened in December 1854. A

Table 1. *Major coal discoveries in Tasmania*

DATE	PLACE	PERSON(S)	REFERENCE
15.2.1793	South Cape Bay	J-J. H. de Labillardière	Labillardière, 1800, Vol. 2, p.22
8.11.1803	Coal River, Richmond	James Meehan (surveyor)	TSA map, Monmouth Plan 0
1809	Schouten Island	James Stacey, shipwrecked sailor	GO 39/4, p. 29
1813(?), certainly pre -1824	Jerusalem (Colebrook)		Besford, 1958
1815	Macquarie Harbour	Captain James Kelly, (mariner & explorer)	*Hobart Town Gazette*, 15 June 1816
1820	Adventure Bay	Thomas Kent (tanner)	HRA III (3), p. 257
pre-1823	New Town		Winch, 1823; based on specimens sent by J. Scott
1824	Huon Inlet (?Coal Mine Bay)	Thomas Scott	*Leg. Council J.* 6, pap. 16, 1861
pre-1831	Emmett's Farm, New Town Road	Roberts to Arthur, 5.9.1831	CSO 1/120/3024
pre-1831	Satellite Island	(no coal on this island)	*Ross's Almanack* (1831), p. 30
pre-1831	New Norfolk	Anon.	*Ross's Almanack* (1831), p. 30
pre-1831	Jericho	Anon.	*Ross's Almanack* (1831), p. 30
1832	near Hampshire (?West Takone, ?Preolenna)	Joseph Milligan	VDL Co. Annual Report, 1832
1833, May	Plunkett Point	George Woodward & James Hughes (surveyors)	CSO 1/680/15052, GO 33/16 pp. 265–5, and O'Hara Booth diaries 23.5.1833
1836	Mt Communication	Lacey & O'Hara Booth (O'Hara Booth to G. T. Boyes)	CSO 22/67/1473
1837	Deer Point		Lhotsky; CSO 5/72/1584
1838	Northern part of Recherche Bay	Captain James Kelly	Mackaness, 1947, p. 50
In or pre-1840	Southport		Executive Council Minutes 19.5.1840
1841	Jerusalem (Colebrook)	James Clare (rediscovery)	LSD 1-28-458 1, August 1841
1843	Denison Rivulet	Jesse & Isaac Garland	CSO 22/84/1807
1843	Apsley River (Llandaff)	Jesse & Isaac Garland	CSO 22/84/1807
1843 (certainly pre-1849)	Douglas River		J. Lyne, in *Proc. R. Soc. VDL.* 1, p. 163
1845	Spring Hill, Jordan River		Strzelecki, 1845
29.7.1848	Falmouth	Anon.	*Hobart Town Courier*
15.12.1848	Spring Bay		*Proc. R. Soc. VDL.* 1, 159
pre-1849	Fingal		Milligan, 1849
pre-1849	Mt Nicholas		Milligan, 1849
pre-1849	Langloh ("High Plains")	Chilton, well sinking	*Proc. R. Soc. VDL.* 1, p. 173 and Johnston, 1888, p. 175
pre-1849	Lagoon Rivulet		*Proc. R. Soc. VDL.* 1, p. 175
pre-13.3.1850	Ouse River		*Proc. R. Soc. VDL.* 1, p. 272
pre-8.5.1850	Beckfords, River Tamar		*Proc. R. Soc. VDL.* 1, p. 278
pre-10.7.1850	below Whirlpool Reach, River Tamar		*Proc. R. Soc. VDL.* 1, p. 283
pre-11.9.1850	Ben Lomond Rivulet	J. Scott	*Proc. R. Soc. VDL.* 1, p. 294
pre-13.11.1850	Three Hut Point		*Proc. R. Soc. VDL.* 1, p. 298

DATE	PLACE	PERSON(S)	REFERENCE
1850	Bott Gorge	William Dean & David Cocker	Ramsay, 1958
1851	New Town		*Hobart Town Courier*, March 29, 1851
pre-1856	'Sherwood' Clyde River		*Rep. R. Soc. VDL.* 1855, p. 34
1852	Coal Hill (?near head of Cuvier Valley)	Burgess, in ?Charles Gould	Gould, 1860
1861	Dalmayne	Charles Gould	Gould, 1861*b*
1861	Seymour	Algernon Horatio Swift	CSD 4/6/40 11.12.1861
1862	Prosser Plains (Buckland)	Z. Williams	Report to Senate Select Committee on Coalfields, 1864 (DOM Old Series 15)
1862	Red Rock (Merrywood)	Z. Williams	DOM Old Series 15
1862	Lewis Hill	Z. Williams	DOM Old Series 15
1864	Ben Lomond	J. Lamont	DOM lease files
1869	Tin Dish Rivulet (near York Plains)	C. Gould	Gould, 1869
1869	Jericho	C. Gould	Gould, 1869
pre-1881	Cygnet		Thureau, 1881*b*
pre-1881	Kaoota		Thureau, 1881*a*
pre-1886	Longford		DOM underground plan 252
pre-1888	Hastings		Analysis in Johnston, 1888, p. 191
1888	George Town	M. J. Hackett	DOM lease files
1892	Barn Bluff	J. Will	Montgomery, 1893*b*
1892	Ida Bay		Twelvetrees, 1902*c*
1900	Catamaran	Major L. Hood	*Rep. Sec. Mines Tasm.*1900, p. xiv, Twelvetrees, 1902*c*
1900	Moss Glen	G. H. Smith	DOM lease files, Twelvetrees 1902*c*
1901	Preolenna	Lowrie & Harris	Twelvetrees, 1903*b* (T. Stevens reported fragments of oil shale 1869)
pre-1902	Mike Howes Marsh		Twelvetrees, 1902*f*
1904	Mt Christie	J. Stevenson	Twelvetrees, 1906
1907	Merrywood (rediscovery)		Hills *et al.*, 1922, p. 215
1908	Strathblane	Woods & W. Anderson	Twelvetrees, 1915
1916	Mt Paul	C. J. Q. Lyne	DOM lease files
1917	Coalmine Crag	J. B.Dean and F. R. Davis	DOM lease files
1919	Rosevale	Gatenby	*Rep. Sec. Mines Tasm.* 1919
1922	Buckland (rediscovery)	P. F. French	DOM lease files
1930	Mt Elephant	A. E. Cooper	DOM lease files
1953	Mt Lloyd	L. Teakle	DOM lease files
1981	Woodbury	Victor Petroleum	Drilling on advice from S. M. Forsyth, geologist

TSA	Tasmanian State Archives	LSD	Records of Lands and Surveys Department
GO	Governor's Office Records	CSD	Records of Chief Secretary's Department
HRA	Historical Records of Australia	DOM	Department of Mines
CSO	Records of Colonial Secretary's Office	VDL	Van Diemens Land

twenty horse-power engine was erected in 1855 at the Outer Mines (Selwyn, 1855). Despite the substantial investment, production was small (100–200 t per month) and in 1858 the company folded (*Hobart Town Courier*, 8 March 1858). Twenty-one young English colliers brought out especially to work the mine found their services not wanted (*Hobart Town Gazette*, 2 March 1858).

Coal was discovered in the Bott Gorge, near Latrobe, in 1850 (Ramsay, 1958) and mining soon began in the Mersey–Don coalfield. A large number of small collieries were opened up, but most had ceased working by the late 1880s. Zephaniah Williams, a convicted chartist, was instrumental in opening up the New Town Coalfield, but sold his New Town venture to open a mine in the Mersey Coalfield.

Williams, a coal merchant and mineral surveyor by trade, was prosecuted in 1839 for high treason, the result of having planned a general uprising in Monmouthshire, Wales, to establish chartism. He was transported to Van Diemens Land (Ramsay, 1958) on board the convict ship *Mandarin*, and was first employed at Saltwater River as an overseer, but quarrelled with the mine manager Lacey and later attempted to escape. This brought a punishment of two years in chains. Then followed a variety of occupations including watchhouse keeper at New Norfolk (from which he was dismissed after having been found locked up in the watchhouse with a female prisoner), and servant, a position from which he attempted to escape and was further sentenced to twelve months hard labour. Williams became interested in coal mining and opened a mine at New Town in 1850, having received a Ticket of Leave in 1849. After moving to the Mersey area, Williams was granted a conditional pardon in 1854. After mining for a short while Williams became a publican at Ballahoo, but kept an interest in the discovery of coal, travelling to Fingal in 1862 to examine the coal there, and finding coal near Merrywood, Lewis Hill, Swansea and other places. Williams had harsh words to say about the Jerusalem coal he was instructed to inspect in 1862, writing to Falconer of the Public Works Department;

> ".... I deem it incumbent to inform you of the state of the coal I am instructed to get 10 tons from. The seam is altogether three feet thick; but it will scarce produce two feet of clean coal. I never was more deceived than to-day; for on cutting into the seam I found it full of hard stone and of iron pyrites distributed throughout which in reality makes it good for nothing except for kitchen purposes, as it is quite impossible, without breaking the coal to pieces, to clean it. This is the coal there has been so much writing in praise of the most worthless seam of coal I ever saw. It contains some good coal. However I shall continue working it till I hear from you. In consequence of so much stone and iron pyrites scattered through it, it is very expensive getting and we can scarcely get tools to stand the cutting, in fact it is a seam that never will be worked for any purpose. Awaiting your answer with the utmost impatience".

Williams died in 1874 aged 79 (*Launceston Examiner*, 9 May 1874, p. 2). The last mine to close in the Mersey field was the Illamatha No. 2, owned by the Bound Brothers, which closed in 1962.

Mining in the New Town area began in the 1850s (*Hobart Town Courier*, 9 August 1851) but interest lapsed and the activity did not last. During the 1870s another burst of interest in coal mining occurred and a few small mines were opened (Thureau, 1883*a*). Coal was sold for domestic purposes. The seams mined were very thin, and the quality of the coal was apparently poor (Krause, 1884).

In 1861 mining began at Seymour, north of the ill-fated Douglas River Coal Mining Company's workings near the Denison Rivulet (Records Chief Secretary's Department (CSD) 4/6/40, 11 December 1861). A. H. Swift formed the Seymour Coal Mining Company in 1863 to mine coal, followed by the Australian Coal and Kerosene Company in 1868, with the aim of retorting kerosene from the 'slack' (waste) coal produced from mining. Some 2700 litres of oil were retorted from the coal and sent to Melbourne to be refined (*Tasmanian Times*, 18 June 1868). Vast sums were expended on the building of a railway, storage bins and a long jetty. The first phase of mining lasted 17 years (Hills *et al.*, 1922).

A new company operated the mine from 1923 to 1931. A dip tunnel was driven to intersect the old, masonry-lined circular shaft of Swift's mine. This enterprise folded when the 400 m long loading jetty was partially demolished by a storm in 1931. The dip tunnel was dewatered in 1959, and the coal mined was transported to St Marys by road. This venture closed in 1964.

While coal seams had been known to occur in the Mt Nicholas area since the 1840s, no real mining occurred there until 1886. Minor prospecting works extracted some coal in the 1840s, and tests of the coal were made by the railways in the early 1880s. However high transport costs to a suitable market precluded this field from being worked until the railway line from St Marys to Conara (then known as Corners) was opened in 1886. The Mt Nicholas area is the premier coalfield in the State, and mining has been virtually continuous in this field since 1886, when the Cornwall Colliery was opened by the Cornwall Coal Company. Two years later the nearby Mt Nicholas Colliery was opened by a rival company. This mine closed in 1958, with the Cornwall Colliery closing in 1964. The Jubilee Colliery, much smaller than the first two mines, was worked from 1920 to 1960. In 1980 the Cornwall Coal Company opened the Blackwood Colliery, close to the old Cornwall workings. The Blackwood Colliery currently produces around 280 000 tonnes of coal per year.

Mining started at Kaoota, south of Hobart, in 1876 and continued in a variety of small workings until 1971. In 1906 an extremely elaborate railway was built from Kaoota to Margate, having ten large wooden bridges in a distance of 19.5 kilometres (Whitham, 1973).

At Cygnet, south of Kaoota, small-scale mining began in 1881, and continued in a haphazard and intermittent fashion until the 1940s. The Cygnet coal is of Late Permian age, as is the coal at Adventure Bay on Bruny Island. A very thin seam, approximately 500 mm thick, was worked from a series of shafts and adits by W. Zschachner over the period 1879 to the early 1890s at Adventure Bay. Zschachner had previously held mining leases in the New Town coalfield. At Gordon, a Mr Abbot opened up an outcrop of coal on the foreshore, calling the adit the Rockwood Coal Mine. Abbot tried to interest the Victorian Chamber of Commerce in his coal (LSD 1/48/310), and complained bitterly in 1879 that he could not compete with the mining at Adventure Bay (LSD 1/48/214).

Coal in the lower Midlands area was described by Gould (1869). Mining at York Plains started around 1883 and continued until 1947. The coal was sold mainly for use in hop kilns. Mining was done by hand on a modified (step) longwall system.

A small mine was worked at Ida Bay, in far southern Tasmania, in 1892. At Catamaran, south of Ida Bay, coal was discovered in 1900. A number of companies worked mines in this field, the last closing in 1939 (Whitham, 1983). Most of the early work in this field consisted of the construction of enormous bins, expensive tramways, and jetties, leaving little capital for mine development proper. Most of the early investing companies in this area collapsed due to over-spending on infrastructure.

Coal was discovered at Strathblane, north of Ida Bay, in 1908. Prospecting work was carried out for some years, and a small-scale mining operation extracted coal from 1926 to 1933. The average seam thickness was about one metre.

Coal was discovered in the headwaters of Storys Creek and a lease issued to J. Lamont in 1864, but no mining followed. An adit was dug into this seam in 1882 by a Mr R. Stevenson (Dickinson, 1945). Coal was transported by pack horse to Avoca, although the distance and difficulty of access to the adit proved too much of an obstacle for the venture to be successful.

In 1904 coal was found on the slopes of Mt Christie. Minor prospecting workings, known as the Buena Vista mine, later became the site of the Excelsior (Stanhope) Colliery, which operated from 1923 to 1957. Extraction was mostly by the bord and pillar system, although the longwall system was adopted briefly in 1944. In 1960 a bushfire swept across the mine site, and the seam outcrop at the portal caught alight. The old workings are still smouldering, and parts of the ground surface over the mine workings has collapsed. The New Stanhope colliery, 1.3 km north of the (old) Stanhope, opened in 1957. A washing plant was installed in 1959 and mining continued until 1973.

The Mt Christie Colliery was opened in 1959 in the vicinity of older prospecting adits on the southern flank of Greenstone Hill. This mine, which produced around 1800 tonnes of coal per year, closed in 1965. Recently a new mine has been opened in this area. The Fenhope Colliery was opened in 1980 close to the (old) Stanhope workings. The mine is owned and operated by Mr D. Fenton. The seam is 3.6 m thick and mining is all done by hand. Coal is wheeled by hand along an impressive wooden gantry to a large wooden storage bin.

The Dalmayne coalfield lies south of Mt Nicholas and south-east of Fingal. Outcrops of coal had been known since before 1860 (Gould, 1861*b*), and reward leases were applied for but not issued in 1887. No mining eventuated until the ambitious Dalmayne Colliery Company was floated in 1914. The company built an aerial ropeway from the mine site to Piccaninny Point, a distance of 5.5 km. A 180 m long jetty was built at Piccaninny Point for loading the coal. Substantial mine development work occurred and the mine was officially opened by Sir Elliott Lewis, Minister for Mines, on 24 August 1917. However a shortage of boats for shipping the coal (because of the war) hampered progress, and in 1918 the jetty was washed away in a storm. The mine was forced to close, but re-opened in 1939 under new management. Coal was transported by road to St Marys until the operation closed in 1953.

At Fingal, south-west of Mt Nicholas, coal had been discovered in the 1840s (Milligan, 1849) but no mining had started. The Government of the day financed the digging of an adit in 1864 (House of Assembly Journal (HAJ) 1867 (95) p. 7). Mining on a small scale continued intermittently for some years. Activity was renewed in 1920 when the Fingal Coal Prospecting Syndicate drove two adits into the outcrop of the Duncan seam on Cat and Kitten Creek. These workings were acquired in 1942 by H. J. Yeates, who opened the Fingal Colliery. The Duncan Colliery opened adjacent to Yeates in 1945, and the Tasmanian Mine opened in 1954, on the same seam and adjacent to the Fingal Colliery; work continued here until 1957. Minor activity in 1962–63 was halted because of poor ventilation.

The Fingal Colliery closed in 1965, but was re-opened in 1969 by the management of the Duncan Colliery, and the Fingal (Cat) tunnel was retimbered to provide access to the Duncan workings following the closure of the adjacent Duncan tunnel.

Very thin seams of coal were mined at Preolenna, on the north-west coast, early this century. Following the discovery of outcrops of coal in 1903 by two track-cutters, small-scale mining of the coal occurred intermittently from 1921 to 1931. Considering that the seams were no more than 0.5 m thick and dipped at up to 25°, the attempts at mining were certainly industrious. The coal is of Early Permian age, and the Preolenna Coal Measures, in which the seams occur, may be correlated with the Mersey Coal Measures further to the east.

In the Derwent Valley, near Hamilton, the Langloh (Lawrenny) Colliery began operations in 1938, continuing until 1963. Coal had been known from this locality since 1855 (Selwyn, 1855), and minor prospecting activity occurred in the 1890s (Montgomery, 1894). Small reserves of coal adjacent to the old colliery, and suited for open-cut extraction, have been evaluated in recent years.

The Merrywood Colliery, south-west of Fingal, opened in 1945, with coal being extracted by both underground and open-cut methods until 1963. A washing plant was installed in 1957, and the coal was hauled by road to the railway at Avoca. Open-cut extraction on a small scale (1500 tonnes/week) has recently resumed, although this activity will be for a limited period only.

Summary of the industry

The years of operation of every known coal mine in Tasmania are shown in Figure 9. One of the most evident features is that many, in fact most, of the mines which have ever existed were worked for a very short time only. Relatively few mines have had long lives, and these are virtually restricted to the Fingal–Mt Nicholas area. Most of these short-lived mines, some of which were in areas where coal was plentiful, were very small in size. The number of mines of varying sizes is shown in Figure 10. During the years of the Great Depression (1931–1938) the number of small mines increased dramatically, falling again in 1939. This indicates that coal mining was done simply as a "fill-in" activity until something better came along. Coal production (fig. 11) does not increase greatly compared to the massive increase in the number of mines during the depression years. At least ten small mines opened and closed in the Mersey coalfield alone during this period.

During the late 1950s and through the 1960s many local industries, which had been using coal in increasing quantities as a boiler fuel for steam raising purposes, converted to fuel oil, which at the time was a cheaper fuel option than coal. Many mine closures resulted, with attendant falls in production and number employed (fig. 12). The reversion from oil to coal as boiler fuel following the large rises in the price of oil during the 1970s caused a rise in the demand for coal, and a rise in the number employed.

A summary of the reasons for mine closures is given in Table 2. Early mining ventures were either thwarted by the geology, or lacked sufficient capital to be set up with maximum efficiency. Often a disaster, such as the loading jetty washing away (as happened at Adventure Bay, Seymour and Dalmayne) became a financial hurdle too large to be overcome, and the operation ceased.

YEARS OF OPERATION OF TASMANIA'S COAL MINES

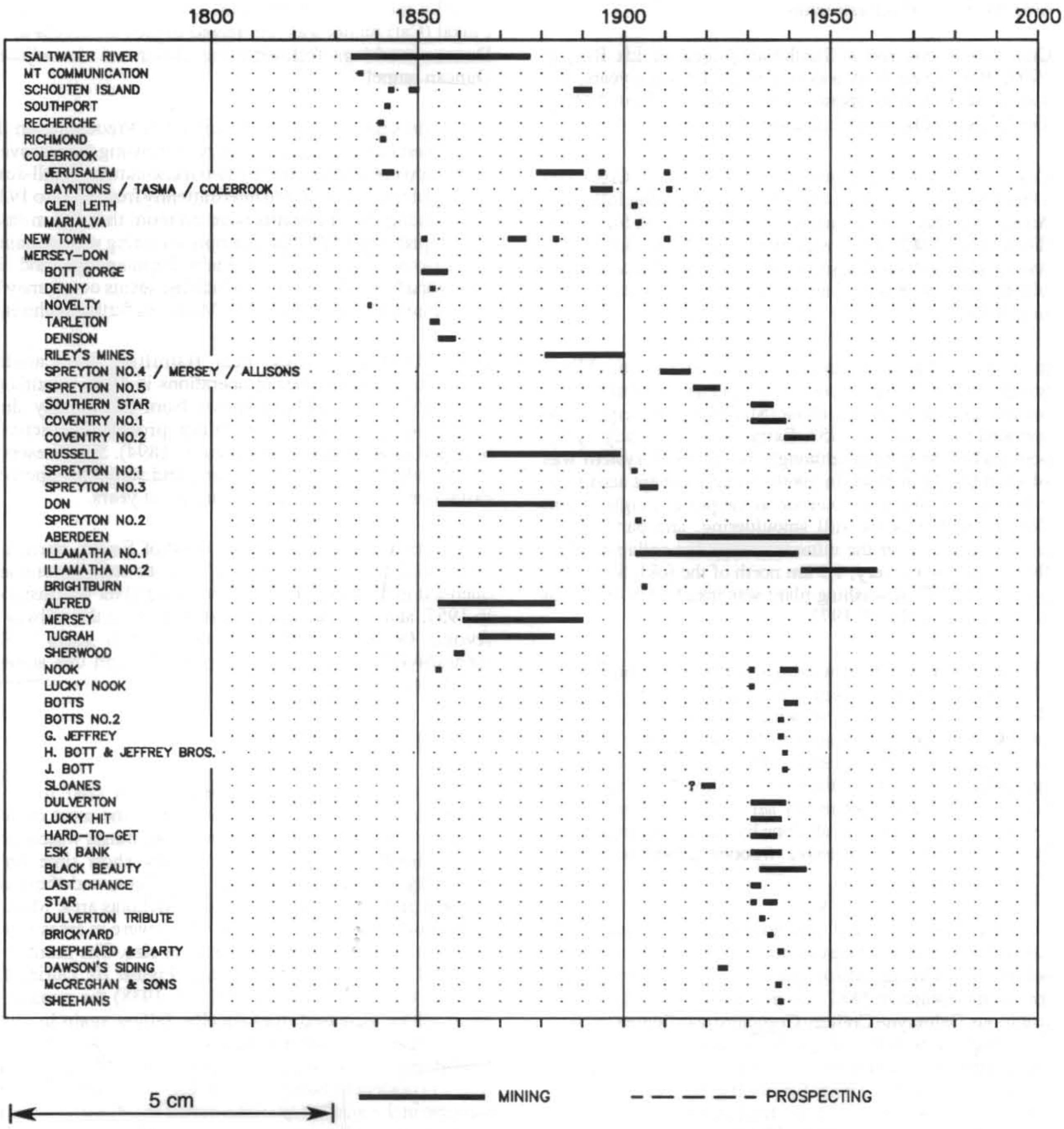


Figure 9.

Seven syndicates had a try at working the Catamaran field during the years 1900–1940. The early syndicates spent most of their funds on massive infrastructure (which could be seen) such as bins, tramways etc., and left insufficient funds for mine development proper. The same activity caused the failure of Swift's operation at Seymour and Dr Milligan's Douglas River mining ventures.

In the last forty years the prime cause of mine closures has been the loss of markets, due to industry using fuel oil in preference to coal. Even when this trend reversed, the small mines did not re-open. With increased mechanisation and greater tonnages of coal produced per man than in the days of hand mining, the opening of a deposit has become an expensive operation, and can only really be justified on the larger deposits.

Mining methods

Most of the coal produced in Tasmania has been mined by the bord and pillar method, where parallel headings are driven and connections (bords) made between headings, so creating large blocks of coal (pillars) which are mined on retreat. This method is often used to work a coal seam which is discontinuous on one horizon because of faulting.

On a number of occasions, a long wall was used. This means the coal was mined across one long continuous face, with the roof collapsing behind the advancing face to form the goaf. For this arrangement a block of unfaulted coal is required, but this method was not very suitable for most Tasmanian mines.

YEARS OF OPERATION OF TASMANIA'S COAL MINES

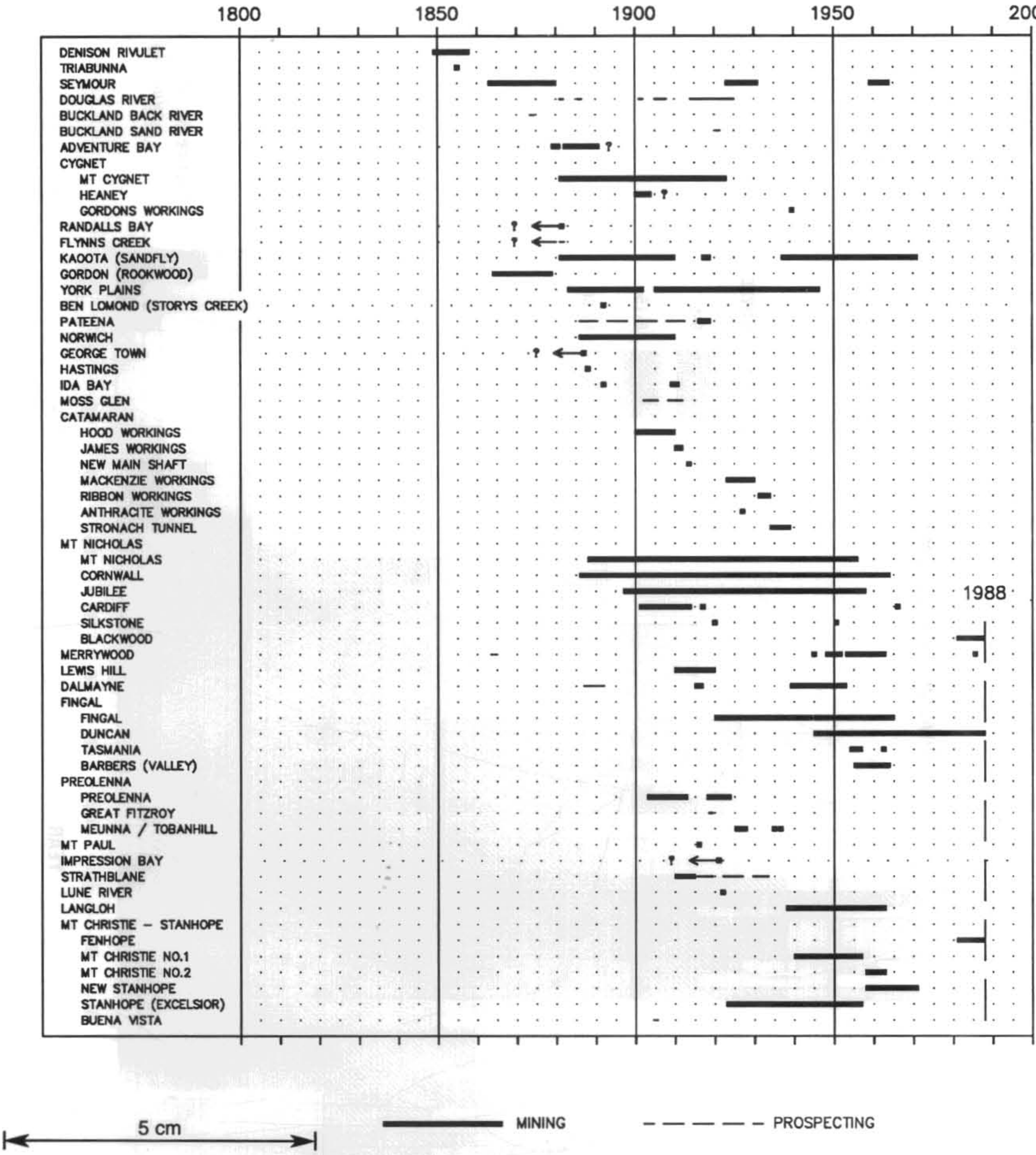


Figure 9.

A short or step long-wall method (simply a shorter than normal long-wall face) was used at the Cornwall Colliery until 1914, and at the Mt Nicholas colliery in 1925. The method was tried at Stanhope in 1943 but collapse of the long-wall face in 1944 caused the management to revert to the more suitable bord and pillar method. Often miners were brought out from England especially to work in a particular mine, and probably the initial mine design and mode of working was based on their previous experience. Until the mines started to become mechanised (in 1943) mining was done by hand, with pit ponies pulling loaded coal skips to the surface on narrow-gauge tram tracks. In 1943 an arc-wall coal cutting machine was installed at the Cornwall Colliery. The neighbouring mines also became mechanised, although some hand mining continued into the 1950s.

The width of current day headings (around 5 m) is a legacy from the days of hand mining, when headings were wide enough for a man to shovel at the side and throw coal into a skip in the middle of the heading (a distance of around 2.1 m). Today the shape of headings and pillars is much more regular than in the old hand mining days. Figure 13 shows the neat, orderly modern pillar shapes compared to the higgledy-piggledy shapes of earlier mining phases. Fewer

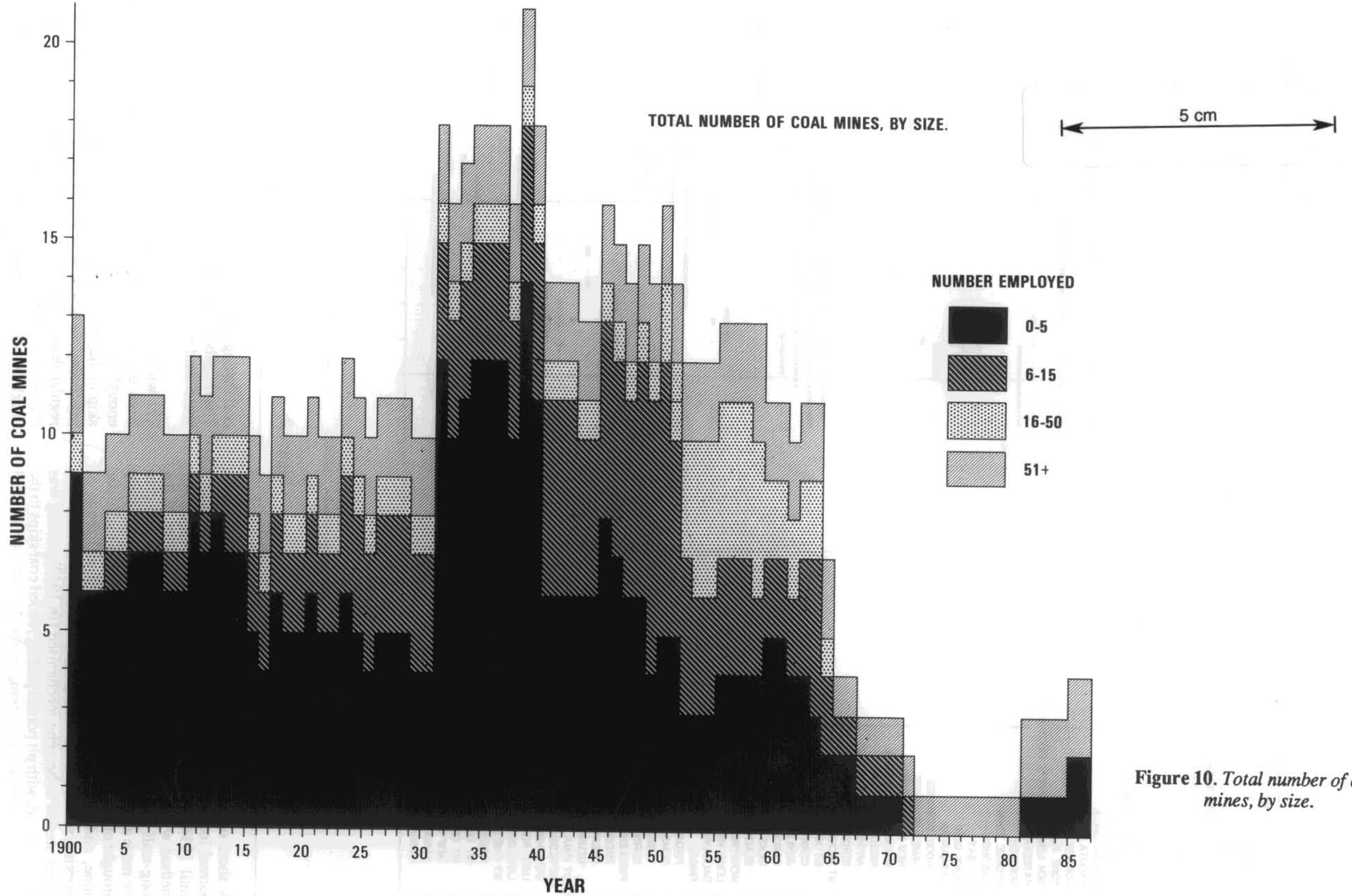


Figure 10. *Total number of coal mines, by size.*

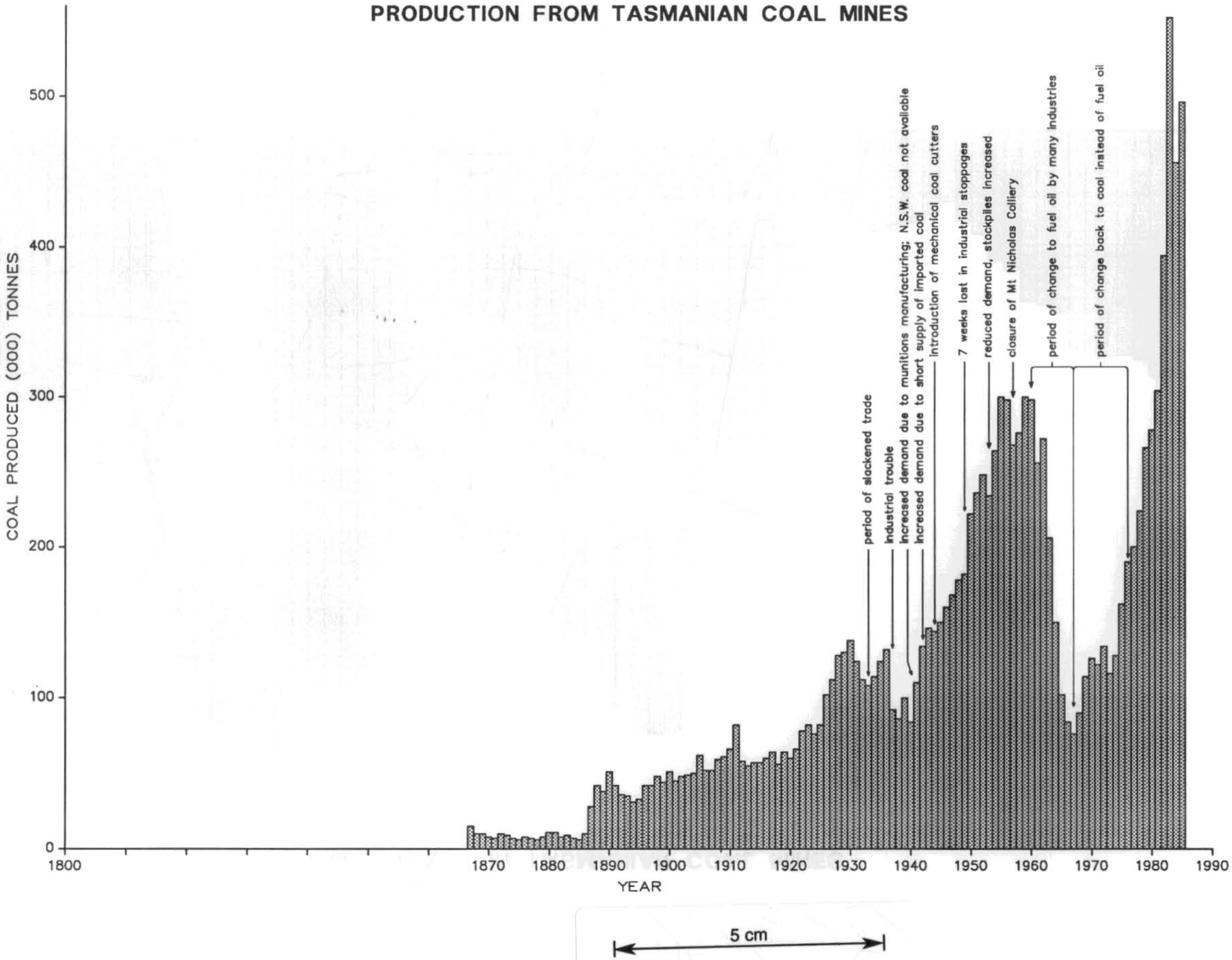

PRODUCTION FROM TASMANIAN COAL MINES
COAL PRODUCED (000) TONNES
0
100
200
300
400
500
1800
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
YEAR
period of slackened trade
industrial trouble
increased demand due to munitions manufacturing; N.S.W. coal not available
increased demand due to short supply of imported coal
introduction of mechanical coal cutters
7 weeks lost in industrial stoppages
reduced demand, stockpiles increased
closure of Mt Nicholas Colliery
period of change to fuel oil by many industries
period of change back to coal instead of fuel oil
5 cm

Figure 11.

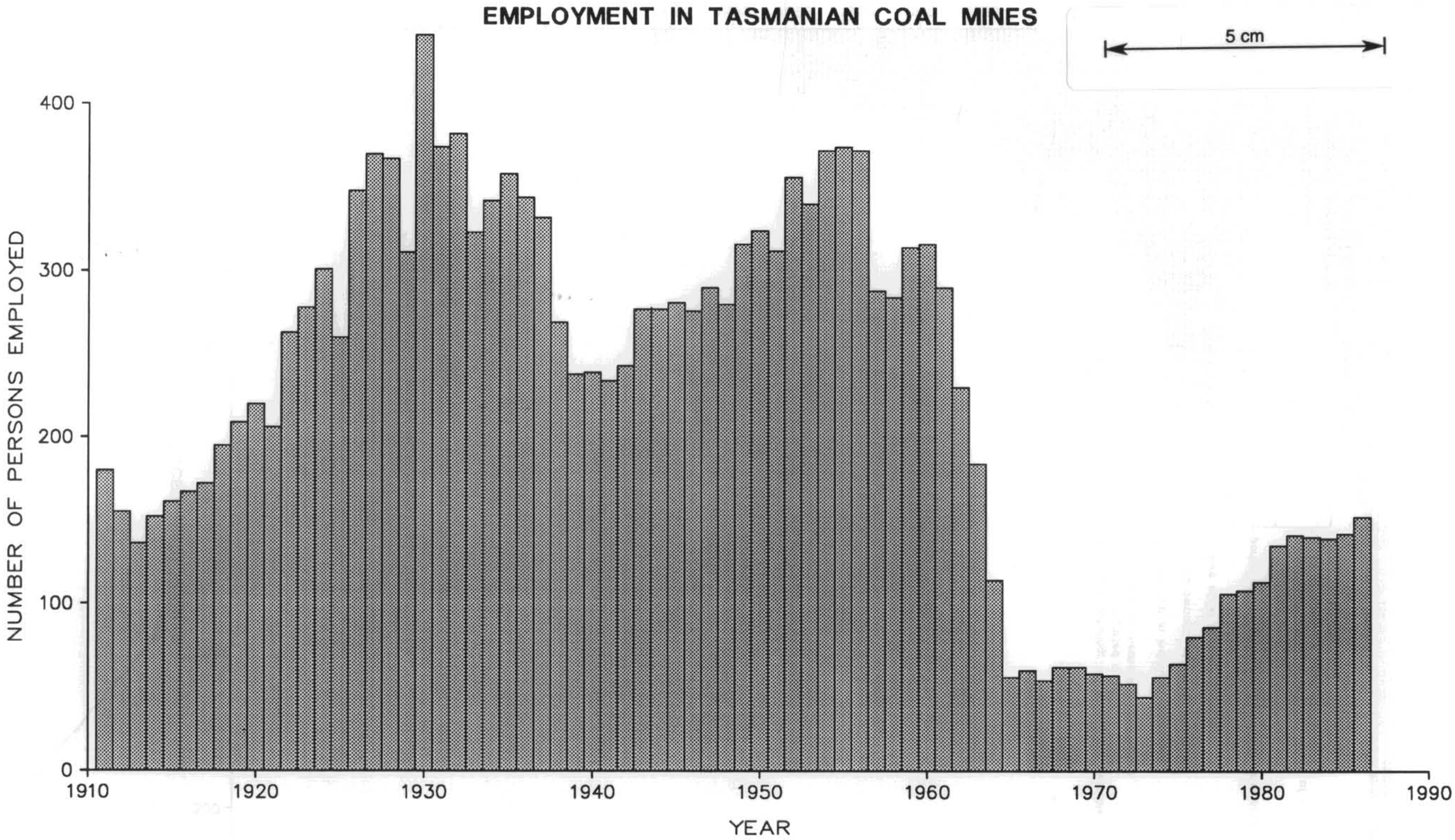

EMPLOYMENT IN TASMANIAN COAL MINES
5 cm
NUMBER OF PERSONS EMPLOYED
400
300
200
100
0
1910
1920
1930
1940
1950
1960
1970
1980
1990
YEAR

Figure 12.

headings are required now, as once there was a need to have a greater number of working places as there were more steps involved in the process of mining. Holes were bored in the face, charges laid, the face fired, the roof secured, the coal shovelled up. Commonly up to seven or eight headings were in use at the one time to provide the mining parties with sufficient working places.

Uses of coal

Last century, most of the coal mined locally and imported was used as a domestic fuel, with minor quantities being used by the railways and in steamships. Some of the Latrobe coal was used to produce gas for town lamps. This century local industries, including hop kilns, used increasing amounts of local coal as a boiler fuel for steam-raising purposes. The railways phased out steam locomotives in preference to diesel locomotives from the early 1950s to early 1960s, however the drop in consumption by the railways was taken up by increased consumption by industry.

The Tasmanian coal industry was drastically curtailed in the 1960s when most industrial users converted boilers to use oil instead of coal and the dieselisation of the railways was completed. The prime use for the coal was that of a boiler fuel, and with the loss of local markets many small mines were forced to close. In recent years a reversion to coal firing of boilers has been evident, and the demand for coal has grown. Tasmanian coal is now used in a wide variety of secondary industries, such as the manufacture of paper, newsprint, cement, and other minor industries.

Production for 1988/89 was 589 943 tonnes (run of mine) from the two operating collieries in north-eastern Tasmania, from which 356 282 tonnes of washed product was produced.

Reasons for closure

1850–1900

Schouten Island: lease not renewed as Government planned a probation station in same area.

Douglas River: overcapitalisation on infrastructure.

Seymour: overcapitalisation on infrastructure and jetty washed away.

Saltwater River: poor-quality coal and nearly mined out.

Adventure Bay: jetty washed away.

Mersey Collieries: ten small collieries worked during this time. Sometimes a small pocket of coal was completely mined out and often adverse geological conditions caused or hastened closure.

1901–1920

Cardiff: reached fault.

Dalmayne: jetty washed away.

Catamaran: Hoods: lack of capital
James: massive infrastructure spending and underground collapses
New Main Shaft: lack of capital

Mersey Collieries: three closures

Strathblane: lack of capital

1921–1940

Preolenna and Meunna: lack of capital

Catamaran: Ribbon: probably lack of capital
Stronach Tunnel: reached fault
McKenzie: flooding, demarcation dispute on Hobart wharves.

Cygnet: not known

Seymour: lack of capital

Mersey Collieries: 15 small mines, only worked during the depression, with coal going to the cement works.

1941–1960

Mt Christie: faulting of seam

Stanhope: nearly worked out; caught fire; loss of markets and deteriorating geological conditions.

Mt Nicholas: taken over and closed.

York Plains: deteriorating geological conditions.

Tasmania: badly faulted ground (geological conditions).

Fingal: loss of markets.

Barbers (Valley): loss of markets, pony died before replacement was trained.

Aberdeen: probably worked out.

Illamatha: worked out.

Jubilee: deteriorating geological conditions.

Dalmayne: Production costs too great.

Mersey Collieries: three, mostly loss of markets.

1961–1980

Merrywood: loss of markets.

Langloh: deteriorating geological conditions.

Cornwall: floor heave, mine fire; loss of markets.

Kaoota: deteriorating geological conditions.

Mt Christie 2: mined out, small area.

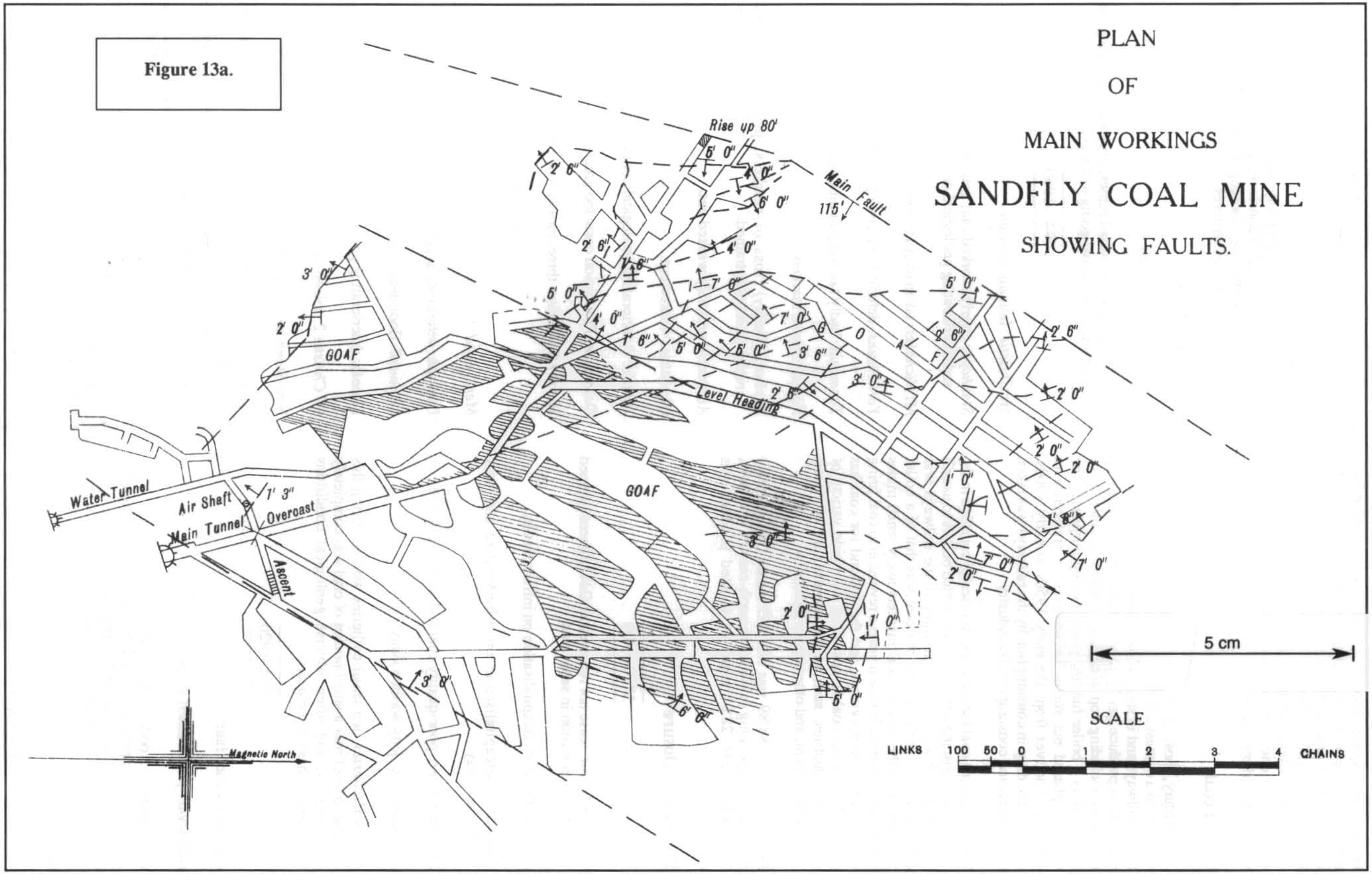
New Stanhope: mined out.

Illamatha 2: loss of market (Ovaltine factory converted to fuel oil).

Table 2. *Summary of reasons for closure.*

	Geological	Mined out	Lack of capital	Loss of markets	Other
1850–1900	10	-	3	-	1
1901–1920	4	-	5	-	-
1921–1940	16	-	3	-	1
1941–1960	4	3	-	6	1
1961–1980	2	2	-	3	-

Figure 13a.



PLAN
OF
MAIN WORKINGS
SANDFLY COAL MINE
SHOWING FAULTS.

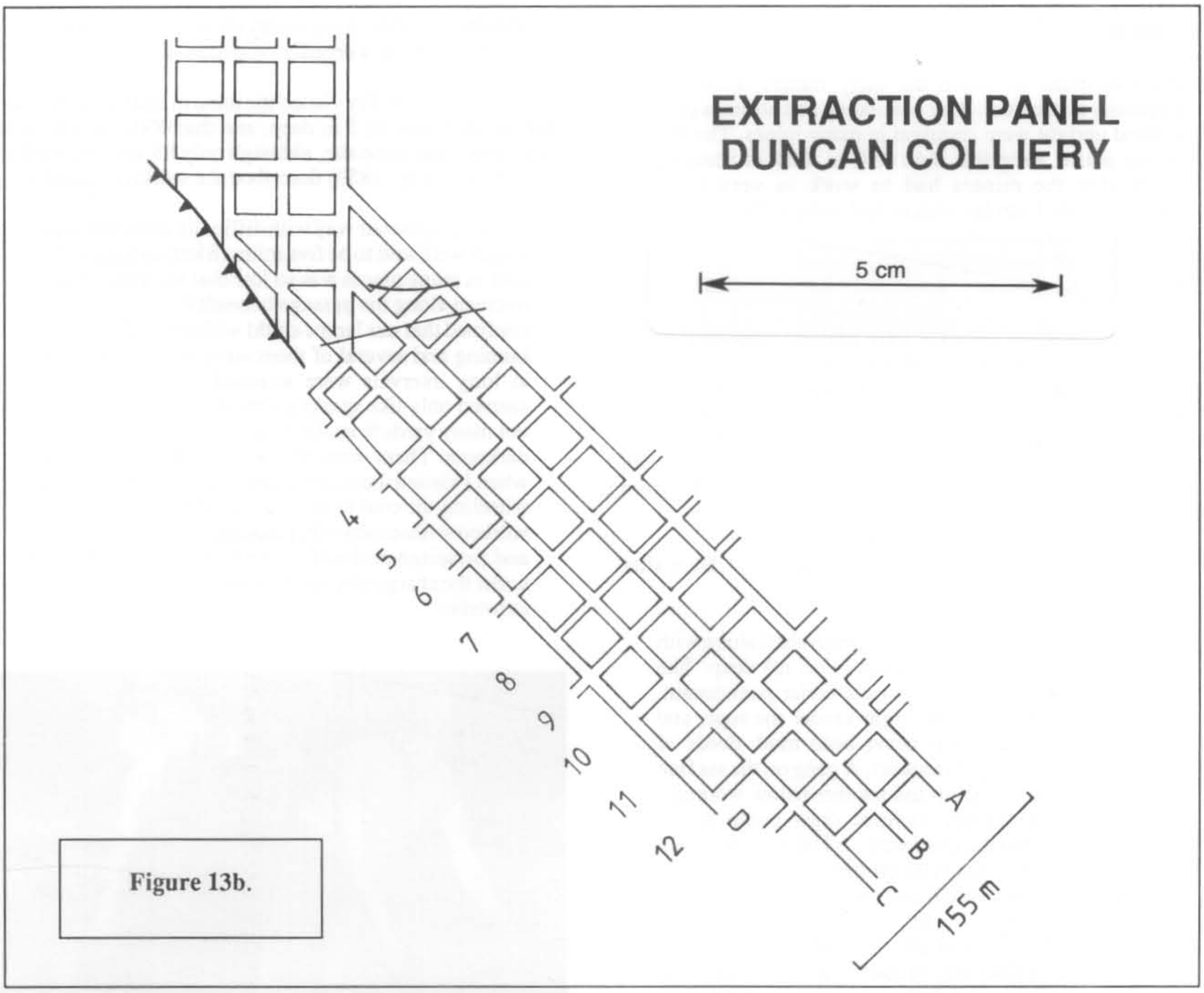
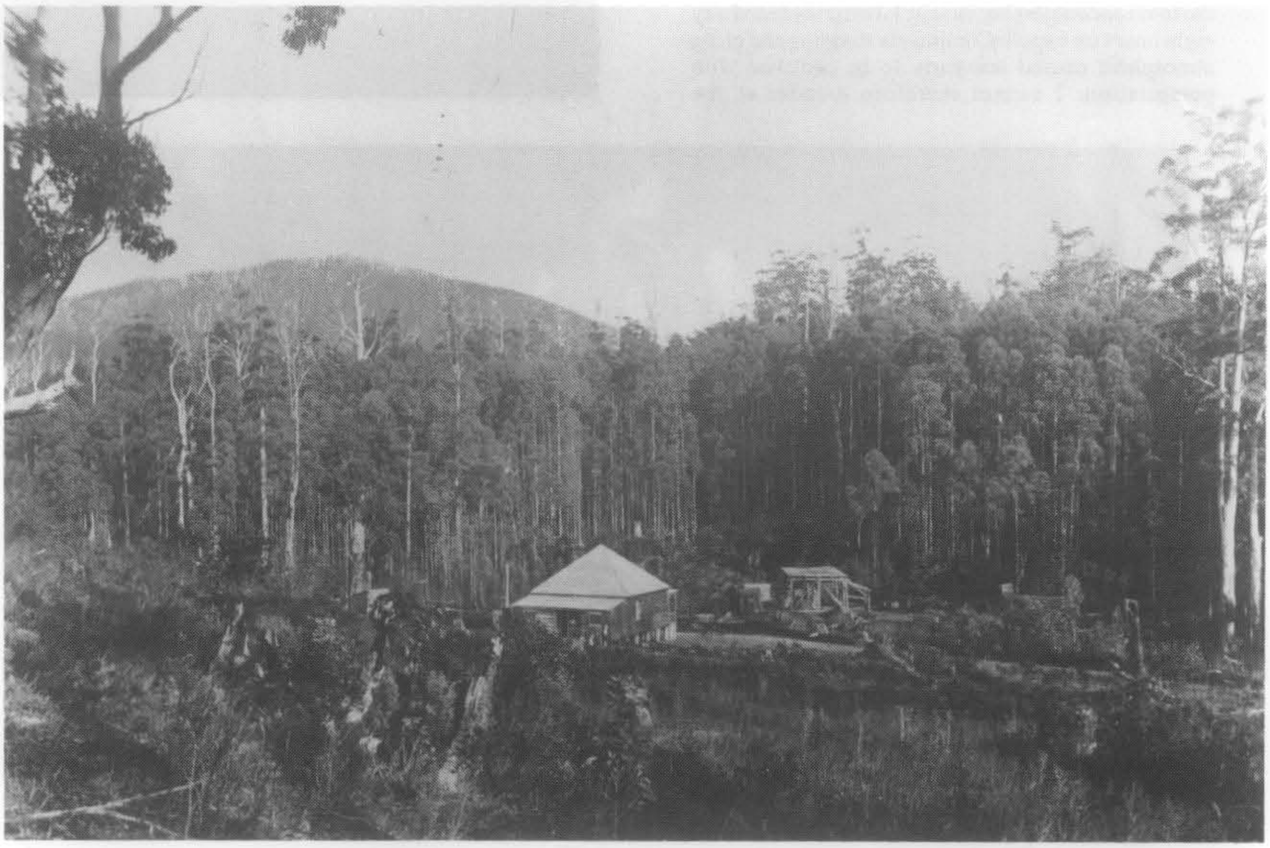


Figure 13b.



There were few major coal mines in Tasmania. The mine at Ida Bay, in far southern Tasmania, was typical of small mines which existed for short periods and produced only small quantities of coal.

Conditions of mining

The conditions in which the early miners worked were frequently unpleasant. Poor ventilation and not enough room to stand upright were common in many mines. The mining of thin seams, even less than 0.60 m thick in some cases, meant that the miners had to work in very cramped conditions. At Latrobe miners had to hew the coal whilst lying on their sides and shovelling the coal over one shoulder, surely a most awkward position to maintain for hours on end, day after day.

At Saltwater River convicts were initially employed in the underground mine, and conditions were most unpleasant. The mine headings were only 1–2 m high and the ventilation was poor (Ford, 1932; Burn, 1892). A steam engine was installed in 1842 to raise the coal to the surface. Prior to this the coal was raised up shafts by a winch which was operated using convict labour. Two pumps, which drew water from the workings, also used convict labour.

Conditions at the coal mine were described by D. Burn after a visit to the mine in 1842:

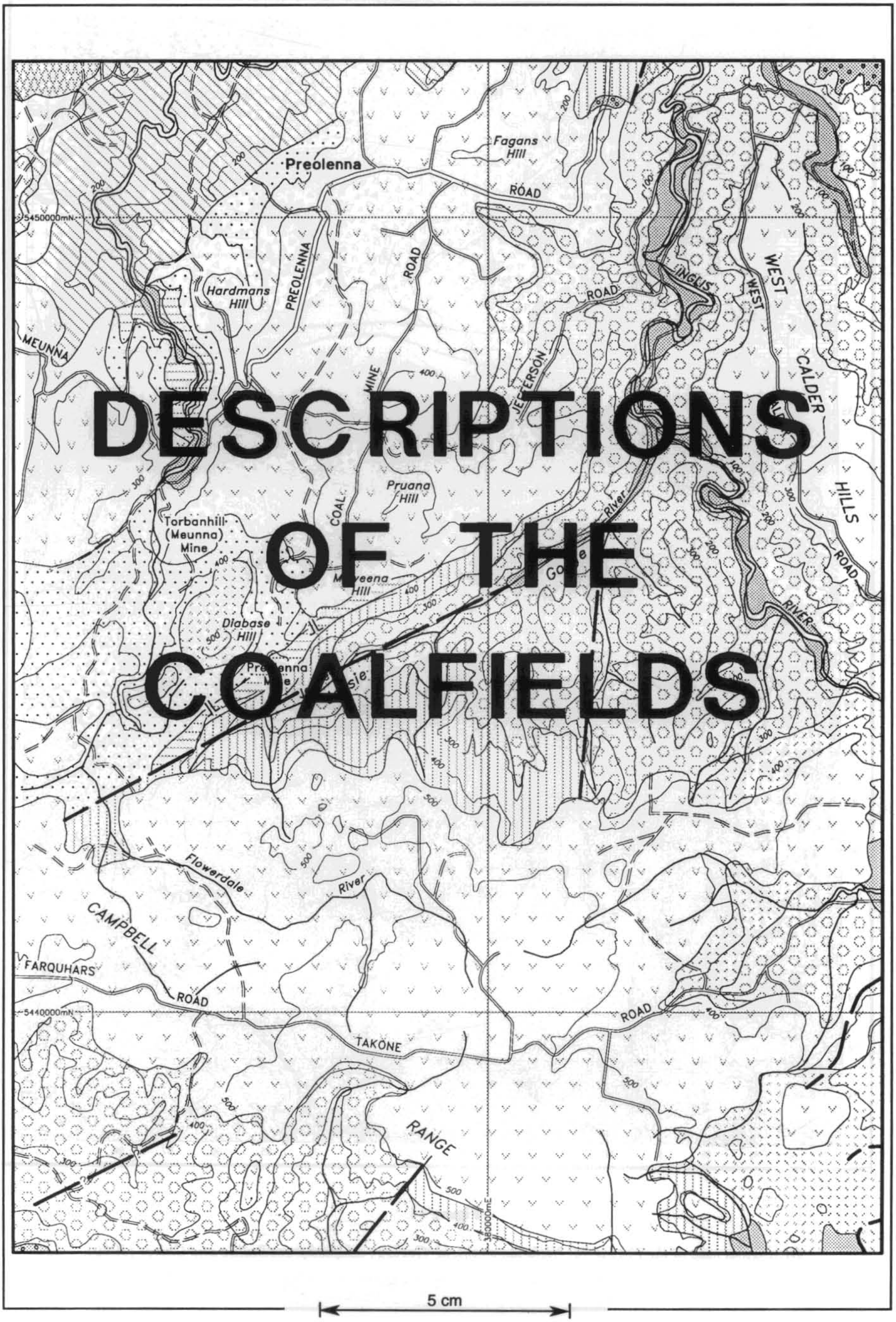
> "Next morning I descended the main shaft along with Captain Booth; it is 52 yards (47.5 m) deep. The winch was manned by convicts under punishment. One stroke of the knife might sunder the rope, and then ... however it has never been tried, deeds of ferocity being very infrequent. A gang on the surface worked the main pump and another below worked a horizontal or slightly inclined draw pump which threw water into the chief well .... The seam has been excavated 100 yards (100 m) from the shaft several chambers diverging left and right. The height of the bore is four feet (1.2 m). The quality of the coal partakes much more of anthracite than of bitumen, it flies a great deal but produces intense heat. The miners are esteemed the most irksome punishment the felon encounters because he labours night and day eight hours on a spell. Continuous stooping and close atmosphere caused our party to be bedewed with perspiration. I cannot therefore wonder at the abhorrence of the compulsory miner in loathing what I conceive to be a dreadful vocation ...."

The Reverend H. P. Fry visited the mine in 1848 and recorded that the shaft was 92.5 m deep, and that 400 convicts were employed at the mine site, although only 83 actually worked underground. Fry (1850) described the workings in detail:

> ".... we groped our way with difficulty along passages which were said to be five miles (8 km) in length. The roof in many places was so low that we were obliged to creep along the passage beneath it. The air was so confined that our lamps could with difficulty be kept burning and several of them went out. A few lamps at long intervals were attached to the walls, but seemed only like sparks glimmering in the mist, and not many yards from them the passage was in perfect darkness. There were 83 men at work in the mines when I visited them, the greater number employed in wheeling the coal to the shaft to be hoisted up. They worked without any other clothing than their trousers and perspired profusely. The men in the mine were under the charge of a prisoner-overseer and a prisoner constable."

Mining conditions in the Cornwall mine in the 1950s were nowhere near as arduous as in the days of the Saltwater River mine, but still entailed a considerable degree of manual labour. [Cornwall Coal]

DESCRIPTIONS OF THE COALFIELDS



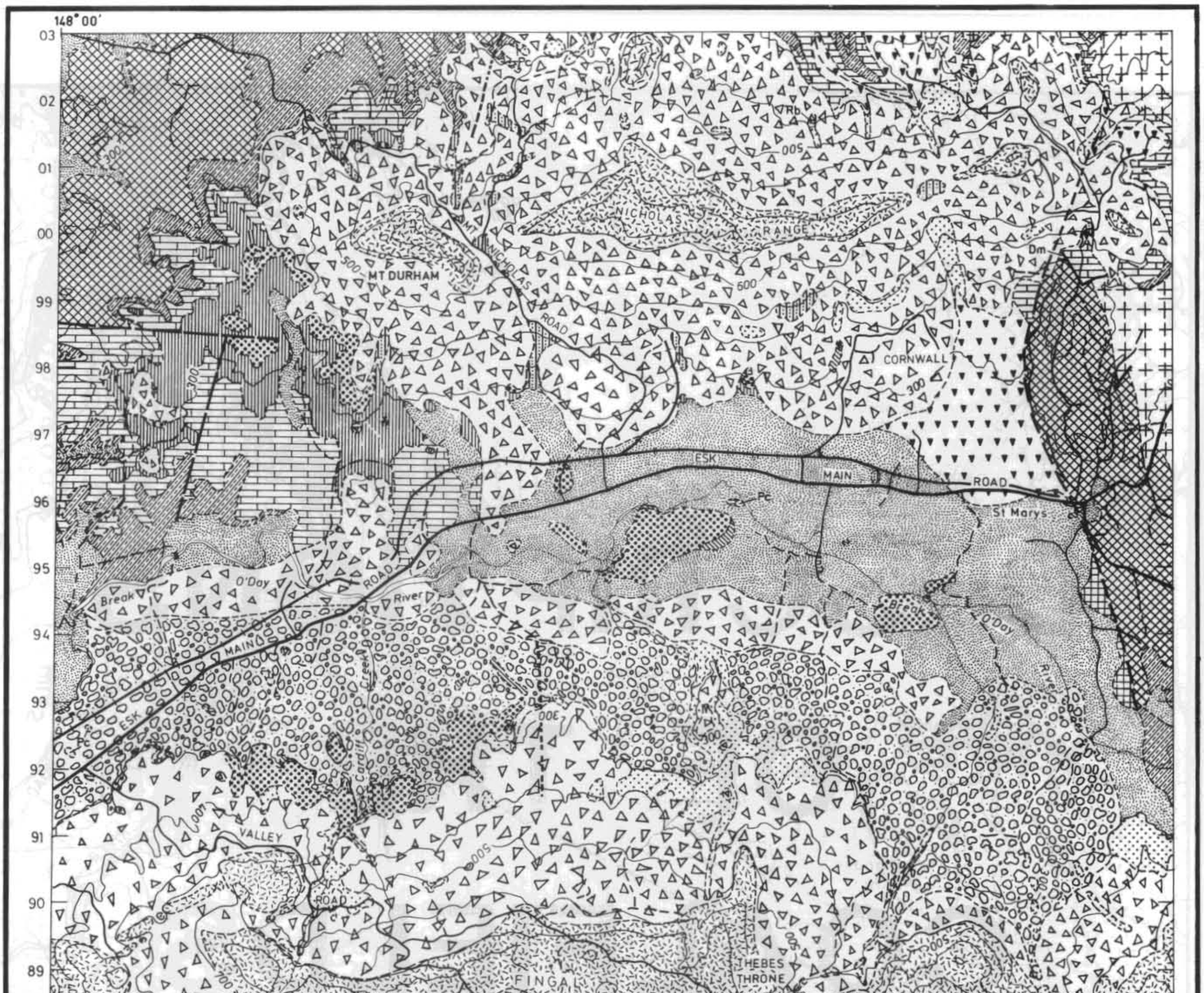


Figure 14.

Geological map of the Fingal–Mt Nicholas coalfield. Geology adapted from Baillie and Calver (1980).

5 cm

PART 1: THE NORTH-EASTERN COALFIELDS

The Mt Nicholas Coalfield

SUMMARY

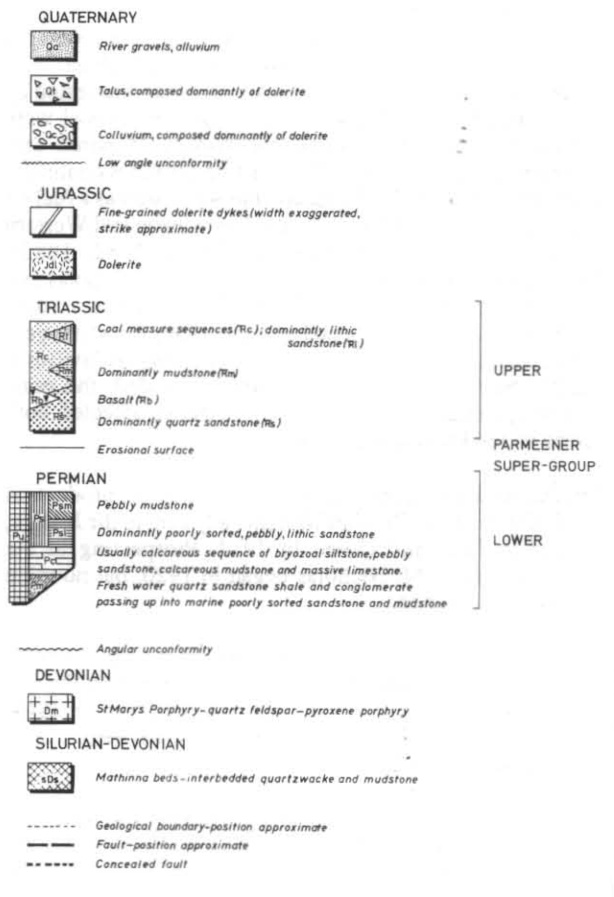
Coal was discovered in the Mt Nicholas area, north-west of St Marys, in the 1840s and has been mined almost continuously since 1886. The only currently operating mine on the Nicholas Range is the Blackwood Colliery, owned by the Cornwall Coal Company NL, which produces about 250 000 t of coal per year.

The coal seams occur in a fluvial sequence up to 400 m thick of dominantly lithic sandstone, siltstone, mudstone, claystone and rare tuff, which gradationally overlie a thin quartzose sandstone unit. These rocks are assigned to the Upper Parmeener Supergroup and are of Triassic age. A basalt of Triassic age occurs close to the base of the sequence. Underlying the fluvial sandstone sequence is a suite of marine sandstone, limestone, and mudstone assigned to the Lower Parmeener Supergroup and of Permian age. The marine sediments unconformably overlie a basement of folded quartzwacke (Mathinna Beds) and porphyry (St Marys Porphyry).

The coal-bearing sequence is capped with Jurassic dolerite, and the steep slopes of the Nicholas Range are heavily mantled in talus derived from the dolerite.

The coal seams have been correlated across the Mt Nicholas coalfield, although the area is faulted, and small faults caused mining difficulties in some of the now closed collieries.

LEGEND (Figure 14)



The measured reserves of part of the Mt Nicholas coalfield are 44 million tonnes, and the total inferred reserve for the whole of the coalfield is about 100 million tonnes. The reserve is classed as a small inferred reserve.

LOCATION AND ACCESS

The Nicholas Range is located nine kilometres north-west of St Marys in north-eastern Tasmania, and is separated from the Fingal coalfield (12 km to the south-west) by the broad, flat Fingal Valley.

The Nicholas Range is well traversed by roads which service forestry operations on the northern slopes of Mt Nicholas. A railway ran from St Marys through the Fingal Valley to Conara, where connection was made with the Launceston–Hobart railway line, but the section of this line between the Duncan Washery (near Fingal) and St Marys is currently out of use and partially dismantled. The small town of Cornwall is situated four kilometres south-east of Mt Nicholas.

The Mt Nicholas area is currently covered by Retention Licence 878 and leases held by IMI and the Shell Company of Australia. The Cornwall Coal Company NL hold a Mining Lease covering the area around the Blackwood Mine.

GENERAL GEOLOGY

The regional geology of the area is discussed by Threader (1968) and Turner and Calver (1987). Detailed geological mapping of the area was done by Baillie and Calver (1980) and Turner *et al.* (1984). The geology of the area is shown in Figure 14. Earlier reports on the area were made by Milligan (1849), Gould (1861*b*), Thureau (1883*c*), Twelvetrees (1902*d*), and Hills *et al.* (1922). The results of a gravity survey of the East Coast coalfields (including Mt Nicholas) are given in Leaman and Richardson (1981). The following outline of the geology of the Mt Nicholas area is summarised from Baillie and Calver (1980).

The oldest rocks in the St Marys area are folded quartzwackes of the Silurian Mathinna Beds, which have been intruded by the Devonian St Marys Porphyry. These rocks form the basement upon which the flat-lying Parmeener Supergroup sediments were unconformably deposited.

The Parmeener Supergroup has been divided into a lower, dominantly glaciomarine sequence and an upper, dominantly freshwater sequence.

Three informal formations have been recognised in the Lower Parmeener Supergroup on Mt Nicholas. The lowest formation consists mainly of poorly sorted sandstone with some pebbly siltstone and mudstone, is poorly fossiliferous, and probably has a maximum thickness of about 40 metres. The overlying formation is a calcareous sequence of bryozoal siltstone, pebbly sandstone, calcareous mudstone and massive limestone, and is often richly fossiliferous. This sequence is about 20 m thick. The uppermost formation is a massive limestone sequence up to 50 m thick which consists dominantly of poorly-sorted pebbly mudstone.

The three formations contain dropstones of quartz, clasts from the Mathinna Beds, minor granite and rare schist, and are considered to be of glaciomarine origin.

The glaciomarine sequence on the south-west slopes of Mt Durham [EP875979] is overlain by quartz sandstone.

Table 3. *Correlation of coal seams on Mt Nicholas.*

Drilling					Mines					
Shell		DOM		Cornwall						
Mt Nicholas	Harefield	Dalmayne	Fingal Tier	Mt Nicholas	Blackwood	Cornwall	Mt Nicholas	Cardiff	Jubilee	Silkstone
			A							
		DA	B							
			C							
		DB	D							
			E							
U8		DC	*F	Rileys						
M1		DDU	*GU	Blue upper	Blue	Blue	6-foot			
M2		DDL	*GL	Blue lower			4-foot			
M3				Cornwall		Hitit	4"9"	Cardiff ?	Jubilee ?	
Minor				Cullenswood						
L1	DE)	)		Fenton		Fenton	8-foot			No name
L2	E2)	)		Millbrook						
Minor	E3)	)	Ha, Hb	Malahide						
Minor	DF)	)		Webber Falls						

* F = Duncan seam
GU = East Fingal seam, Upper Split
GL = East Fingal seam, Lower Split

Elsewhere, the glaciomarine sequence is overlain by massive, well-sorted, medium to coarse-grained lithic sandstone, except for a small area east of Cornwall [EP953983] where the Lower Parmeener Supergroup sediments are overlain by a Triassic basalt. The basalt has been dated at 233 ± 5 Ma (Calver and Castleden, 1981).

The fluvial sandstone sequence contains minor interbedded mudstone, siltstone, claystone and coal seams, some of which have been extensively mined.

Jurassic dolerite has intruded the Parmeener Supergroup sediments and now forms the capping of Mt Durham [EQ887000], the Nicholas Range [EQ912003], and South Sister [EQ976012]. Dolerite talus thickly mantles the slopes of the range.

COAL GEOLOGY

A diagrammatic representation of the coal seam stratigraphy on Mt Nicholas is shown in Figure 15.

There are three intervals in the stratigraphic sequence which contain coal seams. The Shell Company of Australia has called these intervals the upper, middle, and lower groups of seams. The correlation of the seams worked at the various mines, and details of the mining methods employed, are given in Tables 3 and 4.

The upper group of seams are of poor quality coal interbedded with claystone and mudstone. As many as eight seams occur in this interval, although most are better described as richly carbonaceous mudstone rather than coal. Only one of these seams, the U8 or Rileys, has ever been worked, being mined at the Mt Nicholas Colliery.

The middle group of seams usually comprises three seams; the M1 (6', Blue Upper); the M2 (Blue, 4'); and the M3 (4'9", Hitit). The M1 and M2 seams coalesce in some areas. A small seam of coal is intermittently found below the M3 seam.

The M1 and M2 seams appear to be part of the East Fingal Seam, which can be traced from Fingal Tier to the Douglas River. The M3 seam is confined to the Mt Nicholas area.

The lower seam group usually contains four seams. The upper two seams (L1, L2) often come together to form one seam, or are separated by only a few centimetres. The L2 seam, and in parts the combined (L1, L2) seam, is known as the eight-foot or Fentons seam. Two smaller seams persist below the L1 and L2, but these have never been worked. This lower group of seams may be correlated with the H seam interval at Fingal Tier, which usually contains four or more small seams which frequently lens out or split and rejoin.

PREVIOUS MINING HISTORY

The earliest recorded mention of coal in the Mt Nicholas area is by Milligan (1849). Gould (1861*b*) wrote on the East Coast coalfields, and in 1861 coal from Mt Nicholas was tested by the Launceston Gas Works. Further tests on the coal were carried out in 1862 on the steamships *Monarch* and *Tasmania* (Falconer, 1862). Prospecting activities continued for many years, and Mt Nicholas coal was tested as a fuel on both the Tasmanian Main Line and Launceston and Western Railways (Grant, 1883; Thureau, 1883*d*; Lord, 1883). Development work had started at both the Mt Nicholas and Cornwall mines by 1885. The St Marys–Conara (then Corners) railway was opened in June 1886, the same year that production started at the Cornwall Colliery. Activities at the Mt Nicholas mine were briefly suspended, the mine finally opening in 1888. Industrial troubles affected both mines in 1889 and again in 1900–1901.

The Jubilee mine opened in 1897, with an initial production of 25 t for the year. The Cardiff mine, adjacent to the Jubilee, opened in 1901 and closed in 1914. Prospecting in the Silkstone area of Mt Nicholas began in 1920, but no mine was ever established.

The Cornwall Coal Company purchased the Mt Nicholas mine in 1937 from the Mt Nicholas Coal Company Pty Ltd and closed down the workings, but reopened them in 1941. Interest was renewed in the Silkstone area in the early 1950s, but no mine eventuated.

The Jubilee mine closed in 1958, after having had difficulty with faulted seam conditions and water accumulation for most of the mine's life. The Mt Nicholas mine closed in the same year, and the Cornwall mine closed in 1964.

Table 4. *Mining methods, Mt Nicholas*

Mine	Mining methods employed: Bord and Pillar	Mining methods employed: Short or step longwall	Years of operation	Total production (t)
Mt Nicholas	✓	✓	1888–1958	1 748 609
Cornwall	✓	Minor before 1922	1886–1964	4 053 104
Jubilee	✓	x	1897–1958	675 784
Cardiff	✓	x	1901–1914, 1966	1 000
Silkstone	✓	x	1920, 1950–1951	1 000
Blackwood	✓	x	1981–present	*1 856 505

* Production figure to 30 June 1989. Includes 147 971 t mined by open cut.

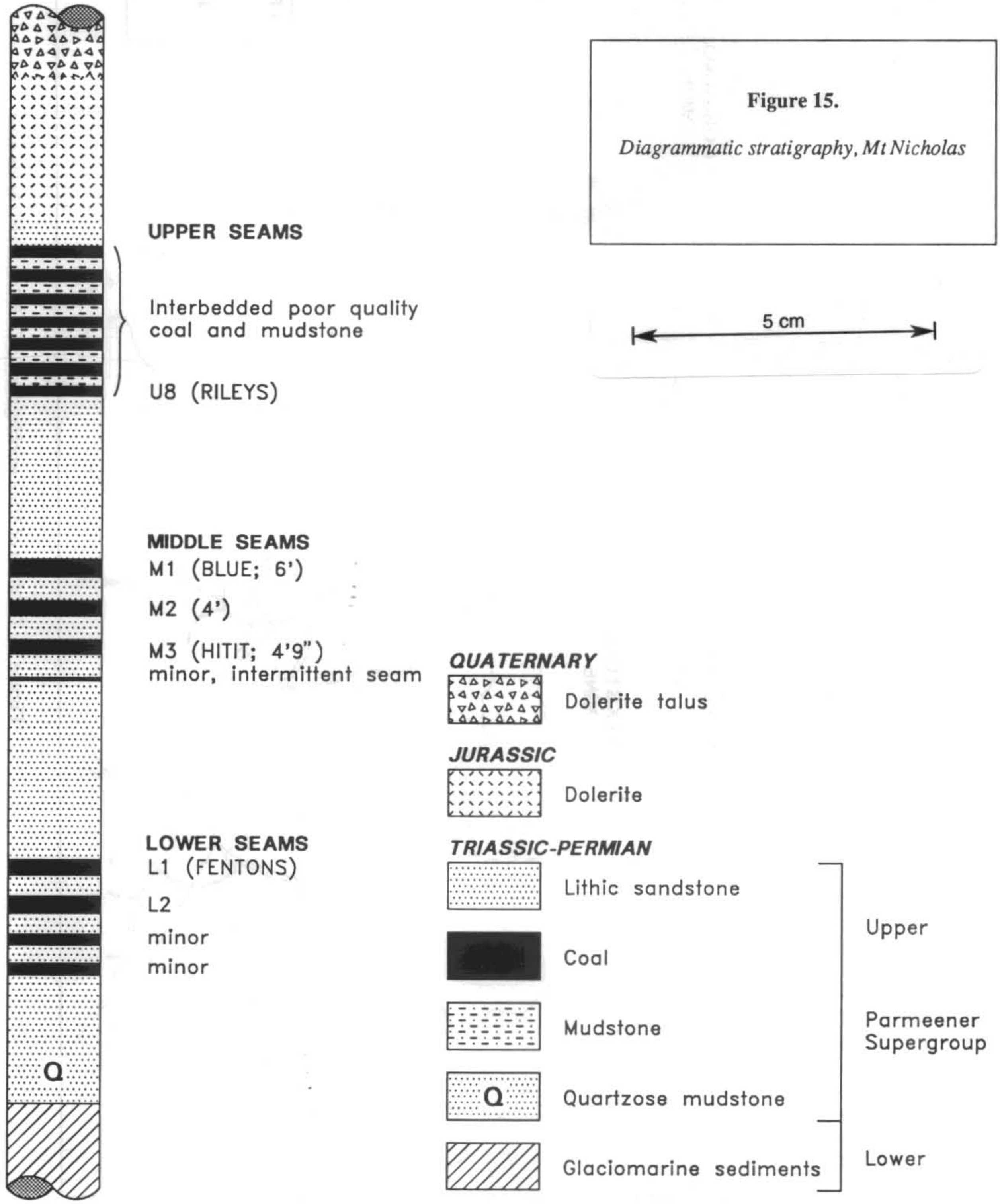


Figure 15.

Diagrammatic stratigraphy, Mt Nicholas

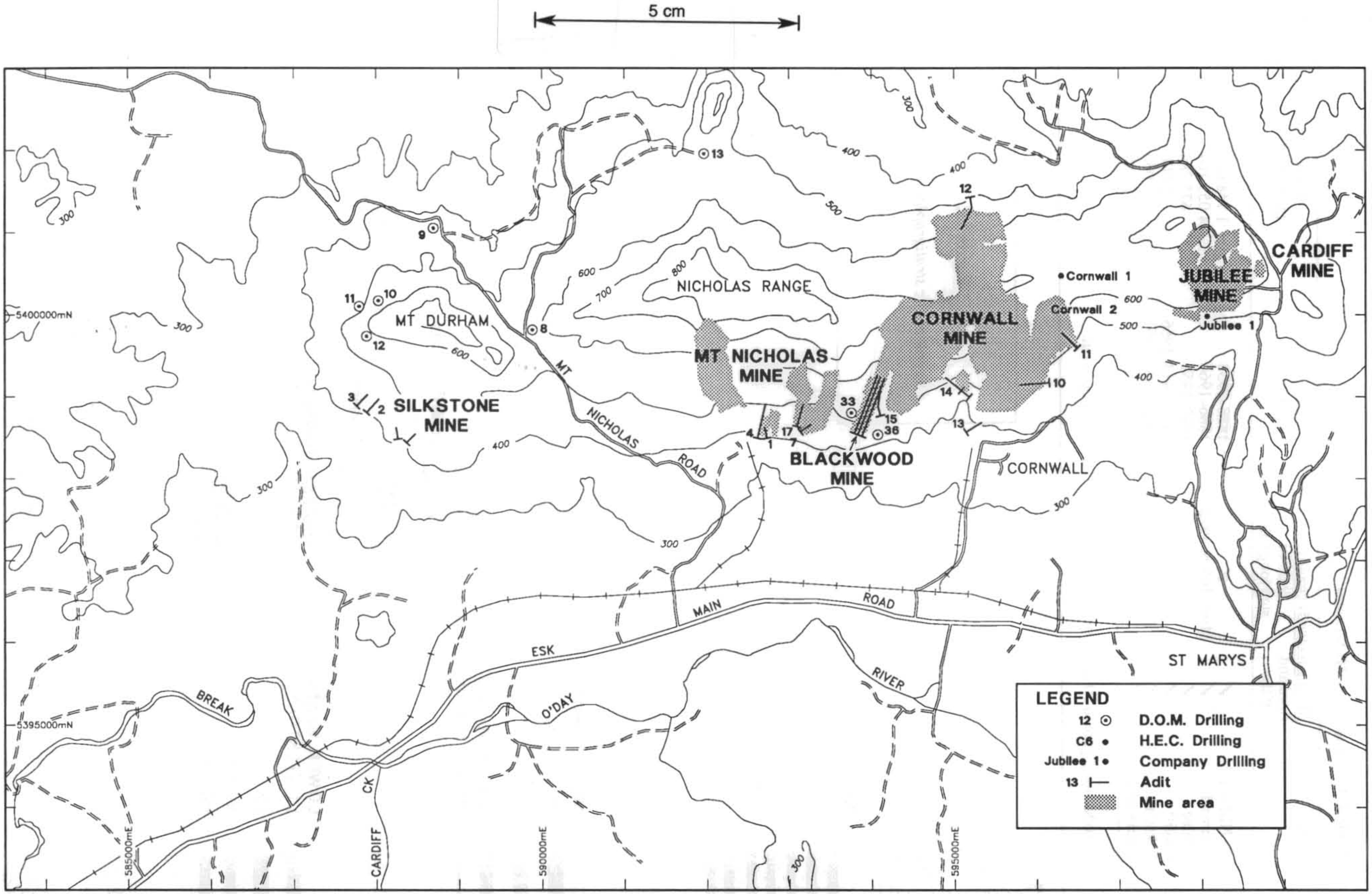


Figure 16. *Location of Mine workings and drill holes, Mt Nicholas area.*

Small-scale mining activities resumed at the Cardiff mine in 1966, but these soon ceased.

The latest, and currently the only working mine on the Nicholas Range, is the Blackwood Colliery, owned by the Cornwall Coal Company NL, which started production in 1981. The locations of the various mines on Mt Nicholas are shown in Figure 16.

Cornwall Mine

Mining at the Cornwall mine, owned by the Cornwall Coal Company NL, started in 1886, with 11 511 t of coal being produced in the first year. Preliminary exploratory prospecting work had been in progress since the late 1840s. The first recorded industrial trouble was in 1899, followed by a ten week strike in 1900.

In 1902 one of the main consumers of the coal, the Tasmania Company at Beaconsfield, withdrew their contract for Mt Nicholas coal, preferring instead to use imported Newcastle coal. The Cornwall Coal Company then secured a market on the mainland for their product, but this market was lost due to another miners' strike in June 1902. By 1906 production was 22 089 t for the year, with 61 men employed. By 1910 two seams were being worked, the Blue (M2) seam which was worked by longwall methods, and the Hitit (M3) seam which was mined by the bord and pillar system. In 1911 work started on the No. 1 and No. 3 tunnels of the Blue (M2) seam and on the No. 4 tunnel of the Hitit (M3) seam. Most development work was concentrated on the Hitit seam (M3) from 1914, as the workings on the Blue (M2) seam struck a major fault. Of the 1918 production of 27 330 t of coal from 72 employees, only 500 t were from the Blue (M2) seam. By 1931 the mine employed 130 men and produced 70 900 t of coal for the year. The workings stretched for 2.4 km. Roof trouble was a problem for the entire life of the mine. Work resumed on the Blue (M1) seam in 1937. Industrial trouble in 1937 and 1938 caused a slight drop in production.

By 1943 production was 83 000 t from 133 employees and an arc-wall coal cutting machine was installed. In 1946 the right hand side of the workings was abandoned due to excessive floor heave and the collapse of some of the airways. Water sprays were installed on the arc-wall coal cutter at the face, and storage bins erected in 1948.

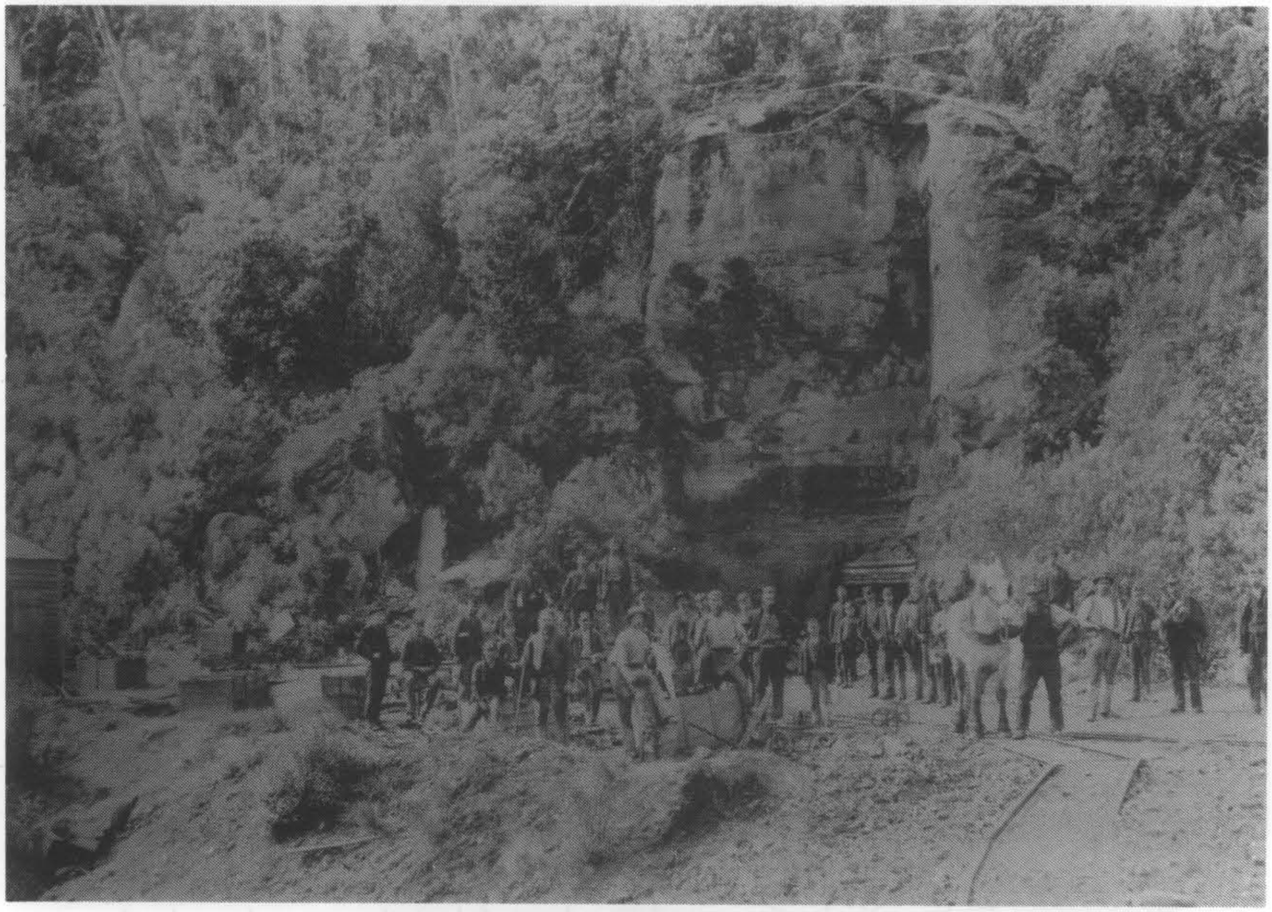
Workings in the Hitit (M3) seam broke out to the northern flank of Mt Nicholas in 1950, and a fan was installed at this point. A continuous miner was imported from the United States in the same year. Output in 1950 was 101 710 t from 131 employees.

Reduced demand for coal in 1953 caused production to drop to 88 147 t, with some of this being stockpiled. The continuous miner was unable to work to capacity due to the faulted nature of the seam. A fire in part of the workings of the Hitit (M3) seam in 1955 caused the arc-wall machine to be lost; entrances were sealed and development continued east of the fire-affected workings. Production in 1959 was 119 791 t, dropping to 92 503 t from 123 employees in 1961.

New ground between the Cornwall and Mt Nicholas faults was opened up in 1963, and in 1964 the mine finally ceased production. Men and machines were transferred to the Duncan mine at Fingal.

Three seams were worked at the Cornwall Colliery; the Blue (M2), Hitit (M3), and Fenton (L2). Only minor work was done on the Fenton (L2) seam in the early days of the mine life. The most extensive workings were on the Hitit (M3) seam.

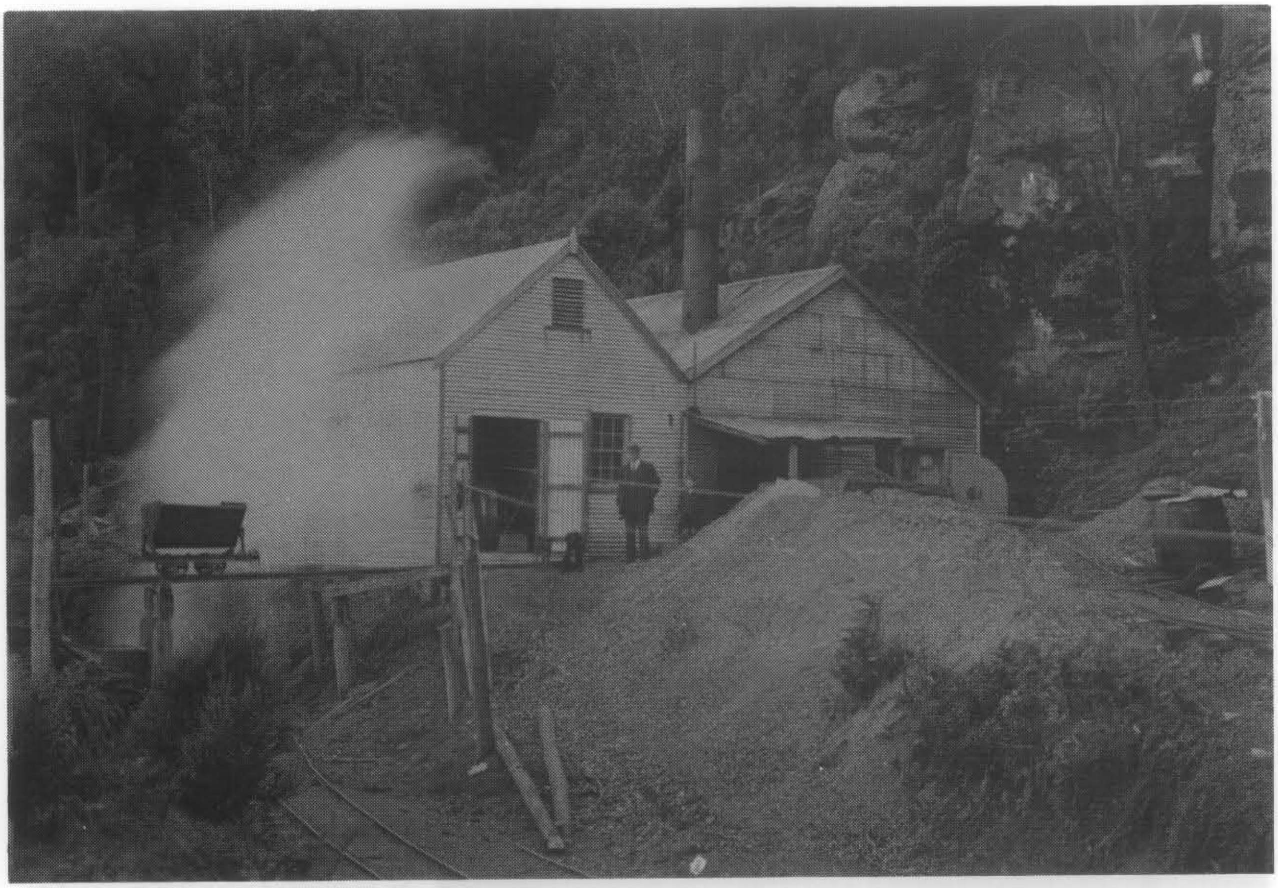
Total production from this mine was 4 053 104 tonnes.



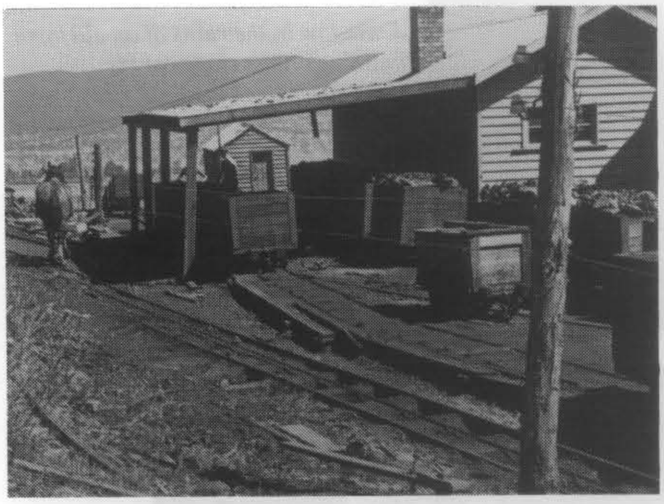
The original Cornwall Mine [Cornwall Coal]

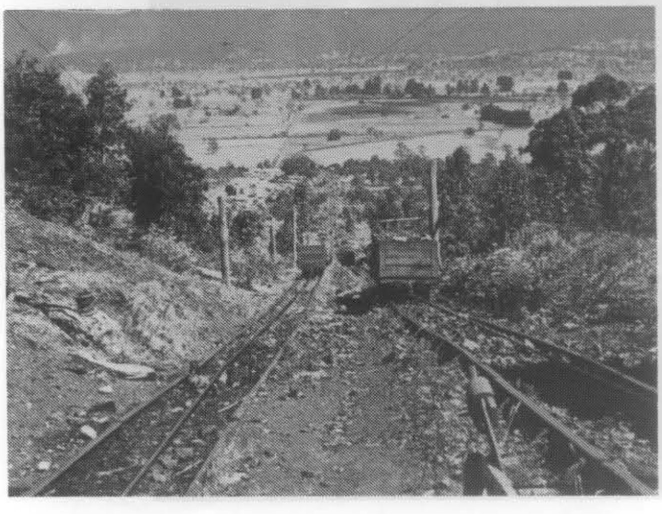
Entrance to the main heading on the Cornwall Seam, circa 1904, showing cable for hauling loaded skips. [Cornwall Coal]

After mining the coal was conveyed via a self-acting tramway to loading bins above the railway siding at Cullenswood. The bins at this location were rebuilt and expanded over the years, and served as the main loading point until the closure of the mine. Current output from the Cornwall area is trucked to Fingal for washing and loading. [Cornwall Coal]



Power house and winch house, Cornwall mine, circa 1930.

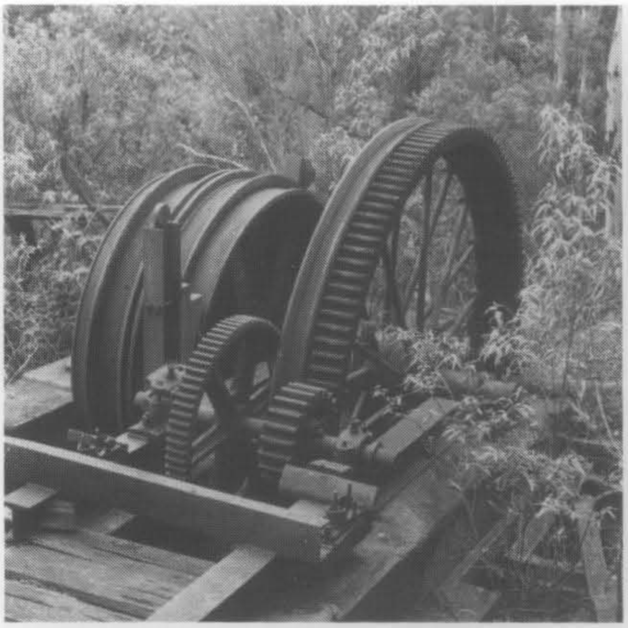




Attaching loaded skips to the winding cable, Cornwall Mine. (above)

Loaded and empty skips at the top of the decline leading to the loading bins. (left above)

Skips on the self-acting tramway which linked the Cornwall Mine, situated on the slopes of the Nicholas Range, with the loading bins, which were located almost 200 m lower on the floor of the Fingal Valley. *[All photos Cornwall Coal]*



Relics of a past era on the Nicholas Range:

Abandoned winding gear on the slopes of Mt Nicholas (top left) and an overturned mine skip (top right).

A window in the ruins of an old mine building on the slopes of Mt Nicholas frames the bush which is reclaiming the mine area (left), while the bush encroaches on an adit entry of the Jubilee Colliery (below left).

[All photos Carol Bacon]

Mt Nicholas Mine

Coal from the Mt Nicholas mine area was examined by Sir H. T. de la Beche in 1861, tested by the Launceston Gas Works in 1862, and also tested on the steamships *Monarch* and *Tasmania* in 1862. Both the Tasmanian Main Line Railway and the Launceston and Western Railway made some steaming tests of Mt Nicholas coal in 1883. These samples appear to have come from prospecting activities, with the first commercial mining starting in 1888. Mine development commenced in 1885, was postponed in 1886, and finally recommenced in late 1887 prior to mining proper starting in 1888.

Industrial trouble erupted at the mine in 1889 and again in 1900. Production slowly increased in 25 462 t in 1906 from 70 employees. In 1909 the company began prospecting behind the Killymoon Estate and found a one metre thick seam with an ash content (of a spot sample) of 8.5%.

By 1911 the longwall face was 500 m long and the mine ventilation had been improved. Production in 1913 was 31 397 t from 65 employees. Faulting of the longwall seam caused mine difficulties in 1916, as did a strike by the miners from 3 November to 4 December of the same year. The 6-foot (M1) seam was opened up in 1917, and in 1918 a lower seam, the 4-foot (M2) was also opened up. By 1919 driving on the 4-foot (M2) seam had stopped, and a drift driven from this seam up to the 6-foot (M1) seam encountered old workings. A main heading was put through these workings into solid coal. In 1920 a drift was driven down from the No. 3 tunnel in the M1 seam to the 4-foot (M2) seam, and in 1921 a new "Sirocco" ventilation plant was installed. Production for that year was 25 325 t from 84 employees. By 1922 most of the production was from the 6-foot (M1) seam, this seam being worked from two tunnels by the longwall method.

Hills *et al.* (1922) noted that the "extensive workings of the Mt Nicholas Coal Mining Company are the results of the operations of upwards of 30 years. The main tunnels have been driven in for over half a mile [800 m] and coal from 100 acres [40 ha] has already been won". Most of this early mining was by the longwall method, although by 1922 a modified version of this mining method, the step longwall, was being used.

In 1923 operations were confined to the No. 1 and 3 tunnels of the 6-foot (M1) seam, and in 1924 the No. 1 Tunnel, which gave access to the long-wall part of the mine, was closed. By 1925 all mining was done by the bord and pillar method. Production rose to 38 610 t in 1929 from 91 employees, but declined in 1931 when only 184 days were worked out of a possible 270, due to there being no market for the coal. A large fault was encountered in 1933 and development in the western part of the mine was restricted, with the eastern part of the mine having trouble with a poor roof. By 1935 seam conditions had deteriorated further and attention was directed to the 4'9" (M3) seam.

Development continued on the 4'9" (M3) seam, with most of the 1937 production of 22 579 t (85 employees) coming from this seam. At the end of 1937 the Mt Nicholas Coal Company Pty Ltd sold out to the Cornwall Coal Company NL, which withdrew all equipment from the mine and suspended mining operations.

Production began again in 1941 (16 982 t), increasing to 22 138 t (35 employees) in 1945. In 1964 some hand mining was done in seams above and below the previous workings in Rileys (U8) and the eight-foot (L2) seams.

In 1947 new headings were advanced into the 6-foot (M1) and 4-foot (M2) seams, and by 1949 work had been done on the 8-foot (L2) seam. Work on the lower (L2) seam was abandoned in 1950, and faulting hindered work in the M2 seam. By 1954 coal was being won from the 4'9" (M3) seam by machine, and by hand from the 6-foot (M1) seam. A fault caused the 6-foot (M1) seam to be downthrown almost in line with the 4'9" (M3) workings. The 6-foot (M1) seam workings were abandoned in 1957 due to the coal being "dirty", with many mudstone and claystone bands. The mine finally closed in 1958, leaving workings on a total of five seams; Rileys (U8), 6-foot (M1), 4-foot (M2), 4'9" (M3), and the 8-foot (L2).

A total of 1 748 609 t of coal was extracted during mining operations.

Jubilee Mine

The Jubilee mine commenced small scale production in 1897. By 1901 the workings consisted of one tunnel 50 m long (Twelvetrees, 1902*d*). Work by the Jubilee Company continued until 1902, by which time 2 455 t of coal had been mined, and work then ceased. Hills *et al.* (1922) state that there was no apparent reason for the operations to have stopped.

The Jubilee Coal Mining Company, formed in 1920, engaged in prospecting works and by 1922 had driven one tunnel 120 m, with cross cuts to the left and right (Hills *et al.*, 1922). By 1924 the daily output was 40 t and an aerial ropeway 3.6 km long had been completed to a railway siding near St Marys. Production increased steadily to 18 064 t in 1928 and 18 584 t in 1929, largely from the No. 5 Heading. In 1933 a "major upthrow" of the Jubilee seam was reached, and the seam was opened up from another tunnel (No. 2). Production in 1934 was 13 798 t from 50 employees. In 1935, 56 t of the 14 807 t mined by 43 employees were from the old Cardiff Workings. Water accumulating in the mine continued to be a problem because of inefficient pumps.

From 1937–1939 effort was directed at mine development, and production of coal came largely from the pulling of pillars in the old Cardiff mine. An electric coal cutter was acquired in 1943, when production was 24 115 t from 47 employees, but the cutter did not function satisfactorily due to faulted seam conditions and water problems.

The faulting and water problems plagued mine development, and finally caused the mine to close. Faulting retarded development of the main heading in 1949, and in 1950 a large landslide washed away part of the haulage lines. A contract system of mining was started in 1950 in order to increase coal production. As a result of this move production increased from 502.7 t/man/year in 1952 to 590.2 t/man/year in 1953. Large roof falls occurred in the eastern section of the mine in 1954. In 1955 work began on exposing part of the seam for open-cut operations. This idea failed, as removal of the dolerite talus was too difficult and expensive. As a result of roof falls, which almost blocked the return airway in 1958, the ventilation at the mine suffered, and in 1960 operations were finally suspended after the mine was worked for one month of the year.

Cardiff Mine

In 1901 the Coronation Coal Syndicate started prospecting activities which led to the opening of the Cardiff mine. The production in 1901 was 695 t, with three men being employed. Production dropped to 100 t in 1914 and thereafter work was intermittent. Mr H. Aulich bought the mine 1916 and in 1917 produced 125 t of coal. Hills *et al.* (1922) noted that production at the "old Cardiff Workings" ceased due to the workings hitting the Gould Fault. The mine was worked in 1966 on a weekend basis for six months, with 76 t being produced.

Silkstone Mine

The area known as the Silkstone mine has never produced any great quantity of coal, although periodic prospecting has been carried out since the 1920s. In 1920, a pre-existing small pit (mine) was leased to Messrs Meredith and Whittle, who obtained a bulk sample of the coal but did little development work. Hills *et al.* (1922) reported that the Silkstone workings comprised three tunnels of a prospecting nature on one seam; one tunnel 76 m long on a lower seam (probably L2); and a few prospecting adits on an upper seam (probably L1). No coal appears to have been mined, apart from the 140 t removed in 1920, until work recommenced in 1950. Elliston (1951) reported that seven tonnes of coal were being produced per day from one adit; a second adit on a lower seam was accessible but was not in use. Production ceased in 1951 after 620 t had been mined. The mine ceased operating mainly because of problems of water accumulating in the adit.

Blackwood Mine

This mine, operated by the Cornwall Coal Company NL, opened in 1980. Preliminary prospecting work began in 1979, and adits were driven in to the Blue Upper seam to the west of the old Cornwall mine to open up a fault-bounded piece of previously unworked coal. Surface infrastructure such as offices, bathroom, stores, equipment workshop and coal bins were established. The coal mined from this colliery is taken by road to the washery at Fingal.

In 1987 an area west of this colliery was prepared for mining by the removal of overburden material, exposing the top of the Blue Upper seam. The overburden of dolerite scree and weathered sediments was removed until a solid sandstone face was reached. Adits will be driven in under the solid sandstone in 1989.

Production for 1988–89 was 321 399 t of raw coal from underground, and 90 371 t of coal from the Blue Upper and Blue Lower seams in the Blackwood West open cut. Forty-two men were employed at the mine.

COAL QUALITY

Early analyses of coal from the Mt Nicholas coalfield are shown in Table 5.

More detailed analytical work has been carried out on these seams in recent years, and a sample of the available data is given in Table 6.

RECENT EXPLORATION

Prospecting activities have been present on Mt Nicholas since the 1840s, and mining of coal has been almost continuous since 1886. The management of the two larger mines have drilled numerous holes around the mines during the course of mining activity. Most of these holes were never fully documented and logs are unavailable. Logs of two holes drilled by the Government in 1888 at Harefield and on the Killymoon Estate are given in Hills *et al.* (1922). The logs of two holes drilled near the Cornwall Colliery (Cornwall 1 and 2) in 1957, and one hole drilled near the Jubilee Colliery (Jubilee 1) in 1959, are given in Threader (1968).

The Department of Mines began drilling on Mt Nicholas in 1969, and six holes were drilled between 1969 and 1972. The positions of these holes are shown in Figure 16. Two additional holes were drilled in 1978 between the old Mt Nicholas and Cornwall mines, in the area in which the Blackwood Colliery was eventually opened.

Exploration Licence 5/61, which included part of the Nicholas Range, was taken out by Industrial and Mining Investigations in 1961. A partnership with the Shell Company of Australia Ltd led to a coal exploration programme by Shell from 1980–1983 (over 15 km^2 of the Nicholas Range). Thirty-one fully-cored holes were drilled, along with sixteen non-cored holes and five pairs of large diameter (100 mm) holes to obtain sufficient seam samples for a washing test. All cores were geologically and geotechnically logged, and coal seams were analysed in detail. Details of this exploration are summarised in Wolff *et al.* (1981) and Patterson (1982, 1983).

This exploration identified four seams (M1, M2, L1, L2) of economic interest. All of the seams are, or could be, accessed by adit mining, although the choice of portal entry is limited

Table 5. *Analyses of coal samples, Mt Nicholas coalfield*

	1	2	3	4	5	6	7	8
Moisture (%)	3.8	2.9	3.4	6.1	5.4	4.2	6.2	6.5
Ash (%)	19.9	23.4	22.3	14.8	15.0	21.5	20.5	19.7
Volatile matter (%)	23.8	26.7	25.2	29.7	27.8	24.4	23.1	23.6
Fixed carbon (%)	52.5	47.0	49.1	55.5	57.2	49.9	50.2	50.2
Sulphur (%)	0.31	0.28	0.46	-	-	0.49	0.41	0.23
Specific energy (MJ/kg)	24.3	23.1	23.3	-	-	24.29	24.03	24.17

1. channel sample, lower 1.49 m Hitit (M3) seam, eastern workings, Cornwall Colliery (Threader, 1968).
2. channel sample, lower 1.70 m Hitit (M3) seam, gully section, Cornwall Colliery (Threader, 1968).
3. channel sample, lower 1.00 m Blue (M2) seam, Cornwall Colliery (Threader, 1968).
4. washed coal, seam M2 composite (excluding one dirt band) DOM DDH 33. Seam 2.65 m thick, separation density 1.6 t/m^3, yield 80.3%.
5. washed coal, seam M3 composite (excluding one dirt band) DOM DDH 33. Seam 3.02 m thick, separation density 1.6 t/m^3, yield 82.2%.
6. washed coal, M2 seam, hole GY42. Seam 3.29 m thick, yield 76% at separation density 1.70 t/m^3 (Patterson, 1983).
7. washed coal, L1 seam, hole GY40. Seam 2.20 m thick, yield 66% at separation density 1.70 t/m^3 (Patterson, 1983).
8. washed coal, L2 seam, hole GY34. Seam 2.05 m thick, yield 82.7% at separation density 1.70 t/m^3

Table 6. *Detailed analyses of coal samples, Mt Nicholas coalfield.*

Sample no.	1	2	3	4	5	6	7
Moisture (%)	5.3	6.7	5.19	6.9	6.3	5.8	5.9
Analysis basis (AD)							
Ash (%)	41.4	16.8	38.35	20.00	20.00	20.00	20.00
Volatile matter (%)	25.0	31.1	23.93	27.7	25.4	25.3	25.2
Fixed carbon (%)	33.6	52.1		45.4	48.3	48.9	48.9
Sulphur (%)			0.33	0.42	0.34	0.34	0.35
Chlorine (%)			0.005	0.04	0.06	0.07	0.05
Specific Energy (MJ/kg)	17.94	25.56	19.22				
C (%)			48.16				
H (%)			3.13				
N (%)			0.90				
CO_2 (%)	0.82	0.22		0.24	0.51	0.19	0.55
Dry, ash-free basis							
Volatile matter (%)			31.86	37.9	34.4	34.1	34.0
Specific Energy (MJ/kg)	30.62	33.12	31.18				
C (%)	78.3	81.6	78.12	80.25	81.31	81.67	81.57
H (%)	5.15	4.93	5.08	4.91	4.94	4.98	4.88
N (%)	1.44	1.49	1.46	1.45	1.42	1.39	1.43
S (%)	0.51	0.55		0.54	0.41	0.47	0.47
O (%)	14.6	11.4	8.55	12.85	11.94	11.52	11.66
Ash Fusion Temperatures (reducing atmosphere) (°C)							
Deformation	1060	1100		1360–1410	1340–1600+	1560–1600+	1330–1600+
Spherical	1330	1350		1470–1500	1410–1600+	1600+	1480–1600+
Hemisphere	1380	1380		1490–1560	1420–1600+	1600+	1500–1600+
Flow	1480	1430		1500–1560	1440–1600+	1600+	1520–1600+
Ash Analysis (%)							
SiO_2	58.9	60.6	57.82	51.00	61.60	64.03	60.96
Al_2O_3	24.4	20.2	26.66	23.27	27.70	29.30	30.68
Fe_2O_3	8.9	12.2	5.60	5.58	4.57	2.68	3.89
Mn_3O_4	0.009	0.006	0.14	0.09	0.05	0.03	0.03
P_2O_5	0.160	0.082	0.05	0.01	0.02	0.02	0.09
TiO_2	0.96	0.73	0.88	1.13	1.10	1.64	1.22
CaO	3.50	2.13	4.68	2.66	0.96	0.35	0.69
MgO	1.19	1.12	1.97	1.06	0.95	0.37	0.69
K_2O	1.40	0.52	1.11	0.65	0.57	0.33	0.42
Na_2O	0.98	0.59	0.32	0.30	0.15	0.20	0.23
SO_3	1.11	0.97		1.31	0.38	0.27	0.15
Trace Elements (ppm)							
U			4				
As				1.3	0.8	1.0	0.8
P				0.001	0.001	0.002	0.001
Separation density		1.60					
Yield (%)		60.6					
Forms of sulphur							
Pyritic			0.0				
Sulphate			0.03				
Organic			0.34				

1. raw coal, channel sample, Blue Upper (M1) seam, Blackwood Colliery; C38 [AMG 594 375 mE, 5 399 750 mN] (Bacon, 1984).
2. washed coal, channel sample as above, 12.7 mm x F1.60 (Bacon, 1984).
3. bulk sample from Blackwood mine bins (Knott and Warbrooke, 1983).
4. washed coal; average of analyses from the M1 seam (Patterson, 1983).
5. washed coal; average of analyses from the M2 seam (Patterson, 1983).
6. washed coal; average of analyses from the L1 seam (Patterson, 1983).
7. washed coal, average of analyses from the L2 seam (Patterson, 1983).

in some areas due to the development of extensive colluvial deposits. All the seams can be washed to a product of around 20% ash, giving a product of around 11% moisture with a heating value of 22 MJ/kg. Total reserves from the drilling are estimated at 48.8 Mt (measured, *in situ*), which should yield some 22 Mt of recoverable coal.

Since 1978 the Cornwall Coal Company has drilled a total of twenty-eight holes on Mt Nicholas, most being on Mining Lease 34M/79. Logs and analyses for some of this drilling are given in Bryan (1979, 1985).

The area of the Mt Nicholas coalfield is currently held under Mining Lease 32M/85 and Retention Licence 878 (9 km^2) held by the Shell Company of Australia; and Mining Leases 34M/79, 1004P/M, 1055P/M and Retention Licence 8815 (25 km^2) held by the Cornwall Coal Company NL.

POTENTIAL FOR FUTURE EXPLORATION

The Mt Nicholas Coalfield is the most promising area in the State for future coal mining operations. Reserves over the whole of the range have not yet been established to measured or indicated status. Total *in situ* reserves would be in the order of 100 Mt, so the coalfield would be classed as having a 'small inferred reserve' according to AS2519-1982.

Estimates on the tonnage of coal recoverable are dependent on economic factors, mining conditions, and market trends, and are not able to be calculated on the information available.

The Fingal Coalfield

SUMMARY

Fingal Tier rises steeply from the floor of the Fingal Valley to a height of 700 m above sea level. Coal crops out around the northern and north-eastern flanks of the Tier.

Coal outcrops south-east of Fingal were first described by Milligan in 1849, and minor mining works in this area were visited by Thureau (1883*c*). A number of mines have operated in the Fingal coalfield, but all have now closed except for the Duncan Colliery owned by the Cornwall Coal Company NL.

The Department of Mines conducted an exploration programme on Fingal Tier from 1959 to 1983, involving diamond drilling, geophysical surveys, geological mapping, and coal sampling and analysis.

The coal seams occur in a 200–400 m thick fluvial sequence of dominantly lithic sandstone with minor interbedded mudstone, claystone, siltstone and rare tuff, belonging to the Upper Parmeener Supergroup. The coal is of Triassic age. The coal-bearing strata have been intruded by, and are now capped with, Jurassic dolerite.

Coal reserves have been calculated for three seams over part of the Fingal coalfield. The *in situ* reserves are 68 million tonnes (measured) for the Duncan seam; 60 million tonnes (indicated) for the East Fingal Upper Split; and 100 million tonnes (indicated) for an intermediate seam. The Duncan seam is the only one in this area which has been mined.

LOCATION AND ACCESS

The Fingal coalfield is located south-east of Fingal in northern Tasmania. The coal-bearing strata on Fingal Tier lies beneath a cap of Jurassic dolerite. Fingal Tier rises steeply from the floor of the Fingal Valley to a height of 700 m above sea level, and coal seams crop out around the northern and north-eastern flanks of the Tier.

GENERAL GEOLOGY

The regional geology of the area has been mapped by Threader (1968) and Turner *et al.* (1984). The geolgy of the area has been described by Turner and Calver (1987), with the geology of the south side of the Fingal Valley and of the Mount St John area (the Fingal Valley Exempt Area) having been described in detail by Baillie and Calver (1980). The geology of the area is shown in Figure 14. The results of a gravity survey of the East Coast coalfields are given in Leaman and Richardson (1981).

In the Fingal area, a glaciomarine sequence of fossiliferous mudstone of the Lower Parmeener Supergroup is paraconformably overlain by coal-bearing sediments of the Upper Parmeener Supergroup.

The sandstone unit immediately overlying the Lower Parmeener Supergroup sediments is a fine to coarse-grained quartzose sandstone, ranging in thickness from 0–50 metres. The quartzose sandstone grades up into a dominantly lithic sandstone sequence with minor interbedded mudstone, siltstone, claystone, carbonaceous mudstone, coal, rare conglomerate and rare tuff. The coal-bearing sequence reaches a maximum thickness of about 400 metres.

Dolerite of Jurassic age has intruded the sedimentary rocks as a series of sheets and dykes. The thickness of the dolerite capping Fingal Tier varies considerably, depending on the position of the base of the dolerite, the base being very irregular. From drilling information, the dolerite is typically 100–300 m thick on Fingal Tier. Fine-grained, later stage dolerite dykes have intruded the main dolerite body. These dykes are usually 2–3 m wide, and have been found in outcrop (Baillie and Calver, 1980) and in drill core on Fingal Tier.

Dolerite talus thickly blankets the slopes of Fingal Tier and higher parts of the plateau area. Immature dolerite stream gravel occurs on the foothills on the southern side of the Fingal Valley. Unconsolidated alluvial sand and gravel are found in low-lying areas close to the Break O'Day River, and swamp and marsh deposits cover part of the high plateau area.

COAL GEOLOGY

There are eight major coal seams on Fingal Tier; these have been labelled seams A–H by the Department of Mines. Some, notably the A and B seams, are better described as carbonaceous intervals, as they consist of plies of coal less than 0.5 m thick interbedded with carbonaceous mudstone and claystone over intervals of 5–10 metres. All the seams are characterised by a high inherent ash content, and all have only a small (<10%) component of bright coal. The coal is of medium rank, with a high ash and low sulphur content, and is suitable for steam raising purposes.

No satisfactory marker horizons have been recognised in the fluvial sequence on Fingal Tier. In order to obtain a reliable correlation of coal seams it has been necessary to drill to the glaciomarine sequence of the Lower Parmeener Supergroup (formerly referred to as 'Permian' sediments). This basement dips gently to the east and forms a known horizon from which correlation of coal seams may be more confidently undertaken. Drill holes must commonly be 500–600 m deep in order to reach the glaciomarine basement.

In the western part of the former (now revoked) exempt area (SR 32/81) a one metre to three metre thick conglomerate horizon has proved to be a reasonable marker where present. The conglomerate band (informally called the Dalmayne Conglomerate) is composed of well-rounded pebbles and cobbles of green and white quartzite, acid pyroclastic rocks, and slate, elongate to spherical in shape, and set in a matrix of coarse-grained lithic sandstone. The conglomerate band is, however, too patchy in areal distribution to be a significant marker bed.

A number of tuff intersections have been recorded in the eastern part of the exempt area. The tuff is an acid, air-fall vitric tuff, with the intersections <1 m thick. However the patchy areal distribution of the tuff makes its use as a marker horizon minimal.

The two seams which are of greatest economic interest on Fingal Tier are the Duncan (seam F) and the East Fingal (seam G).

The Duncan seam is currently mined at the Duncan Colliery and is the only seam to have been extensively worked. Typically the seam consists of 2–3 m of dull coal with minor clay and mudstone partings. The raw ash content is approximately 30%, and the specific energy 22–24 MJ/kg.

The East Fingal seam is about 30 m stratigraphically below the Duncan seam, and is commonly split. The Upper and Lower Splits (GU and GL) of the East Fingal seam are commonly 1–2 m in thickness, with the intraseam sediments being 0–10 m in thickness. The Upper Split is less well developed west of the Mitchell Fault. The coal quality is similar to that of the Duncan seam.

Further details of the seams on Fingal Tier are given in Threader and Bacon (1983).

PREVIOUS MINING HISTORY

Milligan (1849) described in detail the coalfields of the East Coast, and visited outcrops of coal about four kilometres ESE of Fingal. Milligan mentioned three seams of coal in this area, exposed in the upper two branches of an 'insignificant creek'. The main seam, about 3.6 m thick and which crops out in both creek branches, was burnt for 20 m along the seam in the most easterly outcrop; the level of this seam was 150–180 m above the level of the plain.

Two smaller seams were also seen; one 0.98 m thick 60 m above the first, and another seam 0.84 m thick 15.2 m below the main seam. These seams appear to have been seen in Cat and Kitten Creek.

Selwyn (1855) visited the same outcrops as Milligan, reporting two seams as being 4.3 m and 0.9 m thick. Gould (1861*b*) wrote at length on the coalfields of the East Coast, and also visited the seams near Fingal described by Milligan (1849) and Selwyn (1855). Gould could only see 2.1 m exposed of the 3.6 m seam, and commented that the coal appeared to "contain more ash, and to be, on the whole, inferior in quality to that contained in the same seam upon the opposite side of the valley".

Gould (1861*b*) correlated the seam near Fingal with the 'Killymoon' seam on Mt Nicholas. Milligan (1849) also noted that coal or coal measures cropped out in almost every creek along the range (Fingal Tier) east from the town of Fingal, and described the coal outcrops examined.

A lease was held in 1861 by Messrs Brown and Hancock near Fingal, and in 1864 the government financed the digging of an adit to inspect the coal (HAJ 95/1897 p7).

Coal was tested by the Launceston Gasworks and on board the steamships *Tasmania* and *Monarch* in 1862 (Falconer, 1862), and by the railways in 1883 (Thureau, 1883*d*).

Thureau (1883*c*) also visited the thick seam, stating the thickness to be 3.3 m and the seam as having been opened up 'years ago' by means of a tunnel driven in for 13.7 m; the tunnel had recently been extended to 15.2 metres. The whole seam was, at the time of Thureau's visit, being mined in large "lumps or junks" by experienced miners. Thureau (1883*c*) referred to this outcrop (in Cat and Kitten Creek) as the Mt Malcolm coal. He also recorded a seam of coal 0.6 m thick 9.1 m below the 'Mt Malcolm' seam. Thureau recorded two outcrops of coal in Fingal Rivulet, and one 1.2 m thick seam in Telopea Creek which had been worked by some shallow and inextensive workings. This outcrop is probably that of the G (East Fingal seam) at EP84488750. The workings on the 'Mt Malcolm' coal are close to where the Fingal, Duncan, and Tasmanian mines later worked.

A drill hole was put down in the area of the 'Mt Malcolm' coal; the log of this hole is given in the Secretary for Mines Report of 1887. The exact location of the hole is not known.

Johnston (1888) described the geology and details of coal seams found in the north-eastern coalfields, basing his writings on the earlier reports of Milligan (1849), Selwyn (1855), and Gould (1861*b*).

In 1920 the Fingal Coal Prospecting Syndicate drove two tunnels into an outcrop of coal near Coal Creek (now called Cat and Kitten Creek). About 120 t of coal were produced from these workings in 1920.

Hills *et al.* (1922) noted "Minor works of a prospecting nature" in the Fingal area, and inspected three tunnels. One tunnel (adit) was on Cardiff Creek, near where Barbers mine later operated; a second tunnel was inspected in Crouchs Creek, east of where Barbers mine later operated; and a third tunnel was examined near Cat and Kitten Creek.

In 1942 H. J. E. Yeates acquired the leases formerly held by the Fingal Coal Prospecting Syndicate, and mining progressed in a more orderly fashion.

The Duncan mine opened in 1945 and the Tasmanian mine in 1954. These three mines (Mr Yeates' Fingal mine, the Cornwall Colliery's Duncan mine, and the Tasmanian mine) all worked the Duncan seam, and were located within a few hundred metres of each other on the eastern bank of Cat and Kitten Creek.

The Tasmanian mine closed in 1957, but was reopened briefly by the Fingal Coal Company Pty Ltd from 1962–63. The Fingal mine closed in 1965, but in 1970 the Cornwall Coal Company reopened the Fingal (Cat) tunnel, as unstable ground was forcing closure of the adjacent Duncan mine. The Fingal (Cat) tunnel was retimbered and driven ahead into virgin coal, and now forms part of the main heading and part of the belt road of the current Duncan mine. The return air from the current mine is directed through the old workings around the Duncan tunnel.

Several kilometres east of these workings, in a tributary of Cardiff creek where Hills *et al.* (1922) saw prospecting works, another small mine opened in 1955. This was known as Barbers No. 1, later renamed the Valley No. 1 mine. A second set of headings a few hundred metres east of the first were driven in 1963; these were called Barbers No. 2 or the Valley No. 2 mine, and were owned by Mr Barber who had formed the Valley Coal Company.

Fingal Mine (1920–1965)

In 1920 the Fingal Coal Prospecting Syndicate drove two tunnels into an outcrop of coal near Coal Creek (now called Cat and Kitten Creek; the seam is now called the Duncan

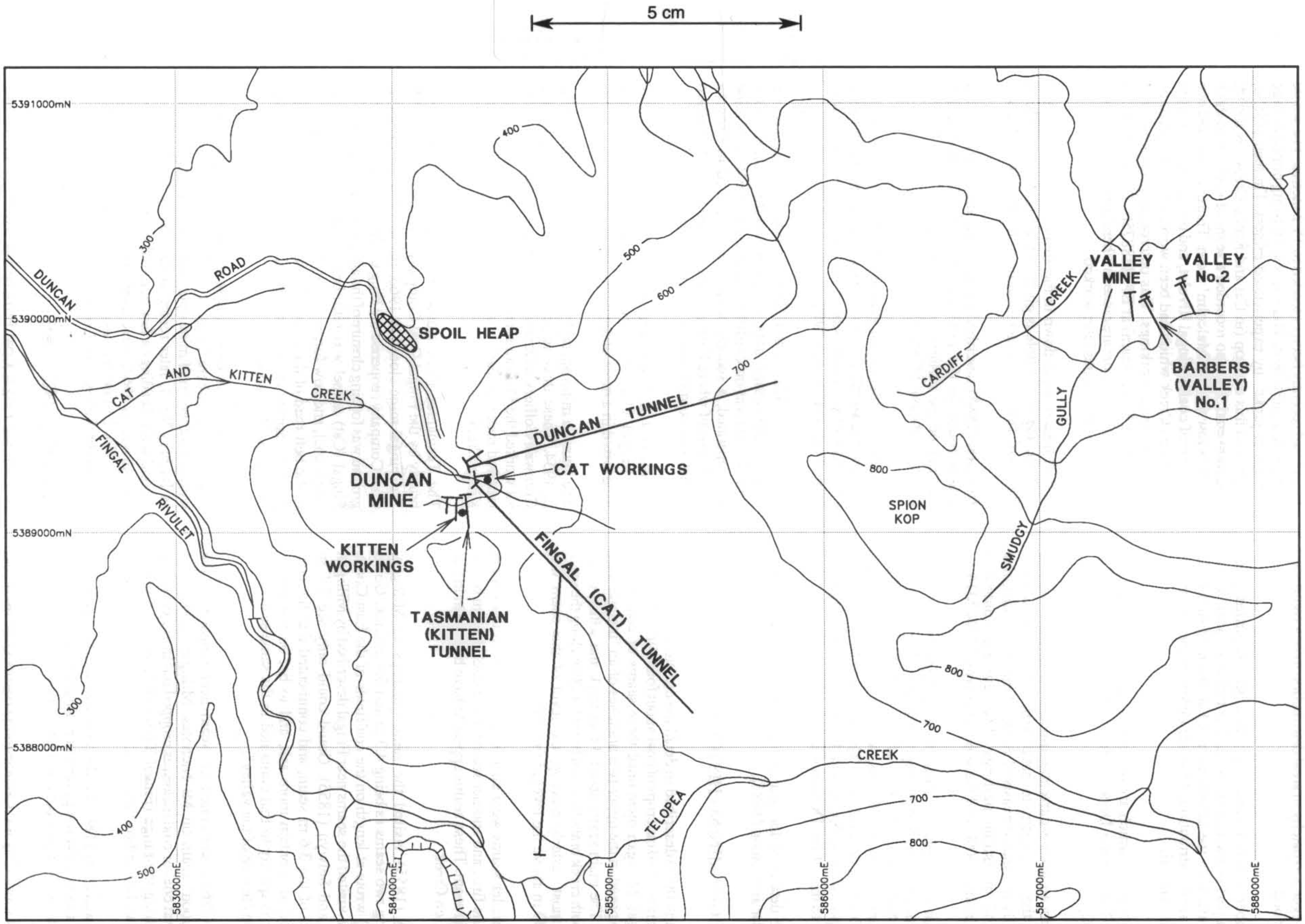


Figure 17. *Location of mine adits on Fingal Tier. Contour interval = 100m.*

seam). Over the next twenty years almost 18 000 tonnes of coal were produced. The two tunnels were known locally as the Cat and the Kitten. The Kitten workings were abandoned after coal was found to have been intruded by dolerite 220 m from the entrance (Blake , 1960).

The leases were transferred to H. J. E. Yeates in 1942, who formed the Fingal Coal Company Pty Ltd and began a series of mine improvements. The old Cat tunnel was renamed the Fingal tunnel, and a new adit was dug adjacent to the Fingal tunnel to serve as a return airway. This was simply called the Main Return Airway.

Production increased from 847 t in 1938 to 4000 t in 1942 from four employees. A ventilation fan was installed in 1946 and a water pump in 1948. The coal was mined by hand, using the bord and pillar method. Production steadily increased from 12 565 t (15 employees) in 1949 to 22 608 t (17 employees) in 1950, which, at 1738 tonnes/man/year was the highest production per employee of any mine in the State for 1950. Mining was done by hand on a contract basis.

In 1958 seam conditions began to deteriorate, and in 1960 large faults with throws of up to six metres were encountered in both the Fingal (Cat) tunnel and the Main Return Airway. In 1962 pillars were pulled along the boundary of the Fingal Colliery–Duncan Colliery leases. In 1965 the mine closed due to the loss of a major market when the Goliath Cement Company's factory at Railton changed from burning coal to oil.

In 1969 the Fingal tunnel was reopened because of the forced closure of the adjacent Duncan mine. The Fingal (Cat) tunnel was wholly rehabilitated and now serves as part of the main heading for the current Duncan mine.

Duncan Mine (1945–present day)

The Duncan mine was opened by the Cornwall Coal Company in 1945, and originally consisted of a main heading (the Duncan tunnel) and an adjacent return airway. Production in the first full year of operation was about 3300 t of coal from six employees, climbing to about 27 000 t from 31 employees in 1953.

The mine was partly mechanised in 1955 with the introduction of an arc-wall coal cutter and two shuttle cars. Some hand mining continued until 1961 when the mine was completely mechanised. A washing plant was installed adjacent to the Esk Highway and railway line in 1959, and was used for the first time in 1960, washing coal from the Company's Cornwall mine near St Marys and the Duncan mine at Fingal. Output from the mine increased to 83 100 t in 1961, and again increased in 1964 when the Cornwall mine closed and the company sought to fulfil all orders with coal from the Duncan mine. Development work was reported to be intermittent in 1966. In 1966 the Company drilled one hole in the vicinity of the Fingal (Cat) tunnel in order to test a lower seam (East Fingal seam). Mechanisation was improved in 1968 with the addition of a CM38H Lee Norse Continuous Miner. Creep, which had hindered mining activity, forced the mine to close in 1969 and all activity was transferred to the nearby Fingal (Cat) tunnel, in the same seam close to the Duncan tunnel.

By 1970 the Fingal tunnel was completely re-timbered and work proceeded through the old workings to virgin coal beyond. Minor production came from the 'Burma Section' of the old Duncan mine in 1970. In 1971 dewatering of the old main heading (Duncan tunnel) commenced, and the Duncan mine finally consisted of the old Duncan workings through which the return airway was vented, and the Fingal (Cat) tunnel, which was used partly as a main heading and partly as a belt road. An area between the Duncan and Fingal tunnels has been called the Cat Workings. This is shown in Figure 17. Production in 1978 was 223 957 t from 107 employees. Infrastructure, such as a pit office, bath house, and first aid room, was added to the mine. A centrifuge was added to the washery, and another continuous miner acquired for work in the mine. In 1979 mining conditions were reported to be poor, and in 1981 an attempted break out in the area above the old Valley mine was abandoned because of dolerite intrusions and excessive floor heave. A second point of egress was provided in 1982 in the south-western part of the mine area. Problems with water, floor heave and minor faulting have been present since the mine opened, however, production has increased from about 3300 t from six employees in 1946 to 371 000 t from 65 employees (18.5 t/man/shift) in 1986/87.

Tasmanian Mine (1954–1957, 1962–1963)

This mine opened in 1954, with the digging of two adits a few metres to the south-west of the old Kitten tunnel, which was renamed the Tasmanian tunnel and used as access to the new mine.

The coal was mined from the Duncan seam, worked also by the Fingal and Duncan mines. Production for the first year was 1540 t of coal, and employment was provided for nine men. The mine closed in 1957. The workings, which were not extensive, were in badly faulted ground. A minor connection was made between the Tasmanian mine and the adjacent Fingal mine. The position of the mine workings is shown on Figure 17. On the closure of the Tasmanian mine in 1957, the leases were taken over by the Fingal Coal Company, which reopened the mine briefly from 1962 to 1963, but the mine was closed as ventilation and safety regulations could not be met.

Barbers (Valley) Mines (1955–1964)

Two kilometres north-east of the Duncan, Fingal and Tasmanian mines are two small mines, the first of which started in 1955 and was known as Barbers mine. This seam appears to be a locally developed lower split of the main Duncan seam mined in the Duncan and Fingal mines.

An adit was put in on an outcrop of coal in a seam which measured 2.01 m thick, and 623 t of coal were removed. A fault was encountered a short distance to the left of the main heading and the tunnel was abandoned. A new tunnel was driven in a short distance to the east of the first. Both these adits comprised Barbers mine. In 1960, a second entrance for a return airway was built next to the 'new' tunnel and a fan installed. In 1962 these workings were renamed the Valley mine, but closed at the end of the year. Two new adits to the east of the Valley mine were dug in 1963, and these were named the Valley No. 2 mine. Coal was cut mechanically but loaded by hand and drawn to the surface by horse-drawn skips. The Valley No. 2 closed at the end of 1964 due to a loss of markets, when the part owners, Goliath Cement Ltd, changed their Railton plant from coal to oil burning. Inspections of the workings were made by Hughes (1955*a*, 1959*a*); Hughes (1959*a*) calls the workings the Cardiff Colliery, as the mine was located on a tributary of Cardiff Creek.

COAL QUALITY

Analyses of samples from seams in the Fingal Coalfield are given in Table 7. Detailed analyses of run-of-mine coal from the Duncan mine are given in Table 8. A complete record of analyses obtained during the Department's exploration programme can be found in Threader and Bacon (1983).

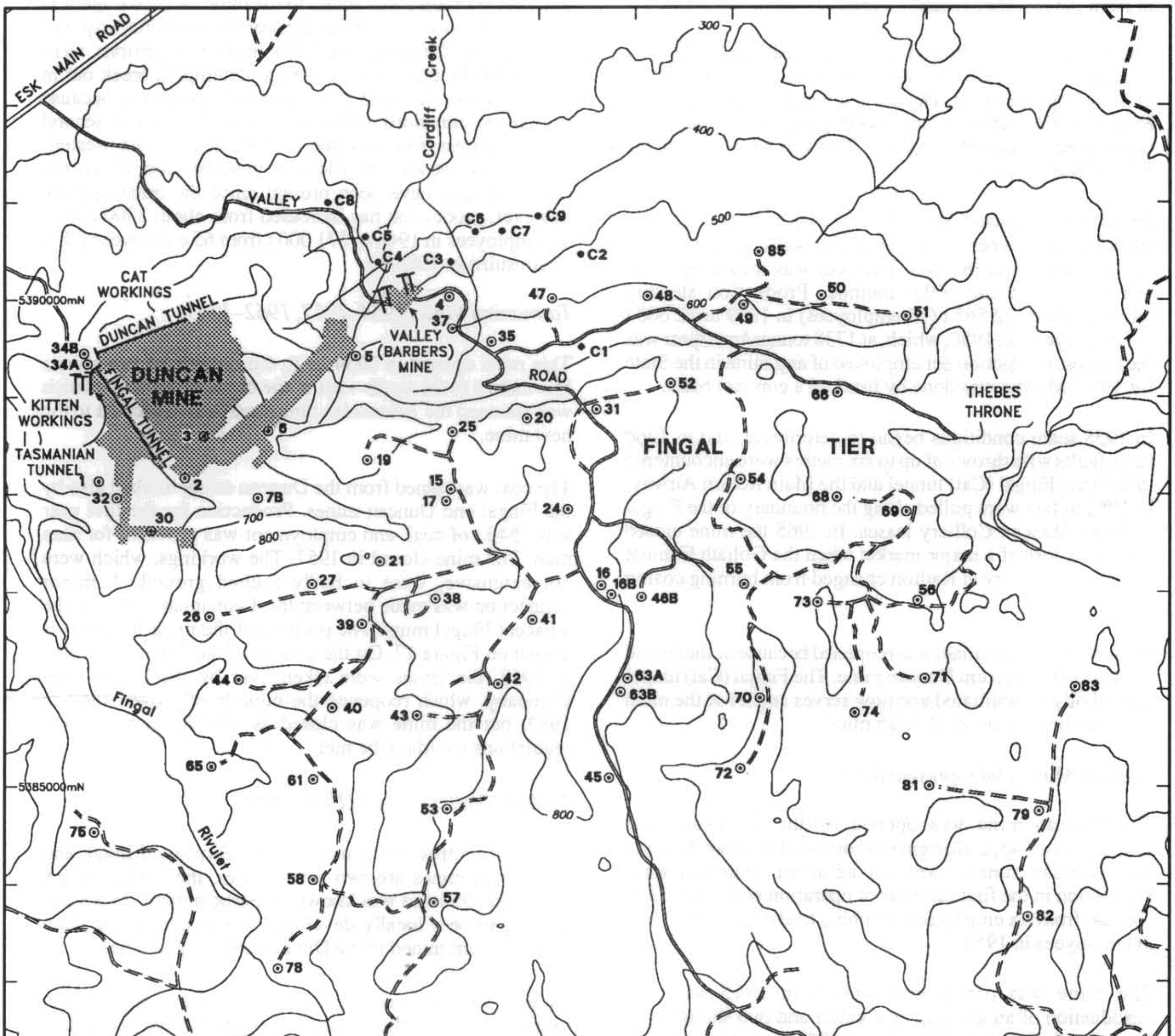


Figure 18. *Location of mine workings and drill holes, Fingal Tier.*

5 cm

Table 7. *Analyses of coal samples, Fingal coalfield.*

	1	2	3	4	5	6	7
Moisture (%)	4.27	4.38	3.6	5.0	4.9	5.0	4.9
Ash (%)	21.1	22.30	26.3	23.2	26.3	33.5	25.0
Volatiles (%)	23.5	23.7	22.9	28.6	28.7	21.3	24.9
Fixed C (%)	51.1	49.62	49.8	48.2	45.0	45.2	50.1
Sulphur (%)	0.24	0.30		0.30	0.41		
SE (MJ/kg)	23.3	23.4	24.3	26.3	22.9	21.5	27.7

1. Channel sample, Valley No 2 seam (Duncan seam lower split) near portal, 1965
2. Channel sample of Duncan seam worked section; some coal left in roof, Fingal (Yates) Colliery, 1965.
3. East Fingal Lower Split (GL), DDH17, 2.00 m thick, raw coal (Threader and Bacon, 1983)
4. Duncan Seam (F), DDH2, 1.70 m thick, raw coal (Threader and Bacon, 1983)
5. 'D' seam, DDH5, 1.22 m thick, raw coal (Threader and Bacon, 1983)
6. East Fingal Upper Split (GU), 1.76 m thick, raw coal (Threader and Bacon, 1983)
7. East Fingal Lower Split (GL), DDH20, 2.94 m thick; sample of top 1.18 m of seam, raw coal (Threader and Bacon, 1983)

RECENT EXPLORATION

In 1978 an area of 94 km^2, known as the Fingal Valley Exempt Area (Statutory Rule 1978/10, amended SR 1964/167), to the south and east of the Duncan mine lease, was made exempt from the provisions of the Mining Act, 1929, by the Department of Mines, to allow the Department exclusive exploration rights over this area. In 1979 the Mt St John Exempt Area of 78 km^2 (SR 1979/107) and the Fingal Exempt Area (176 ha; SR 1979/168) were added. The latter area was later amended to 176 ha (SR 1979/168). The total area available for exploration by the Department was 174 square kilometres.

In 1981 the western part of the Exempt Area was relinquished, and taken up as EL 17/81 by the Cornwall Coal Company. This Exploration Licence was incorporated into EL 50/82, and the ground is now held under Retention Licences 8812 and 8816.

Exploration commenced in 1959 with a scout diamond-drilling programme aimed at testing the continuation of known seams in the vicinity of the Duncan, Valley and Fingal mines.

Eventually much of the Exempt Area was drilled on a one kilometre spaced grid (fig. 18). During the period 1972–1982 sixty-nine holes were drilled, including eight holes drilled to assist in the location of new adit entries. Five additional holes were drilled in the neighbouring areas for stratigraphic control of the gravity survey of the coalfields. Details of the Department's exploration are given in Threader and Bacon (1983).

In February 1986 a study titled "Evaluation of dolerite sill overburden on underground mining operations" and funded by the National Energy Research Department and Demonstration Council (NERDDC) began at the Duncan Colliery. The project was undertaken by the Australian Coal Industry Research Laboratories (ACIRL), with assistance from the Department of Mines. The aim of the investigation was to research the problems associated with coal mining

Table 8. *Analyses of run of mine coal, Duncan Colliery*

Sample No.	1	2	3	4
Moisture (%)	4.6	4.44	6.5	5.9
Analysis Basis (DB)				
Ash (%)	30.7	35.45	48.4	20.4
Volatile matter (%)	-	21.10	18.6	26.5
Fixed carbon (%)	-	51.72	33.0	53.1
Total sulphur (%)	-	0.77	0.24	0.39
Chlorine (%)	-	0.004		
Specific energy (MJ/kg)	-	28.97	15.88	26.68
H (%)	-	2.92		
N (%)	-	0.91		
CO_2 (%)	-	3.42	1.22	0.58
Dry, Ash Free Basis				
Volatile matter (%)	-	25.50		
Specific energy (MJ/kg)	-	30.78	26.68	33.52
C (%)	82.04	80.12	79.6	83.6
H (%)	4.59	4.52	5.01	4.86
N (%)	1.28	1.41	1.51	1.39
S (%)	0.48	-	0.46	0.49
O (%)	11.61	7.53	13.4	9.7
HGI	54			
Ash Fusion Temperatures (°C)				
Deformation	-	-	1160	1160
Spherical	-	-	1360	1300
Hemisphere	-	-	1390	1330
Flow	-	-	1480	1430
Ash Fusion Temperatures (oxidising atmosphere) (°C)	1620			
Ash Analysis				
SiO_2 (%)	62.0	57.24	62.7	63.0
Al_2O_3 (%)	27.5	26.43	22.9	20.2
Fe_2O_3 (%)	4.2	4.04	4.66	6.70
Mn_3O_4 (%)	0.09	0.13	0.14	0.15
P_2O_5 (%)	0.01	0.02	<0.01	<0.01
TiO_2 (%)	1.1	1.00	0.85	0.92
CaO (%)	1.6	7.47	4.31	4.63
MgO (%)	1.1	1.13	1.01	1.19
K_2O (%)	1.4	1.61	1.19	0.36
Na_2O (%)	0.41	0.43	0.23	0.05
SO_3 (%)	0.41	-	0.68	1.35
Trace Elements				
U (ppm)	<4	3		
Forms of Sulphur				
Pyritic	0.13	0.07	nil	nil
Sulphate	0.02	0.02	nil	0.01
Organic	0.16	0.37	0.24	0.38

1. Bulk sample, Duncan mine bins, 1981 (Threader and Bacon, 1983).
2. Bulk sample, Duncan mine, 1983 (Knott and Warbrooke, 1983).
3. Channel sample, seam 2.4 m thick, Duncan mine, AMG 585 390 mE, 5 387 230 mN, composite all plies (D1–D15) (Bacon, 1983*a*).
4. Channel sample, as above, 12.7 mm × F1.60.

5 cm

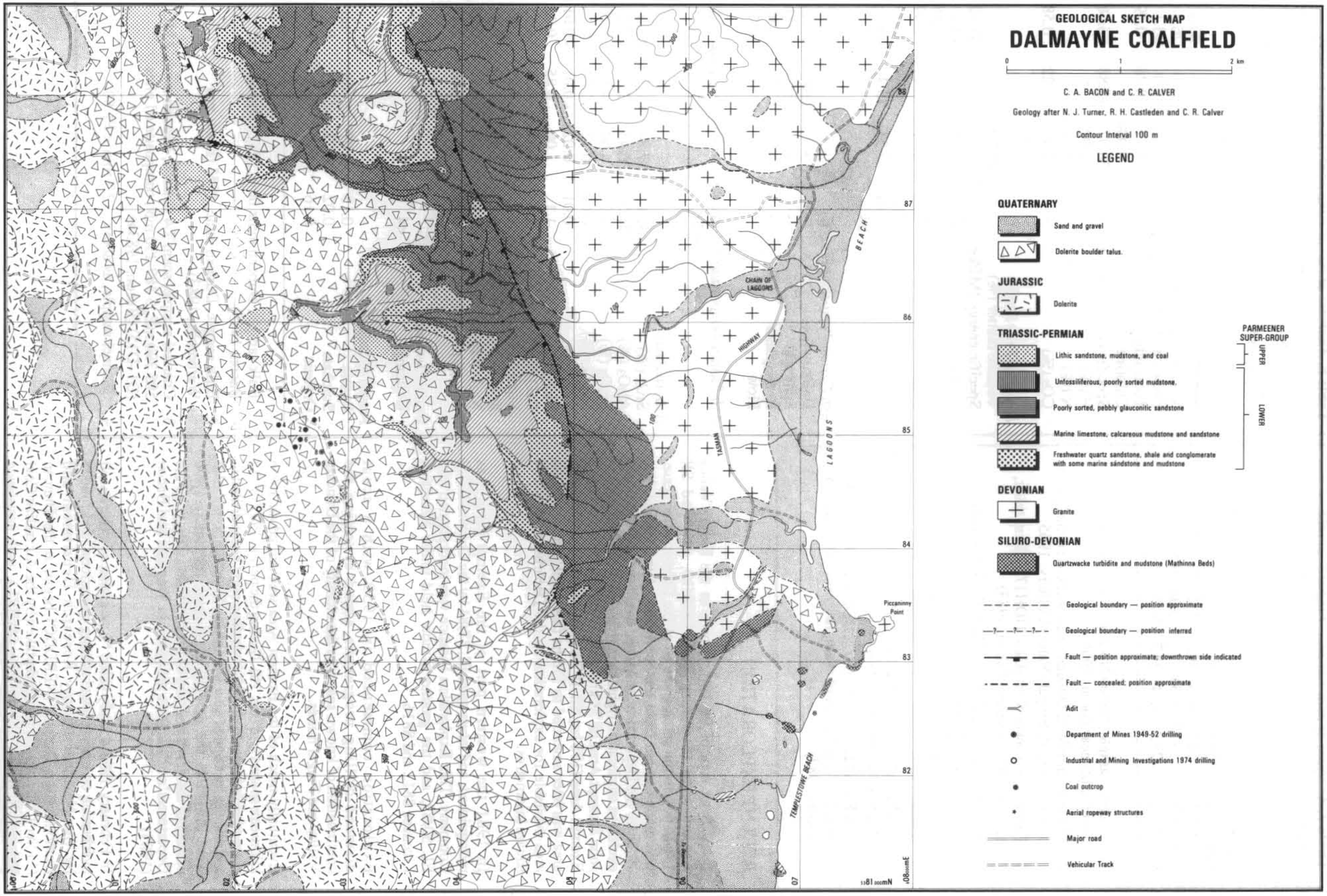


Figure 19.

under a massive dolerite sill, and to determine extraction techniques suitable for efficient resource recovery.

One of the two south-eastern headings was driven anddeveloped as an extraction panel. Geomechanical tests were made on various rock strength properties, and instrumentation was installed in pillar walls and at roadway, floor and roof sites to monitor the stress reaction of the panel area to pillar extraction. A borehole (DOM DDH86) was drilled to intersect the panel, and extensometers were installed at points above the seam. The results of this study will be available in NERDDC Report on Project 806.

Currently, the Duncan Colliery headings are extending south-easterly past DDH 40 and 44, towards a patch of reasonably high quality coal.

POTENTIAL FOR FUTURE EXPLORATION

The Fingal coalfield is currently covered by Mining Lease 46/80 and Retention Licences 8812, 8816 and 8813, all held by the Cornwall Coal Company.

Reserves of coal have been estimated for four seams over various parts of the coalfield. These are:

Duncan seam	68 Mt (measured, in situ)
'D' seam	101 Mt (indicated, in situ)
East Fingal Upper Split	60 Mt (indicated, in situ)
East Fingal Lower Split	44 Mt (indicated, in situ)

These are measured and indicated *in situ* reserves. Tonnages of recoverable coal are dependent on geological and mining constraints, and cannot easily be calculated on the available data. Historically, recovery of the *in situ* coal from the Duncan seam has been around 40–50%, with a washery yield of 60–80%.

Total measured and *in situ* reserves are in the order of 250 million tonnes. Some 27 Mt of the East Fingal Lower seam reserves coincide with ground containing the East Fingal Upper seam reserves, and as only one of these seams could be extracted, these reserves are discounted. The split between these two seams is too thin to consider the separate extraction of both, and at 5 m or so thickness is too large to allow the seams to be mined together. The coal could, however be used for in-seam gasification or similar *in situ* uses.

The coalfield has considerable potential for future exploration. The southern part of the field, around the valley of the St Pauls River has not yet been extensively drilled.

The Dalmayne Coalfield

SUMMARY

The Dalmayne coalfield lies eleven kilometres south of St Marys, and may be considered to be an easterly extension of the Fingal coalfield.

One coal seam has been exploited in the area, although several seams exist within a fluvial sequence of lithic sandstone, siltstone and mudstone. The coal-bearing sequence is of Triassic age and belongs to the Upper Division of the Upper Parmeener Supergroup.

Sediments of the underlying Lower Division of the Parmeener Supergroup have been divided into four mappable units. Jurassic dolerite has intruded the sedimentary pile and now caps the higher ground. Talus thickly mantles hill slopes and obscures dolerite–sediment contacts.

The Dalmayne Colliery first opened in 1915, with extensive infrastructure such as bins and an aerial ropeway which transported the coal to Piccaninny Point. These operations closed in 1917. The mine was re-opened in 1939 and coal was transported to St Marys by road until the mine closed in 1955.

An indicated reserve of 128 million tonnes of black coal exists in one seam. The area has much potential for future exploration.

LOCATION AND ACCESS

The Dalmayne coalfield lies eleven kilometres south of St Marys and five kilometres west of Piccaninny Point, on the east coast of Tasmania, and extends from the coastal plain to the eastern margin of the central Eastern Highlands.

Access is obtained from a series of rough tracks bulldozed for forestry and exploration activities. An unsealed road runs from Gray past the old colliery and joins the forestry 'E' Road which joins the Tasman Highway near Piccaninny Point. Most of the roads are only suitable for four-wheel drive access.

GENERAL GEOLOGY

The geology of the Dalmayne coalfield and environs has been mapped by Turner *et al.* (1984) (fig. 19). The essentially flat-lying Parmeener Supergroup rocks unconformably overlie basement of folded and cleaved Siluro-Devonian quartzwacke turbidite and Devonian granite. The Lower Division of the Parmeener Supergroup is wholly Permian in age and is about 120 m thick in the Dalmayne area. The Lower Division consists of four mappable units, being from oldest to youngest:

(i) Dominantly quartz arenite with minor basal conglomerate, passing up into interbedded fine quartz arenite and shale;

(ii) Poorly sorted, sparsely pebbly, usually highly fossiliferous marine sandstone, siltstone, mudstone, and bioclastic limestone;

(iii) A thin (2–4 m) unit of pebbly glauconitic sandstone;

(iv) Poorly bedded, grey gritty mudstone, sparsely pebbly and unfossiliferous except for rare foraminifera.

The oldest unit is equivalent to the Lower Freshwater Sequence, the upper three to the Upper Marine Sequence (see Forsyth *et al.*, 1974).

The Upper Division of the Parmeener Supergroup comprises the coal measures of economic interest. Here, as elsewhere in north-eastern Tasmania, the Upper Division is wholly Triassic in age, and disconformably overlies the Lower Parmeener Supergroup. Erosion preceded deposition of the coal measures, causing variable thinning of the Permian sequence; for example, the uppermost Permian formation is about 20 m thick over most of the area, but only two metres thick where it is exposed on 'E' Road at FP047831.

At the base of the Upper Parmeener Supergroup is a thin unit of dominantly quartz arenite, only 2–3 m thick over most of the area, but at least 12 m thick at 'E' Road [FP047831]. The rest of the Triassic sequence, about 350 m thick, consists dominantly of medium-grained lithic arenite, interbedded with mudstone, carbonaceous mudstone and coal. The lithic arenite is typically thick-bedded, often showing trough cross-bedding. Intraformational breccia, with rip-up clasts of mudstone and coal, is common at the base of sandstone beds. Sparse, rounded, bed-load pebbles and cobbles of extrabasinal provenance are occasionally seen. A

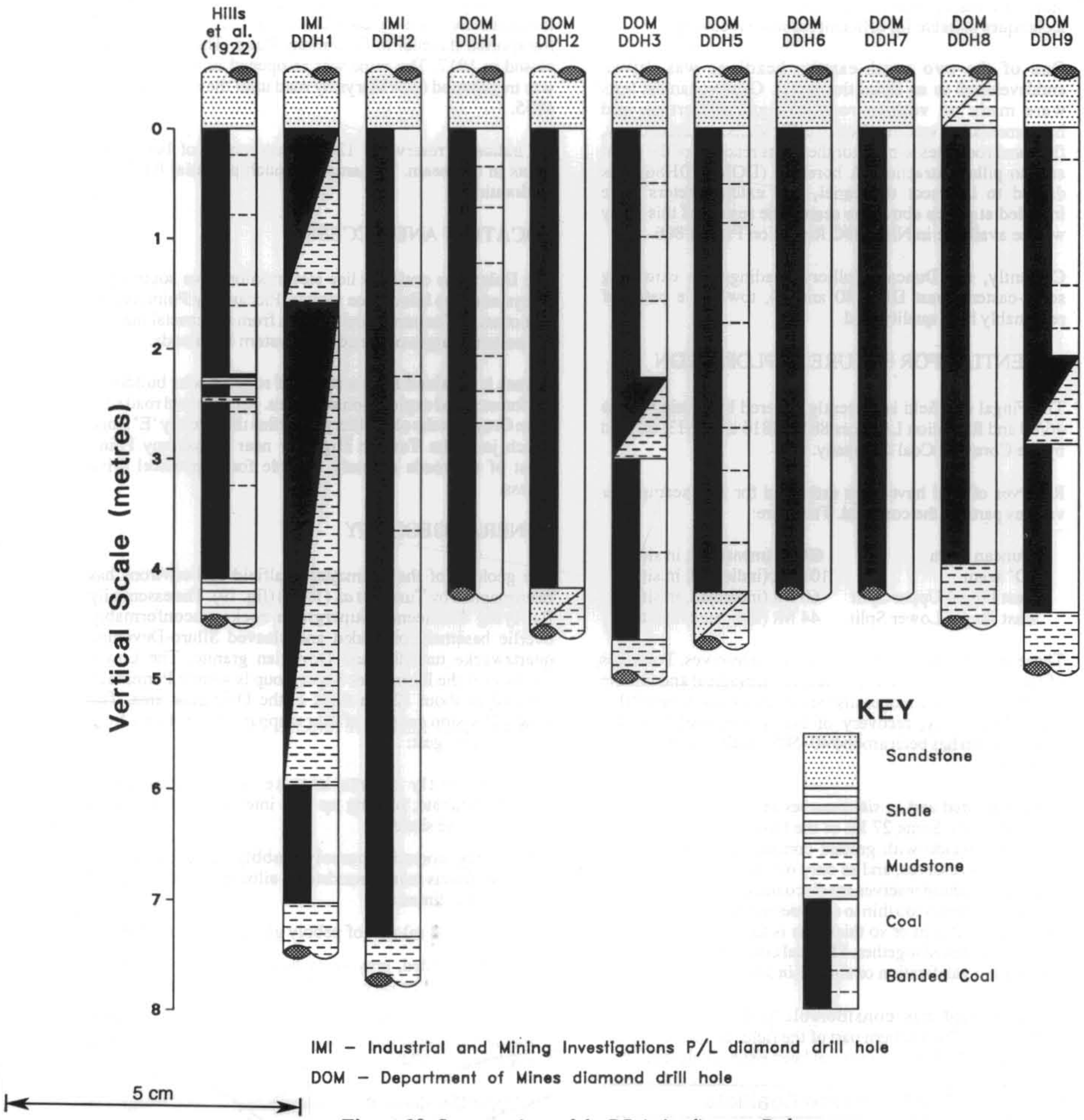


Figure 20. *Seam sections of the DB (mined) seam, Dalmayne.*

pebble-conglomerate bed crops out at FP008891, and 3.52 m of conglomerate was intersected high in the sequence in IMI DDH2 and in many subsequent drill holes. This conglomerate band is informally known as the Dalmayne Conglomerate, and provides a useful marker bed in the Dalmayne and adjoining areas. Clast lithologies in the pebbly bands and conglomerate include rhyolite, quartzite, schist, and granite. Contemporaneous volcanic activity is indicated by a vitric tuff cropping out at FP012890. A low-sinuosity meandering stream floodplain is the probable environment of deposition for the coal measures.

Jurassic dolerite caps the Parmeener Supergroup. The configuration of the base of the sill is complex and is not accurately mappable due to talus cover. The base of the sill is at about 500 ± 100 m a.s.l. in the Dalmayne area, allowing a Triassic section 200–350 m thick. Isolated bodies of fine-grained dolerite mapped at lower levels [e.g. FP030830, FP030818, FP033879] are probably minor feeders.

Geophysical surveys, largely aimed at defining the base of the sill on Fingal Tier (Leaman and Richardson, 1981), revealed a major feeder system under, and extending south of, Bare Rock [EP963884], but the surveys do not extend further east into the Dalmayne area.

Dolerite boulder talus mantles the eastern slopes of Fingal Tier and obscures most outcrop in the vicinity of the Dalmayne Colliery. The talus attains a maximum known thickness of 51 m in DOM Dalmayne DDH4.

A series of faults, probably of Tertiary age, trend approximately NW through the area, and downthrow to the south-west. These faults, together with a gentle southward prevailing dip, result in a change in elevation of the base of the Parmeener Supergroup from about 200 m a.s.l. north of the Dalmayne Colliery, to below sea level south of Piccaninny Point.

COAL GEOLOGY

Six seams were intersected during the drilling programme. These have been correlated with seams in the Douglas River coalfield to the south, with the Harefield area to the north, and the Fingal coalfield to the west (see p. 61). One seam (DD), which splits into two plies in the southern part of the coalfield, was found to be of economic interest.

The seam which was mined at the Dalmayne Colliery is the DB (Shell terminology) or D seam (Department of Mines Fingal Tier terminology). The seam is described as being composed of 1.8 m of 'top coal' overlying a mudstone band one metre thick, which in turn overlies 1.4 m of 'bottom coal'. The basal 1.4 m constituted the working section of the coal. Measured sections are shown in Figure 20.

PREVIOUS MINING HISTORY

Gould (1861*b*) inspected an outcrop of shaly coal about 600 mm (2') thick in the upper portion of the 'main branch' of Piccaninny Creek, at an elevation of 300 m above sea level. Gould refers to another outcrop of coal, thicker than the one described, which had been seen in the same creek, but which was now covered by 'drifted materials or dense vegetation'.

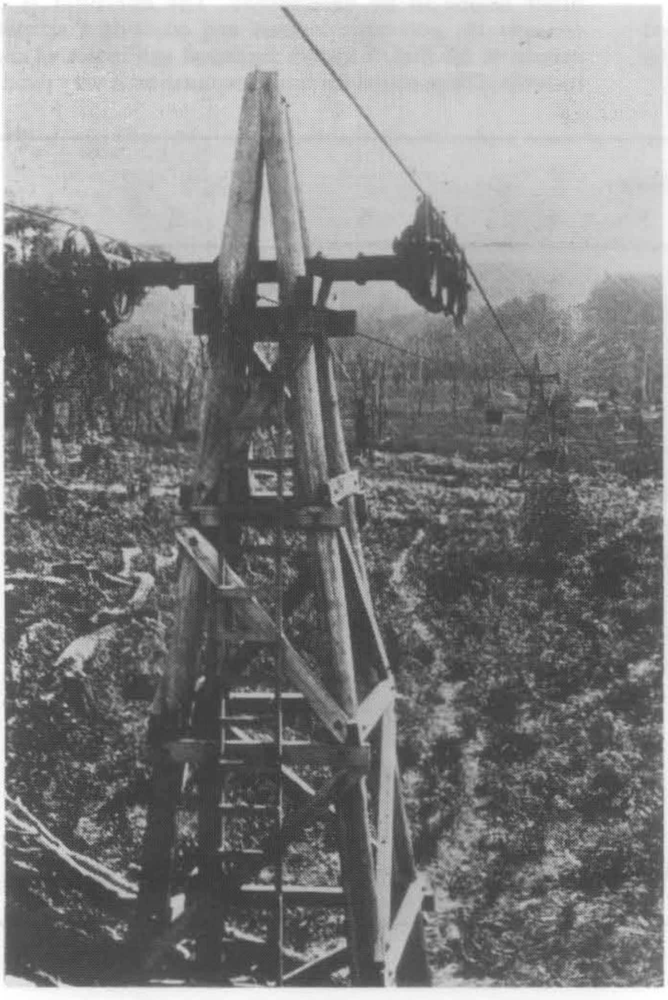
Reward claims for coal were issued in 1887 to Messrs McMillan and Inglis in the Dalmayne area. These leases were held until 1892. Since then, a plethora of mining leases for coal have been issued, and all the leases have changed hands many times.

Twelvetrees visited the area in 1901, and inspected prospecting work done on three seams. In 1889 one tunnel was driven on a seam of coal 680 mm (2'3") thick for 8.2 m (27') south-east, then 3.7 m (12') south-west. Another tunnel which had been driven for 12 m (40') on a bearing of 350° in a split seam [top ply 1.35 m (4'5"); clay band 1.35 m (4'5"); bottom ply 1.45 m (4'9") thick] was reported to have fallen in at the entrance (Twelvetrees, 1902*d*). A third seam exposed in a creek bed was also examined by Twelvetrees.

In 1914 the Dalmayne Collieries Company was floated in a bid to open up some of the Dalmayne seams. By 1915 the main tunnel had been driven 120 m with a number of cross roads put in, and a connection made with the old 12 m prospecting adit. Plans were underway for the erection of an aerial ropeway from the mine to Piccaninny Point as a means of transporting the coal. The contract to build the ropeway was let to Gibson-Battle and Company of Sydney, for £9 000. On 24 August 1917 the mine was officially opened by Sir Elliott Lewis, Minister for Mines. The aerial ropeway had a haulage capacity of 50 tons/hour, and the coal was loaded on to boats from a 180 m long jetty at Piccaninny Point.

A track 40 m wide was cleared of scrub and trees for the aerial ropeway. Bins were erected at each end of the ropeway, with the hopper at Piccaninny Point having a capacity of 1000 tons.

The company experienced difficulty in getting boats to take the coal to the mainland in 1917 because of the war, and in 1918 the jetty was badly damaged by stormy weather, so operations at the mine were forced to close.



Counterweight for the old aerial ropeway system at Dalmayne. (above) [Carol Bacon]

Part of the aerial ropeway system connecting the colliery at Dalmayne with the jetty at Piccaninny Point. (left) [State Archives of Tasmania]

The colliery was visited by Hargreaves and Jack (1920) to ascertain if the mine could supply 150 000 tonnes of coal per year for two years to Adelaide. The authors suggested that although the mine could supply the required tonnage, the coal was not suitable for use on the railways and could only be used in stationary boilers. Lack of adequate shipping facilities was also stressed.

The mine was re-opened in 1939. Coal was mined and wheeled to the surface by hand, and transported by road to St Marys. Bins were built in 1944, and a fault was encountered in the main heading. Excessive rains caused severe damage to the main heading roadway in 1946, but this was repaired. Pillar extraction commenced in 1947. The Transport Commission acquired the mine from the previous owners, Chapman Brothers, in 1948 and pillar extraction was stopped.

Development to the south was started, and in 1950 a second drive (through sandstone) began. The second drive was finished in 1952 and replaced the old main heading which had become unfit for use. The mine closed in 1953.

COAL QUALITY

Analyses of coal from the Dalmayne Colliery are given in Table 9. The analyses are mostly of channel samples from either the 'top' or 'bottom' (worked section) of the seam, which was split by a prominent mudstone band.

Some analyses of coal samples obtained during the Shell Company's exploration programme are give in Table 10.

RECENT EXPLORATION

The Permian rocks to the east of Dalmayne were described by Voisey (1938). The entire area has been mapped by McNeil (1965) and more recently by Turner *et al.* (1984).

Keid (1920) reported on a possible railway route from Piccaninny Point to Coles Bay. Nye (1926*a*, *b*) investigated the occurrence of limestone to the east of Dalmayne, as did Everard (*in* Hughes, 1957, p. 205).

The Department of Mines drilled nine holes near Dalmayne between 1949 and 1952. The exploration proved the existence of multiple block faulting of sufficient magnitude to dislocate the continuity of mining horizons. Beatson (1951) defined three fault blocks in the vicinity of the colliery.

In 1961 Industrial and Mining Investigations took out an exploration licence (EL 5/61) over the East Coast coalfields at the same time as taking similar options over the iron ore deposits in the north-western part of the State, with a view to the possible establishment of an iron ore refining industry. Two holes (IMI 1, IMI 2) were drilled near Dalmayne in 1974 (Edyvean, 1975), and in 1978 the Shell Company became involved in a joint venture partnership with IMI, and exploration for coal began in earnest. Twenty-four fully cored holes were drilled on a 2 km grid.

The results of this exploration (logs, sections, detailed analytical and structural data) are summarised in Bos (1987) and Ford and Bos (1984).

The area of the Dalmayne coalfield is currently covered by Retention Licence 8710 held by the Shell Company of Australia Ltd.

POTENTIAL FOR FUTURE EXPLORATION

A coal reserve of 128 Mt (indicated *in situ*) has been defined for the DD seam. Potential exists for additional reserves in other seams to be determined. The coalfield is of considerable economic interest and contains a sizeable portion of the State's known measured and indicated coal reserves. The potential for future exploration is very good.

Table 9. *Analyses of coal from the Dalmayne Colliery*

	1	2	3	4	5	6	7	8	9
Moisture (%)	5.10	4.0	4.5	3.3	4.46	3.56	4.81	3.3	3.0
Ash (%)	27.34	24.7	25.52	24.1	18.02	20.54	24.19	20.25	22.2
Volatile matter (%)	18.52	24.7	18.68	24.2	22.20	21.14	20.47	24.15	26.4
Fixed carbon (%)	49.04	46.6	51.40	48.4	55.30	54.76	50.53	52.57	48.4
Sulphur (%)	0.34	0.30	0.33	0.40	0.69	0.41	0.41	0.43	0.29
Specific energy (MJ/kg)	21.4	22.7	-	23.3	-	-	-	25.6	24.3

Channel samples of top part of seam (above mudstone band)

* 1. Sample 415 (1922); from main heading

\+ 2. Sample 1 (1948); from same place in main heading as sample 415

* 3. Sample 414 (1922)

\+ 4. Sample 2 (1948); from near a fault north of the main heading

Channel samples of bottom or productive part of seam (below mudstone band)

* 5. Sample 411 (1922)

* 6. Sample 412 (1922)

* 7. Sample 413 (1922)

\+ 8. Sample of lower 1.4 m of seam (1943)

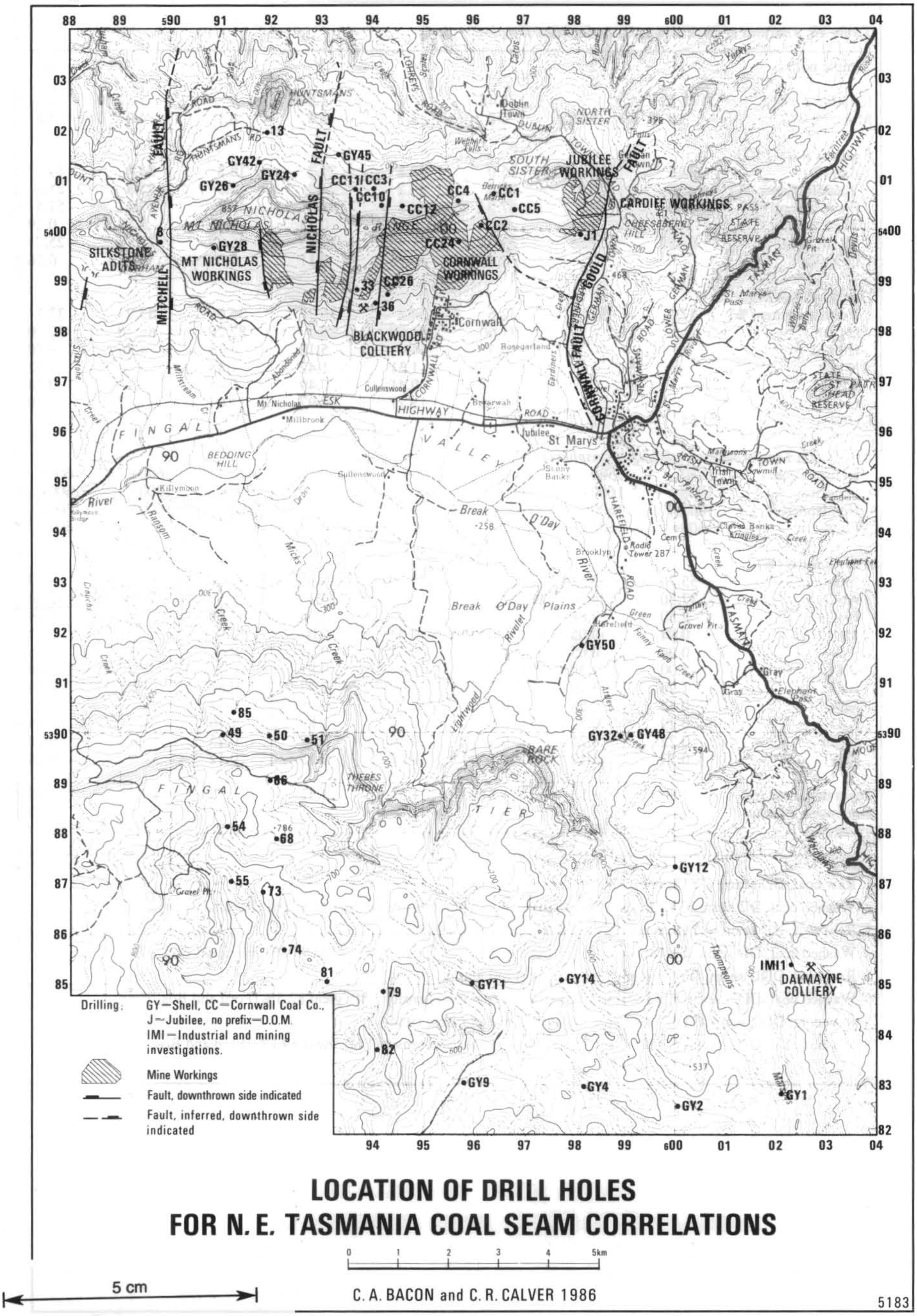
\+ 9. Sample 3 (1948); from working face

* Hills *et al.*, 1922; + Department of Mines correspondence files

Table 10. *Analyses of Shell Company exploration samples.*

Sample no.	1	2	3	4	5	6	7	8
Relative density	1.52	-	1.48	-	1.54	-	1.52	-
Moisture (%)	3.0	3.8	5.0	3.7	3.8	4.1	4.0	3.8
Analysis Basis (AD)								
Ash (%)	28.5	18.4	25.0	22.8	29.2	18.3	24.4	19.2
Volatile matter (%)	25.5	26.9	22.8	25.2	24.3	27.9	23.8	25.5
Fixed carbon (%)	43.0	50.9	47.2	48.3	42.7	49.7	47.8	51.5
Total sulphur (%)	0.30	0.34	0.29	0.30	0.33	0.35	0.35	0.29
SE (MJ/kg)	21.87	25.05	23.03	24.40	22.13	25.92	23.77	25.73
CO_2 (%)	-	-	0.09	0.18	0.11	0.08	0.15	0.16
Dry, Ash Free Basis								
Volatile matter (%)	37.2	34.6	32.6	34.3	36.3	36.0	33.2	33.1
C (%)	-	-	81.60	81.60	82.0	82.20	86.10	82.00
H (%)	-	-	4.57	4.41	5.12	4.18	4.76	4.90
N (%)	-	-	1.46	1.31	1.42	1.48	1.38	1.42
S (%)	-	-	0.41	0.41	0.49	0.45	0.49	0.38
O (%)	-	-	11.96	12.27	10.97	11.07	11.77	11.30
HGI	54	57	54	-	51	-	53	-
Ash Fusion Temperatures (reducing atmosphere) (°C)								
Deformation	1550	1580	1600+	1600+	1280	1420	1600+	1600+
Spherical	1600+	1600+	1600+	1600+	1570	1600+	1600+	1600+
Hemisphere	1600+	1600+	1600+	1600+	1585	1600+	1600+	1600+
Flow	1600+	1600+	1600+	1600+	1600+	1600+	1600+	1600+
Ash Analysis (%)								
SiO_2	55.70	55.50	59.60	60.60	67.60	66.50	-	59.50
Al_2O_3	37.30	34.60	32.00	30.40	24.10	25.40	-	32.60
Fe_2O_3	2.30	2.88	3.04	3.09	3.14	3.62	-	3.09
Mn_3O_4	0.04	0.05	0.04	0.03	0.04	0.05	-	0.03
P_2O_5	0.04	0.05	0.03	0.02	0.02	0.04	-	0.06
TiO_2	1.00	1.30	1.36	1.45	0.81	0.72	-	1.28
CaO	1.90	3.10	0.50	0.66	0.79	0.88	-	0.24
MgO	0.48	0.58	0.81	0.91	0.98	0.92	-	0.51
K_2O	0.29	0.32	0.69	0.54	1.83	1.10	-	0.46
Na_2O	0.22	0.25	0.35	0.36	0.27	0.25	-	0.28
SO_3	0.53	1.12	0.25	0.17	0.15	0.12	-	0.08
Seam thickness (m)	1.86	1.86	1.51	1.51	1.52	1.52	1.95	1.95
Separation density	-	1.80	-	1.80	-	1.80	-	1.80
Yield (%)	-	80.6	-	93.8	-	82.5	-	89.1

1. Raw coal, DD seam, GY12; seam 1.86 m thick (Ford and Bos, 1984).
2. Washed coal, DD seam, GY12; seam 1.86 m thick, separation density 1.80, yield 80.6% (Ford and Bos, 1984)
3. Raw coal, DD seam, GY18; seam 1.51 m thick (Ford and Bos, 1984)
4. Washed coal, DD seam, GY18; seam 1.51 m thick, separation density 1.80, yield 93.8% (Ford and Bos, 1984)
5. Raw coal, DDU seam, GY17; seam 1.52 m thick (Ford and Bos, 1984)
6. Washed coal, DDU seam, GY3 seam; 1.52 m thick, separation density 1.80, yield 82.5% (Ford and Bos, 1984)
7. Raw coal, DDL seam, GY17; seam 1.95 m thick (Ford and Bos, 1984)
8. Washed coal, DDL seam, GY17; seam 1.95 m thick, separation density 1.80, yield 89.1% (Ford and Bos, 1984)


LOCATION OF DRILL HOLES
FOR N. E. TASMANIA COAL SEAM CORRELATIONS
C. A. BACON and C. R. CALVER 1986
5183
Drilling: GY—Shell, CC—Cornwall Coal Co., J—Jubilee, no prefix—D.O.M. IMI—Industrial and mining investigations.
Mine Workings
Fault, downthrown side indicated
Fault, inferred, downthrown side indicated
0 1 2 3 4 5km
5 cm
SILKSTONE ADITS
MT NICHOLAS WORKINGS
MITCHELL FAULT
NICHOLAS FAULT
BLACKWOOD COLLIERY
CORNWALL WORKINGS
JUBILEE WORKINGS
CARDIFF WORKINGS
GOULD FAULT
CORNWALL FAULT
DALMAYNE COLLIERY
St Marys
Cornwall
FINGAL VALLEY
Break O'Day Plains
FINGAL TIER
ESK HIGHWAY
TASMAN HIGHWAY
GY42
GY26
GY24
GY28
GY45
CC11
CC3
CC10
CC12
CC4
CC1
CC5
CC2
CC24
CC26
J1
GY50
GY32
GY48
GY12
GY11
GY14
GY9
GY4
GY2
GY1
IMI1
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36
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49
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51
86
54
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55
73
74
81
79
82

Figure 21.

Correlation of coal seams in North-Eastern Tasmania

SEAM CORRELATION

To compare the stratigraphic sections and relationships of the coal seams in the area of Fingal Tier, Dalmayne and Mount Nicholas, a series of sections were drawn within and between the areas, using data from drilling done by the Department of Mines, the Cornwall Coal Company, and the Shell Company of Australia. The results are summarised in Figures 22–25. In many cases individual seams cannot be traced for great distances, but the position of each seam relative to seams in adjacent areas can still be noted. The locations of various drill holes used in the diagrams are shown in Figure 21.

MOUNT NICHOLAS

There are three groups of seams on Mount Nicholas. The Upper seams are largely interbedded mudstone, carbonaceous mudstone, and thin coal, and are not of any economic interest. The Middle seams extend across the whole range, although individual seams split and lens out. The Blue Upper seam thins dramatically to the east.

The Cornwall seam is thickest in the central part of the Nicholas Range, thinning to the west. To the east the Cornwall seam splits, and is known as the Jubilee seam at the Jubilee Colliery, and the Cardiff seam at the Cardiff open cut. The Cullenswood seam is not present in the western part of the Nicholas Range.

The lower group of seams is represented by seams L1 and L2 in the western part of the Nicholas Range. These are equivalent to the Millbrook and Fenton seams in the central and eastern parts of the range. These two seams (L1 and L2) coalesce in places to produce a thicker combined seam. Towards the east, the interval of Lower seams consists of four thin seams in total; Millbrook, Fenton, Malahide and Webber Falls. The latter two seams are not present in the western part of the range.

WEST				*EAST*
Middle Seams				
M1	Blue Upper			
M2	Blue			
M3	Cornwall	{Cornwall Upper {Cornwall Lower	Jubilee	Cardiff
	Cullenswood			
Lower Seams				
L1*	Millbrook*			
L2*	Fenton*			
	Malahide			
	Webber Falls			

* often coalesce

FINGAL TIER–DALMAYNE

A number of seams may be correlated between Fingal Tier and Dalmayne. The Duncan Seam (F) lenses out to the east and is not present in the Dalmayne area. The attractive DD seam, which is usually split into the DD Upper and DD Lower in the Dalmayne area, thins to the west and is represented on Fingal Tier by the much thinner E seam and an intermittent mudstone.

However in the lower part of the sequence (H seams), individual seams lens out frequently and cannot be traced over the whole area. The H seams on Fingal Tier are found within the same part of the sequence as the DF and DG seams in the Dalmayne area, although the seams are not continuous. The intermittent DE3 seam, which occurs in the Harefield area above the DF seam, is also included in this group of seams. The H seam interval is then the same stratigraphic interval as the DE3, DF, and DG at Harefield and the DF-DG interval at Dalmayne, where the DE3 is absent.

Fingal		*Dalmayne*	
		DA (above Dalmayne Conglomerate)	
A			
B		DB	
C		DC	
E		DDU	
mudstone		DDL	
F		mudstone	
GU		DE	
GL		DE2	
Ha	{ intermittent	DF	{ intermittent
Hb		DG	

HAREFIELD

The Harefield seams are the equivalent of the East Fingal seam upper and lower splits (GU, GL) on Fingal Tier, and the Lower seams on Mount Nicholas.

Mt Nicholas		*Harefield*	*Fingal Tier*	
L1	Millbrook	DE	GU	
L2	Fentons	DE2	GL	
	Malahide	DE3	-	
	Webber Falls	DF	{ Ha }	intermittent
		DG	{ Hb }	

CONCLUSIONS

A summary correlation table is given below. Where seams cannot be traced between coalfields due to lensing and facies changes, the stratigraphic position can still be seen in relation to other seams.

Fingal Tier	*Dalmayne*	*Harefield*	*Mt Nicholas*	
DOM	*Shell*	*Shell*	*Shell*	*Cornwall*
	DA			
A				
B	DB			
C	DC			
D	DC1			
E	DDU		M1	Blue Upper
mudstone	DDL		M2	Blue
-	-	-	M3	Cornwall
-	-	-	-	Cullenswood
F	mudstone	-	-	-
GU	DE	DE	L1	Millbrook
GL	DE2	DE2	L2	Fenton
Ha }	-	DE3	-	Malahide
}	intermittent	DF	-	Webber Falls
Hb }		DG	-	

5 cm

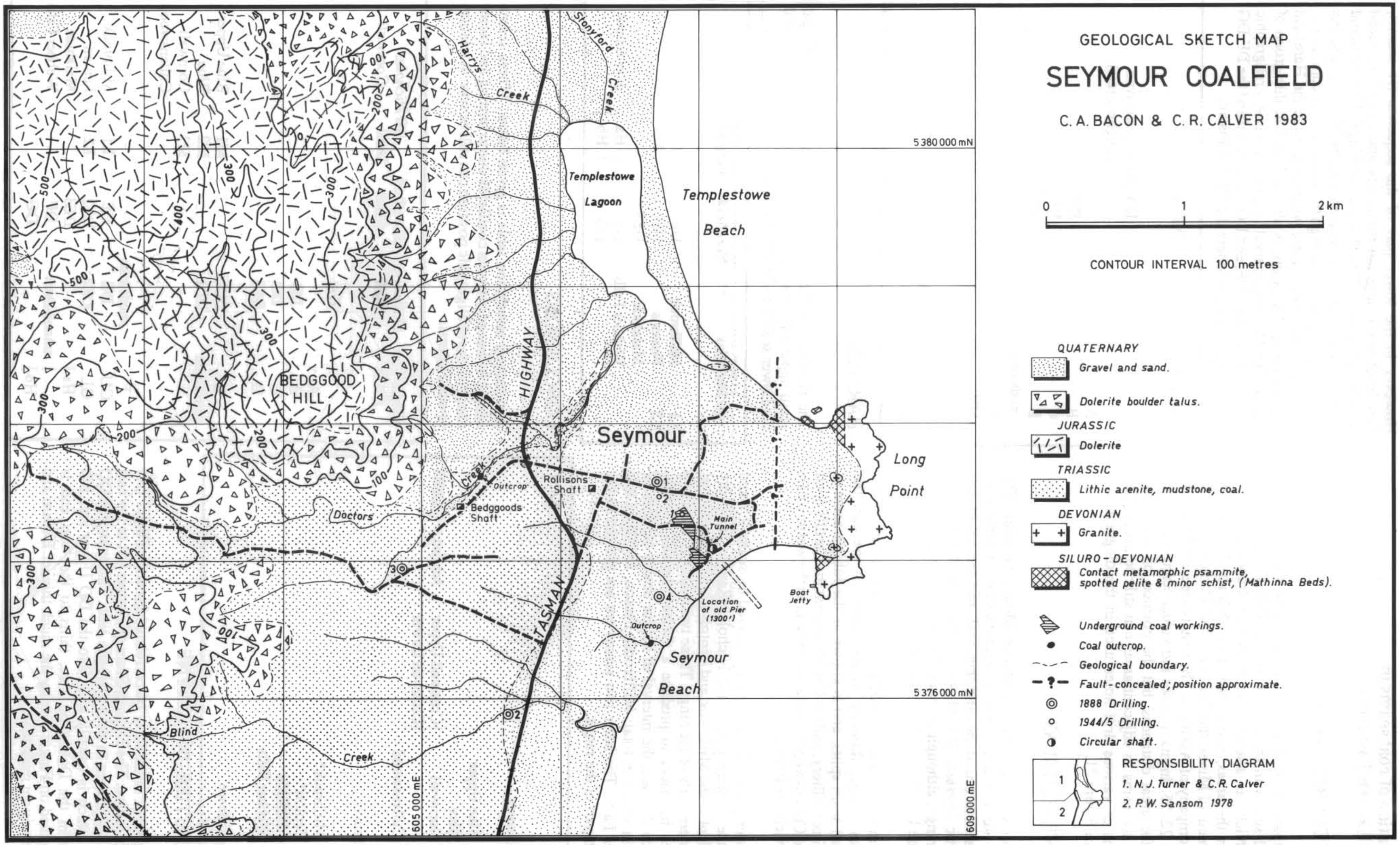


Figure 26.

PART 2: THE EAST COAST COALFIELDS

The Seymour Coalfield

SUMMARY

Coal was mined from two seams in the Seymour coalfield during three periods of mining activity: from 1861–1880; 1928–1931; and from 1959–1964. The seams were less than 1.5 m thick and were mined by underground methods.

During the original mining activity an attempt was made to use the 'slack' coal to produce kerosene by fractionation.

The coal seams are contained in a flat-lying fluvial sequence of Triassic age, a correlate of the Upper Division of the Upper Parmeener Supergroup. At Seymour this sequence is approximately 100 m thick and overlies a correlate of the Lower Division of the Parmeener Supergroup which, in this locality, is wholly Permian in age. Drilling suggests that the Permian sequence is approximately 170 m thick. Regionally, an erosional unconformity separates the Upper and Lower Divisions of the Parmeener Supergroup.

The potential for future exploration of the Seymour coalfield is limited because of the thin nature of the seams, and the restricted lateral extent of the coalfield.

LOCATION AND ACCESS

The Seymour coalfield is located on the coastal plain adjacent to Long Point [FP080775], on the east coast of Tasmania. Long Point is 14 km north of Bicheno and 20 km south-east of St Marys. The country is flat and open, is used for grazing purposes, and is marshy in places. Access is by farm roads off the Tasman Highway.

GENERAL GEOLOGY

The geology of the Seymour area has been mapped by Turner *et al.* (1984) and Sansom (1979) (fig. 26). The Seymour coalfield is situated on a 1–2 km wide coastal plain underlain by a flat-lying coal-bearing Triassic sequence, a correlate of the Upper Division of the Parmeener Supergroup.

Seymour Borehole 4 (1888), collared near sea level, reached the base of the Upper Parmeener Supergroup at 104 m, and intersected a further 168 m correlated with the Lower Parmeener Supergroup, bottoming probably near basement in granite-boulder conglomerate. Typically for north-eastern Tasmania, only the Lower Freshwater Sequence and the Upper Marine Sequence are represented in the Lower Parmeener Supergroup, which is here wholly Permian in age. Regionally, an erosional disconformity separates the Lower and Upper Divisions of the Parmeener Supergroup.

The dominant and characteristic lithology of the Upper Parmeener Supergroup is medium-grained lithic arenite, usually thickly bedded, cross-bedded and interbedded with mudstone, carbonaceous mudstone and coal. The base of sandstone beds is often erosional, and flaky intraclasts of mudstone and coal are often included in the lower parts of sandstone beds. These lithologies are repetitive and unchanging through the sequence; hence, no mappable subdivisions are discernible. However, by comparison with the Triassic sequence in the rest of the St Marys Quadrangle, the distinct absence of pebbly horizons from abundant outcrop along Doctors Creek as far west as Cliff Creek suggests that these rocks are low in the sequence (within 160 m of the base of the Upper Parmeener Supergroup).

Jurassic dolerite intrudes the Parmeener Supergroup and caps the sequence on the highlands to the west. Dolerite crops out on Bedggood Hill [FP043783] and at a relatively low level in Cliff Creek [FP036780]. This low-level dolerite is probably a transgressive mass, possibly a large feeder.

A thick mantle of dolerite boulder talus covers the slopes flanking the coastal plain, obscuring the dolerite/sediment contact relationships. A veneer of Quaternary gravel and sand blankets most of the coastal plain, and outcrop is largely confined to the banks of incised streams.

Long Point, a prominent headland, is composed of Siluro-Devonian Mathinna Beds and Devonian granite. A major fault, concealed by Quaternary sediments, is inferred to trend approximately N–S across the neck joining Long Point to the mainland. This fault must have an eastward upthrow of at least 270 metres.

COAL GEOLOGY

Correlation between drill holes in the Seymour coalfield shows that four seams exist over most of the area. These have been labelled S1 to S4 (fig. 27). Correlation between the seams at Seymour and those at Dalmayne, to the west, cannot confidently be made on the available data.

Three seams were noted by Cundy (1931) as being of interest. Their depths, as encountered in the mine workings, were given as:

- S1: Top seam (No. 1) at 10.6 m depth; thickness 1.37 m.
- S3: Middle seam (No. 2) at 50 m depth; average thickness 1.47 m.
- S4: Bottom seam (No. 3) at 56.4 m depth; thickness not known.

The S2 seam, not mentioned by Cundy (1931), is usually no more than 0.50 m thick where present in drill core, and where not present the seam is represented by a carbonaceous or muddy interval.

The Top (S1) seam contained a band of "shale, mudstone and coaly matter" which discounted the value of the coal considerably (Cundy, 1931), and was not worked as extensively as the Middle (S3) seam.

The Middle (S3) seam varied in thickness from 1.14 m to 1.68 m and was the seam from which most of the mined coal was extracted during the 1923–31 and 1959–64 periods of mining.

Cundy (1931) records that in the "old workings" (i.e. 1861–1880 mining) some "six acres" (2.5 ha) of coal were mined from the No. 1 (S1) seam, and "eight acres" (3.2 ha) were mined from the No. 2 (S3) seam.

A seismic reflection traverse of the coalfield by Richardson and Leaman (1980) found four reflectors, which appear to represent sections of two seams. Two of these reflectors correspond to seams in DOM Seymour 1888 DDH 1 at 7.94 m (1.46 m thick, S1 seam) and 25.48 m (0.52 m thick, S2 seam). A zone of poor signal over the central part of the traverse does not allow correlation between the two ends of the traverse. However the two reflectors at the eastern end of the traverse are most probably the continuation of the two seams.

Small faults with throws of less than five metres break the seams. Some faults do not disrupt the upper coal seam, and these appear to be contemporaneous with coal deposition.

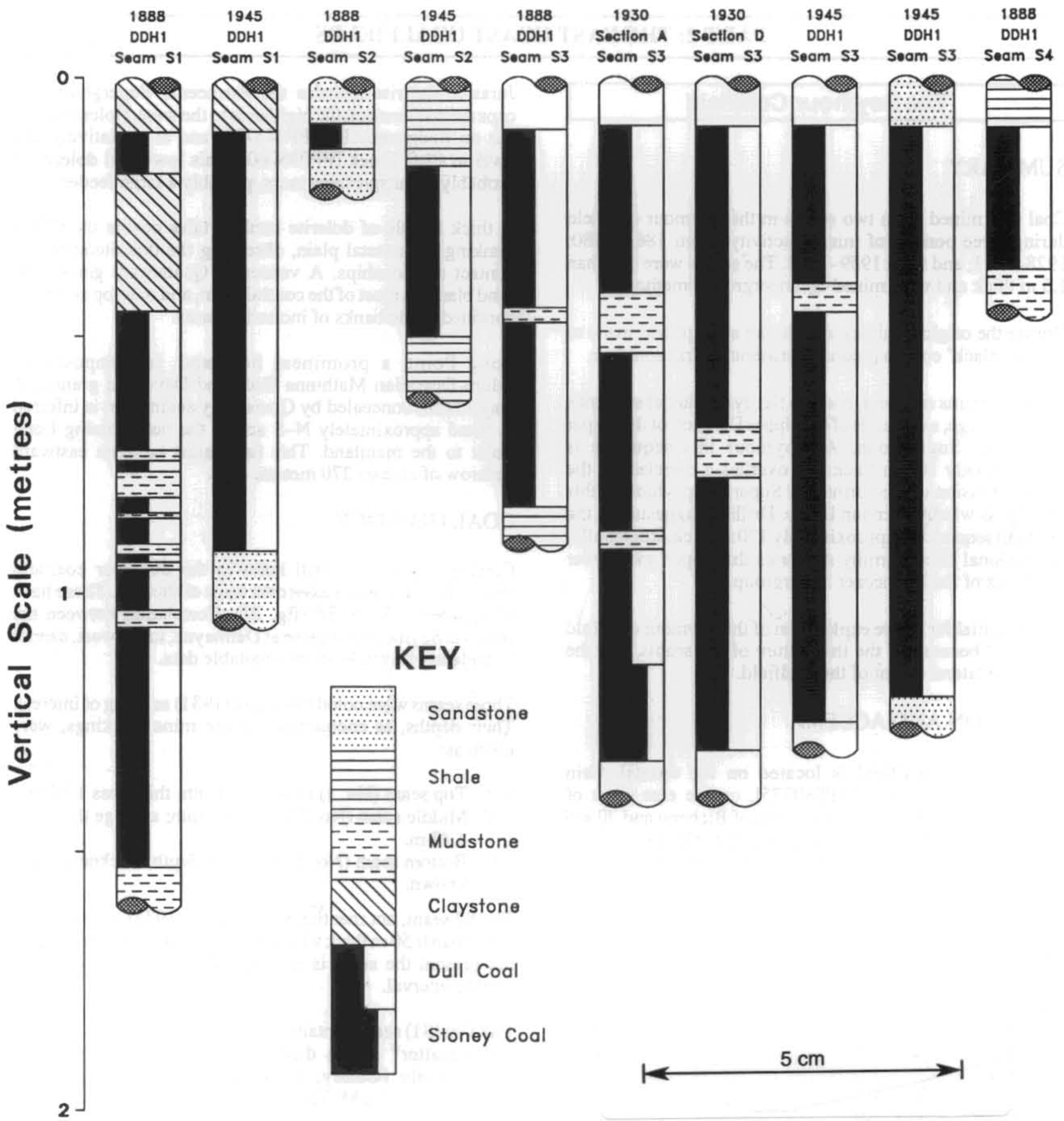


Figure 27. *Seam sections, Seymour.*

PREVIOUS MINING HISTORY

A. H. Swift commenced mining operations at Seymour in 1861, and wrote to the Executive Council requesting Government assistance in laying a tramway and building a jetty. Swift stated that 20 men were employed getting 100 t of coal weekly (CSD 4/6/40, 11 December 1861).

Charles Gould was sent to inspect Swift's claims (CSD 4/6/40, 11 December 1861) and reported to the Colonial Secretary on 24 December 1861 that the work consisted of two shafts, between 18 m and 21 m deep, and a drive 50 m in length. Gould noted that although the total seam was 2.08 m thick, only the basal 1.63 m was exposed in the roadways and a section of only 1.14 m (including bands) was worked.

The coal was tried by a steamboat; both the captain and the engineer commented unfavourably on its suitability as a steaming coal, saying the coal contained much ash. Gould recommended the coal as being suitable for household use, and Swift asked for another trial of the coal at the Hobart Gas Works.

The Marine Board sent an officer to inspect the site of Swift's proposed jetty (CSD 4/6/40, 4 January 1862), and the Inspector of Public Works examined a stockpile of coal at Patterson's wharf with a view to using some of the coal in a trial at the gas works. The Inspector (Falconer) noted that the coal was "badly got out, being a mixture of coal, shale and dirt; no tests could be made to ascertain the value for steam raising until coal alone was supplied". He added that the coal would have to be sold at ten shillings ($1) per ton, half the cost of Newcastle coal (CSD 4/6/40, 4 January 1862).

The House of Assembly granted Swift £1,000 towards building a tramway and jetty on 17 January 1862. The sum was to be recouped by a royalty on coal when mined.

The Seymour Coal Mining Company was formed in 1863, and a report of the directors at the first ordinary general meeting of shareholders on Wednesday 4 March 1863 states that the pier was partly complete, being 18 m long, and a depot capable of holding 400–500 t of coal was almost complete. An iron tramroad from the pit mouth to the jetty had been laid, and three shafts had been sunk. At the next meeting, in August 1863, the directors reported a stockpile of 1400 t of coal, and continued efforts to build the pier and two depots.

In 1868, the Australian Coal and Kerosene Company was formed by Swift, to utilise 50–60 t per month of 'slack' coal from the Seymour mine. Some 2700 litres of oil was retorted from the coal and sent to Melbourne to be refined (*Tasmanian Times*, 18 June 1868).

The original mining venture operated for 17 years (Hills *et al.*, 1922) and so would have ceased around 1880. One of the original shafts was circular and lined with bricks.

Four diamond-drill holes were put down by the Department of Mines in 1888 near Seymour, and one hole was drilled close to the Douglas River. The locations of these holes are shown in Figure 26.

A. M. Reid visited the Seymour coalfield in 1921, when no workings were able to be inspected (Hills *et al.*, 1922).

In 1923 a new company, the Seymour Coal Mines Limited, began operations, with one of the old shafts being cleaned out and retimbered. Construction of bins and a jetty commenced, and the first coal was raised on 7 January 1924. Driving of a dip tunnel began in 1928; this tunnel connected with the old underground workings to be west of the circular shaft for ventilation purposes. The tunnel was driven on a grade of 1 in 5 for 240 metres.

Cundy (1931) inspected the construction work for the company and reported on the economic prospects of the mine. The bins were reported to have been poorly constructed.

Production was suspended in 1931 following the partial demolition of 180 m of the 400 m long jetty by heavy seas. The company did not hold a mining lease as such but entered into a private treaty with the landowners of freehold lands who also held the mineral rights to the coal. After liquidation of the company, the mineral rights were acquired by a Mr. C. O. Staite, who transferred these rights to the Seymour Collieries Proprietary Limited. However, after a small expense had been incurred on surface works, the project was abandoned.

In 1944/45, the Department of Mines put down two diamond-drill holes at Seymour. The locations of the holes are shown on Figure 26.

In 1959 the old Seymour workings were dewatered by Messrs Yates and Haas. Although the main dip tunnel needed a few repairs, the remainder of the workings were in good condition. The coal from the 1.33 m thick (S3) seam was mined and wheeled to the surface by hand, and then transported to St Marys by road. The mine closed in 1964.

Two shafts, labelled 'Beddgoods' and 'Rollisons', are shown on Department of Mines mineral charts. Whilst no reference to these shafts can be found elsewhere, the date of the plan on which they are recorded suggests that they were dug during the 1930 mining.

COAL QUALITY

The following analyses, from Department of Mines correspondence files, are of channel samples of the main worked seam, exclusive of removable dirt bands.

Table 11. *Analyses of coal samples, Seymour coalfield.*

	1	2	3
Moisture (%)	0.94	1.54	3.10
Ash (%)	19.96	17.50	12.50
Volatile matter (%)	28.48	25.00	22.80
Fixed carbon (%)	50.62	55.96	61.60
Sulphur (%)	0.85	0.81	0.74
Specific energy (MJ/kg)	26.4	27.5	28.9

1. Channel sample (1.75 m) of working face 'B'; exclusive of removable bands, 1930.
2. Channel sample (1.32 m) of working face 'C'; exclusive of removable bands, 1930.
3. Channel sample (1.52 m) of working face 'D'; exclusive of removable bands, 1930.

RECENT EXPLORATION

Since the last operating mine closed in 1964, there has been no further exploration for coal in the Seymour area. In 1971 a study of heavy minerals in beach sands over part of the East Coast by Inland Exploration NL covered the Seymour coalfield. A number of shallow holes were drilled over Long Point (Shirley, 1971).

A seismic reflection traverse of the Seymour coalfield was made in 1980 (Richardson and Leaman, 1980), and the area was included in the gravity survey of the Central Eastern Highlands (Leaman and Richardson, 1981).

POTENTIAL FOR FUTURE EXPLORATION

The thin and banded nature of the coal seams at Seymour, together with their restricted lateral extent, suggest that the coalfield has limited potential for future exploration. The inferred ***in situ*** reserves of the coalfield are small.

The Douglas River Coalfield

SUMMARY

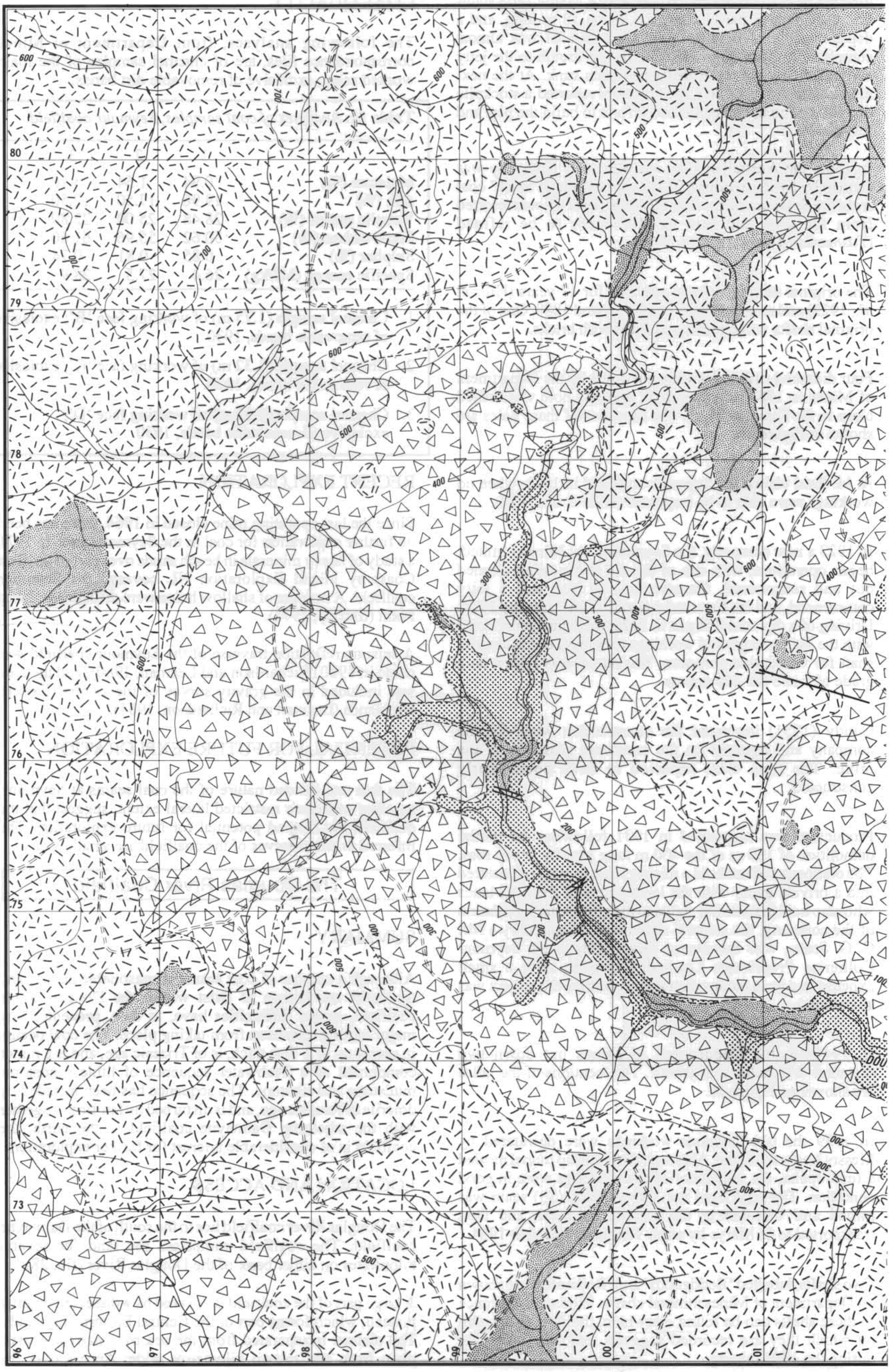
Although a number of coal seams of reasonable quality and thickness are known to exist within the Douglas River coalfield, access difficulties have, to date, prevented any major mining operation from taking place. The coal occurs in seams up to 2–3 m thick, is of Triassic age, and is a minor component of a freshwater sequence of lithic sandstone, mudstone and siltstone. The sequence has been intruded by dolerite of Jurassic age, and is disturbed by faulting. Together with the adjoining Dalmayne coalfield to the north, the coalfield is of considerable interest for further exploration.

LOCATION AND ACCESS

The Douglas River coalfield lies to the south of the Dalmayne coalfield. The coalfield comprises the land for several kilometres on either bank of the Douglas River (fig. 28).

A large part of the coalfield is covered by a dissected dolerite plateau, which forms part of the Central Eastern Highlands. The plateau is separated from the sea by a narrow coastal plain from one to two kilometres wide. Access over the

5 cm



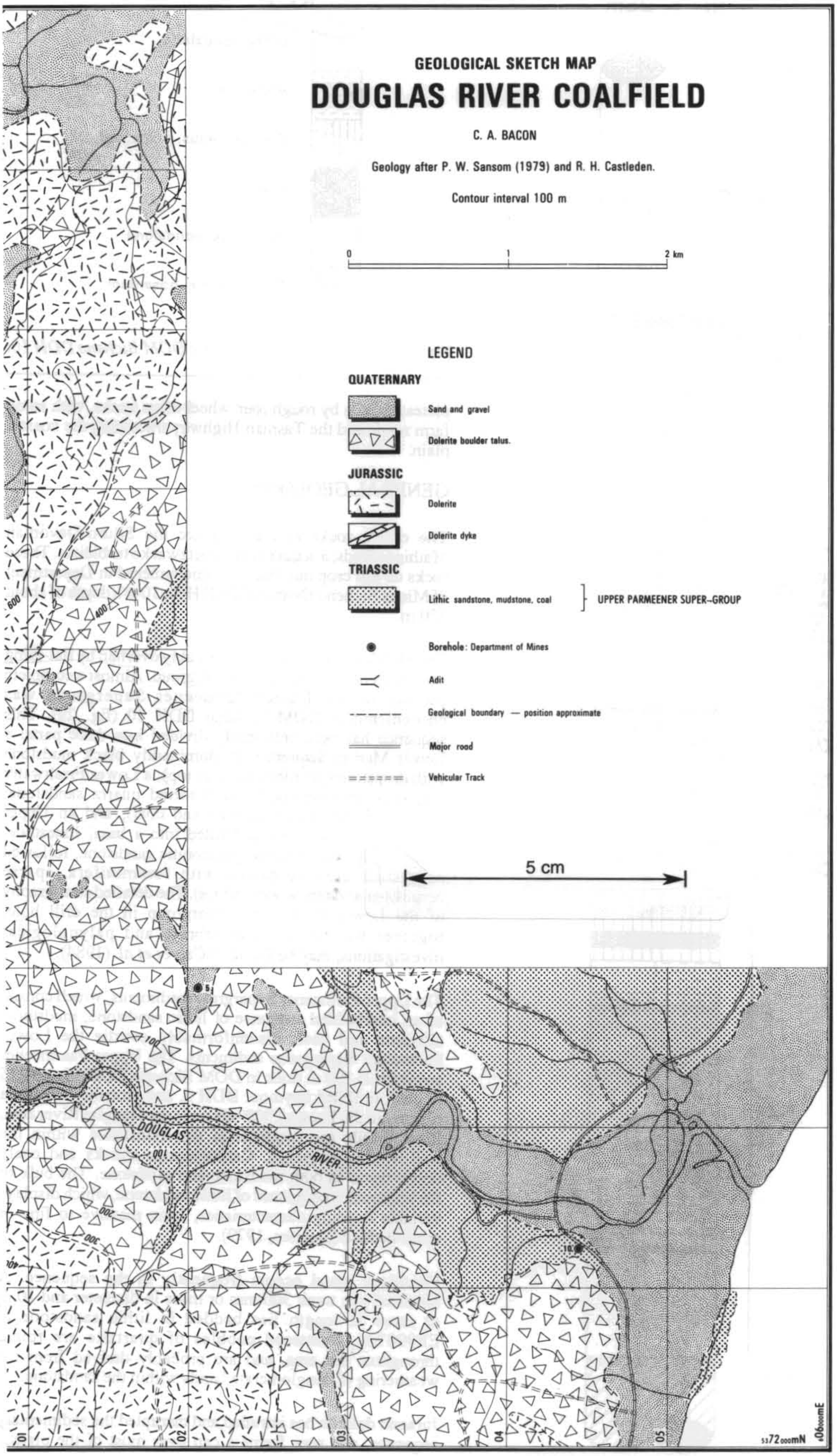

GEOLOGICAL SKETCH MAP
DOUGLAS RIVER COALFIELD
C. A. BACON
Geology after P. W. Sansom (1979) and R. H. Castleden.
Contour interval 100 m
0
1
2 km
LEGEND
QUATERNARY
Sand and gravel
Dolerite boulder talus.
JURASSIC
Dolerite
Dolerite dyke
TRIASSIC
Lithic sandstone, mudstone, coal
UPPER PARMEENER SUPER-GROUP
Borehole: Department of Mines
Adit
Geological boundary — position approximate
Major road
Vehicular Track
5 cm
DOUGLAS
RIVER
01
02
03
04
05
5372000mN
606000mE

Figure 28.

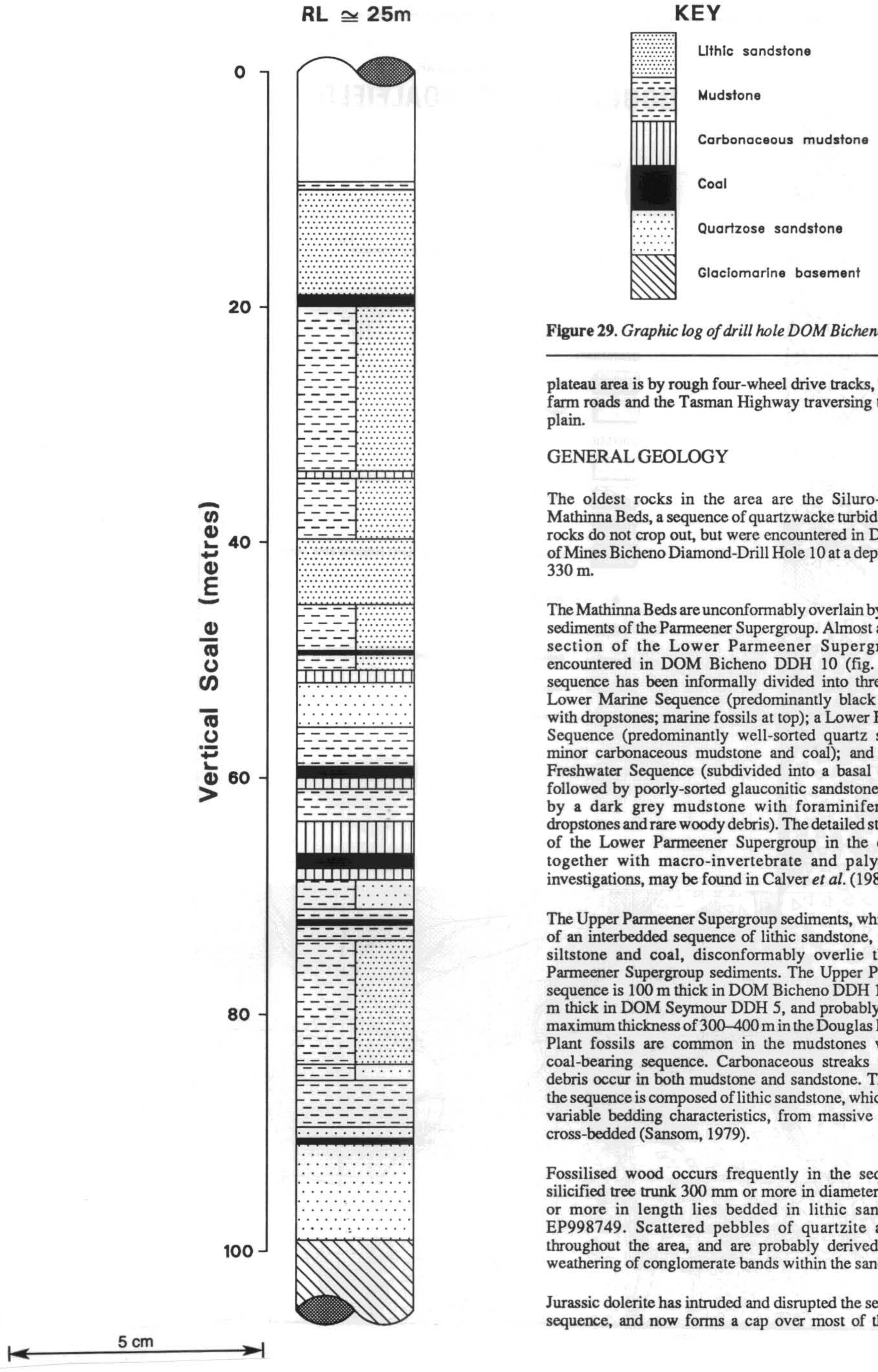


Figure 29. *Graphic log of drill hole DOM Bicheno DDH 10.*

plateau area is by rough four-wheel drive tracks, with some farm roads and the Tasman Highway traversing the coastal plain.

GENERAL GEOLOGY

The oldest rocks in the area are the Siluro-Devonian Mathinna Beds, a sequence of quartzwacke turbidites. These rocks do not crop out, but were encountered in Department of Mines Bicheno Diamond-Drill Hole 10 at a depth of about 330 m.

The Mathinna Beds are unconformably overlain by flat-lying sediments of the Parmeener Supergroup. Almost a complete section of the Lower Parmeener Supergroup was encountered in DOM Bicheno DDH 10 (fig. 29). This sequence has been informally divided into three parts: a Lower Marine Sequence (predominantly black mudstone with dropstones; marine fossils at top); a Lower Freshwater Sequence (predominantly well-sorted quartz sandstone, minor carbonaceous mudstone and coal); and an Upper Freshwater Sequence (subdivided into a basal limestone, followed by poorly-sorted glauconitic sandstone, followed by a dark grey mudstone with foraminifera, sparse dropstones and rare woody debris). The detailed stratigraphy of the Lower Parmeener Supergroup in the drill hole, together with macro-invertebrate and palynological investigations, may be found in Calver *et al.* (1984).

The Upper Parmeener Supergroup sediments, which consist of an interbedded sequence of lithic sandstone, mudstone, siltstone and coal, disconformably overlie the Lower Parmeener Supergroup sediments. The Upper Paarmeener sequence is 100 m thick in DOM Bicheno DDH 10 and 215 m thick in DOM Seymour DDH 5, and probably reaches a maximum thickness of 300–400 m in the Douglas River area. Plant fossils are common in the mudstones within the coal-bearing sequence. Carbonaceous streaks and coaly debris occur in both mudstone and sandstone. The bulk of the sequence is composed of lithic sandstone, which displays variable bedding characteristics, from massive to fine or cross-bedded (Sansom, 1979).

Fossilised wood occurs frequently in the sequence. A silicified tree trunk 300 mm or more in diameter and 10 m or more in length lies bedded in lithic sandstone at EP998749. Scattered pebbles of quartzite are found throughout the area, and are probably derived from the weathering of conglomerate bands within the sandstone.

Jurassic dolerite has intruded and disrupted the sedimentary sequence, and now forms a cap over most of the plateau country. The underlying coal-bearing strata are exposed only where streams (e.g. Douglas River, Mayson River, Possum Creek, Coal Creek) have eroded a passage through the dolerite.

Numerous small waterfalls occur in the upper and middle reaches of the Douglas River. The largest waterfall [at FP003785] is in dolerite. In its middle section, the river has cut a deep channel through sandstone, with cliff faces 20–25 m high rising from the water's edge to form the river banks. From FP003785 to EP998751 the river drops 300 m in four kilometres, producing a spectacular gorge which is in part choked with dolerite bounlers of varying sizes.

A dolerite feeder is centred on Nichols Cap (Leaman and Richardson, 1981). Two dykes, both <5 m in width, are exposed in the bed of the Douglas River [at EP993758 and EP997752]. The contact between dolerite and sedimentary rocks has produced a localised hornfels, which is exposed in a quarry at FP035749 (Sansom, 1979).

Dolerite talus thickly mantles the lower slopes of the river valley, masking the dolerite–sediment contact. The talus is derived from the weathering of a retreating escarpment, with landslips helping to transport weathered material. Many small faults are evident, and a number of active landslips occur on the steep slopes of the Douglas River valley.

Recent alluvium and sand cover the narrow coastal plain, through which the lower part of the Douglas River has cut a meandering channel.

COAL GEOLOGY

Six coaly intervals were noted during the drilling in the Douglas River area, and a tentative correlation was made with coal seams in the Dalmayne coalfield adjoining to the north. Only one seam (DD) is of any significant economic potential in this coalfield. The seam is split into two plies (DDU, DDL) in the Douglas River area. The top split (DDU) averages only 0.5 m in thickness, and is of no economic interest. The lower (DDL) split is 2–3 m thick, and splits again in the eastern part of the coalfield into two distinct plies. These coalesce around drill holes GY105 and GY25 to form a seam about five metres thick.

Indicated ***in situ*** reserves of 60.8 million tonnes have been calculated for the DDL seam in the Douglas River area.

PREVIOUS MINING HISTORY

Two 2.4 m thick outcrops of coal in the bed of the Douglas River [at EP998749 and FP002745] were described by Milligan (1849). The same two outcrops, located 6 km from the mouth of the river, were also visited by Selwyn (1855) and Gould (1861*b*). These two outcrops probably represent the same seam, dislocated by faulting. In addition to these outcrops Gould (1861*b*) reported on a number of seams further upstream. A letter dated July 4 1857 from W. Thompson (Surveyor) to the Surveyor-General details the finding of two large seams (the outcrops mentioned above) of coal in the Douglas River, and is accompanied by a map (CSD 1/22/4404).

In 1881–82 coal was sampled from one of the two 2.4 m thick seams by Messrs Gill and party. Twelvetrees (1902*e*) noted that a short drive, dug in 1891 on the north bank of the river into the most easterly of the two outcrops [at FP002745] was full of water at the time of his visit. Another short tunnel was dug into an outcrop of coal in Coal Creek in 1886.

The Department of Mines drilled one hole (Seymour DDH5) on the north bank of the Douglas River in 1888.

Two leases for coal (6/M; 7/M) were held in the Douglas River area in 1901–02 by J. R. May, and one lease was held by B. Tevelin (1232/M) from 1905 to 1908. Part of this lease was taken up from 1914 to 1915 by J. Brooks, who transferred the lease to R. B. Reynolds (1915–16) who in turn transferred the lease to the Mt John Coal Company.

This company held the lease until 1925. Reid visited the area in 1921 and recorded the work done by the company as consisting of "a number of prospecting adits and shafts of shallow depth", as well as a tunnel 50 m long with a crosscut 47.5 m wide on the "main seam" (i.e. the most westerly of the two outcrops at EP998749) (Hills *et al.*, 1922). Production for 1925 was 25 tons.

COAL QUALITY

Although a number of coal seams are known to crop out in the Douglas River area, few analyses are available for these seams. Representative analyses are given in Table 12, with more detailed analyses from the Shell Company exploration given in Table 13.

Table 12. *Analyses of coal samples, Douglas River coalfield.*

	1	2	3	4	5
Moisture (%)	3.4	4.26	4.50	5.50	5.50
Ash (%)	30.30	23.65	16.40	17.20	12.30
Volatile matter (%)	24.08	25.58	27.10	29.20	30.90
Fixed carbon (%)	42.22	48.51	52.00	48.10	50.80
Sulphur (%)	0.48	0.56		0.05	0.05
Specific Energy (MJ/kg)	19.7	22.8			

1. Sample 417: channel sample from "main tunnel seam" (Hills *et al.*, 1922).
2. Sample 418: channel sample from seam below "main tunnel seam" (Hills *et al.*, 1922).
3. Sample from upper part of "main seam" (Twelvetrees, 1902*e*).
4. Sample from one of the 2.4 m seams, taken in 1881 (Twelvetrees, 1902*e*).
5. Sample from seam in Coal Creek (Twelvetrees, 1902*e*).

RECENT EXPLORATION

An exploration licence was taken out over this coalfield and surrounding areas in 1961 (EL 5/61) by Industrial and Mining Investigations Ltd. In 1979, the Shell Company of Australia, in partnership with the licence holder, began an exploration programme aimed at finding economic coal deposits which could be exploited to serve the needs of the local market. The area was mapped (Sansom, 1979) and seven fully-cored diamond-drill holes (GY103, GY104, GY105, GY22, GY23, GY25, GY27) were drilled. A complete summary of the coal intersections in these holes is given in Ford (1984). The area of the coalfield is currently held under Retention Licence 8711 by the Shell Company of Australia.

The area was included in an extensive gravity survey of the East Coast coalfields (Leaman and Richardson, 1981) aimed at delineating basement structures, dolerite structures, and sedimentary basin structures in order to provide a guide to the drilling programmes. One hole, Bicheno DDH10, was drilled in 1978 as one of the control points for this survey. A study of the Permian stratigraphy, together with macro-invertebrate and palynological studies of the sequence in this drill hole, is presented in Calver *et al.* (1984).

Table 13. *Detailed analyses of coal samples, Shell Company exploration.*

Sample No.	1	2	3	4	5	6
Relative Density	1.55		1.4			
Moisture (%)	4.6	2.7	4.2	3.9	3.1	5.0
Analysis basis (AD)						
Ash (%)	30.2	20.0	17.2	13.4	19.0	19.1
Volatile matter (%)	24.7	27.8	28.5	30.2	26.9	26.1
Fixed carbon (%)	40.5	49.5	50.1	52.2	51.0	48.8
Sulphur (%)		0.28	0.35	0.33	0.27	0.23
Chlorine (%)		0.20	0.05			
Specific energy (MJ/kg)		25.33	26.15	28.06	26.04	25.51
Carbon dioxide (%)		0.04		0.22		
Dry, ash free basis						
Volatile matter (%)	37.9	36.0	36.3	35.6	34.5	34.4
Specific Energy (MJ/kg)						
C (%)		82.10		83.40		
H (%)		4.54		4.80		
N (%)		1.46		1.47		
S (%)		0.37		0.40		
O (%)		11.53		9.93		
Hardgrove Grind. Index		45	49	47		
Ash fusion temperatures (reducing atmosphere) °C						
Deformation		1600+		1450		1600
Spherical		1600+		1600+		1600+
Hemisphere		1600+		1600+		1600+
Flow		1600+		1600+		1600+
Ash analysis (%)						
SiO_2		67.60		62.90		
Al_2O_3		26.50		28.50		
Fe_2O_3		2.72		3.40		
Mn_3O_4		0.03		0.05		
P_2O_5		0.03		0.03		
TiO_2		1.08		1.19		
CaO		0.59		0.50		
MgO		0.65		0.85		
K_2O		0.78		0.60		
Na_2O		0.01		0.10		
SO_3		0.01		0.08		
Seam thickness (m)	2.51	2.51	1.86	1.86	3.17	4.00
Separation density		1.80		1.70	1.7	1.7
Yield (%)		71.8		91.9	67.9	81.3

1. Raw coal, DD seam, bulk sample from adit (Ford and Bos, 1984).
2. Washed coal, DD seam, bulk sample from adit; separation density 1.80, yield 71.8%.
3. Raw coal, DD seam, GY103; seam 1.86 m thick (Ford and Bos, 1984).
4. Washed coal, DD seam, GY103; seam 1.86 m thick (Ford and Bos, 1984).
5. Washed coal, DDL seam, GY25; 3.17 m thick, separation density 1.70, yield 67.9% (Ford and Bos, 1984).
6. Washed coal, DDL seam, GY27; 4.00 m thick, separation density 1.70, yield 81.3% (Ford and Bos, 1984).

POTENTIAL FOR FUTURE EXPLORATION

Exploration to date has revealed an *in situ* indicated reserve of black coal of 60.8 million tonnes in one seam, suitable for extraction by underground mining. The area has considerable potential for future exploration and development.

The Denison Rivulet Coalfield

SUMMARY

The Denison Rivulet coalfield is located to the south of and adjoining the Douglas River coalfield. Coal seams exposed in the area are thin, and banded with mudstone. Some small-scale mining activity occurred during the 1850s, and prospecting activities have been intermittent since that time. An outcrop of air-fall tuff in the Denison Rivulet has been dated, using K-Ar geochronology, at 214 ± 1 million years. Whilst the area is of interest, the future potential of the field is limited.

LOCATION AND ACCESS

The Denison Rivulet coalfield lies to the south of the Douglas River coalfield, and includes the land for several kilometres on both banks of the Denison Rivulet.

Access to the eastern part of the coalfield is from the Tasman Highway. The central and northern parts of the coalfield are not easily accessible, although a rough track from Ferndale Road around Mt Andrew provides access to the middle reaches of the Denison Rivulet.

GENERAL GEOLOGY

The geology of the Denison Rivulet coalfield has been mapped by Leaman and Richardson (1981) and Sansom (1979) (fig. 30).

No rocks older than Triassic in age are known to crop out in the area. However, in DOM Bicheno DDH5, collared at five metres a.s.l., the sequence intersected comprised 217 m of lithic sandstone, interbedded with mudstone, siltstone and minor coal; followed by 124 m of glaciomarine mudstone. The hole terminated in quartzwacke and slate (Mathinna Beds).

The lithic sandstone sequence belongs to the Upper Division of the Parmeener Supergroup, which elsewhere in the north-east unconformably overlies a glaciomarine sequence, the Lower Division of the Parmeener Supergroup.

The sedimentary sequence has been extensively intruded by Jurassic dolerite, which now caps the plateau country and hills around the Denison Rivulet.

Positive gravity anomalies along the southern side of the Denison Rivulet valley enclose a small pocket of coal measures, although sizeable dolerite dykes are considered to be present in the area (Leaman and Richardson, 1981).

Dolerite talus thickly mantles the valley slopes, obscuring outcrop. The Denison Rivulet has cut a deep channel through the dolerite and talus, exposing the Triassic lithic sandstone sequence which contains occasional coal outcrops.

Alluvial sand and gravel covers the coastal plain at the eastern end of the coalfield.

COAL GEOLOGY

The coal seams exposed in the Denison Rivulet belong to the upper part of the lithic sandstone sequence. The seams are thin (<1 m thick) and extensively banded (fig. 31).

The seams worked on the coastal plain by the Douglas River Coal Company were also thin and banded, although these seams are stratigraphically lower than those exposed in the

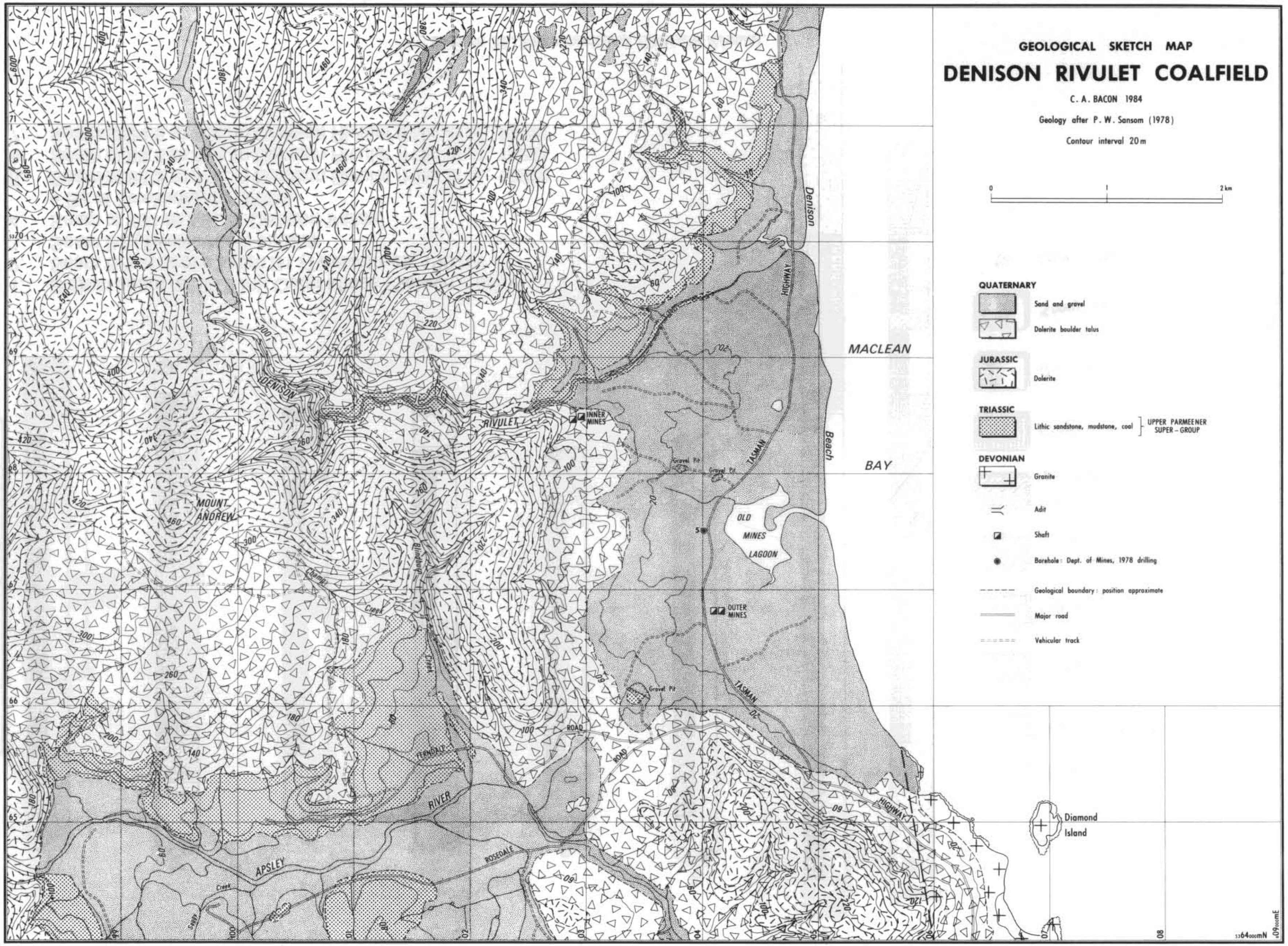
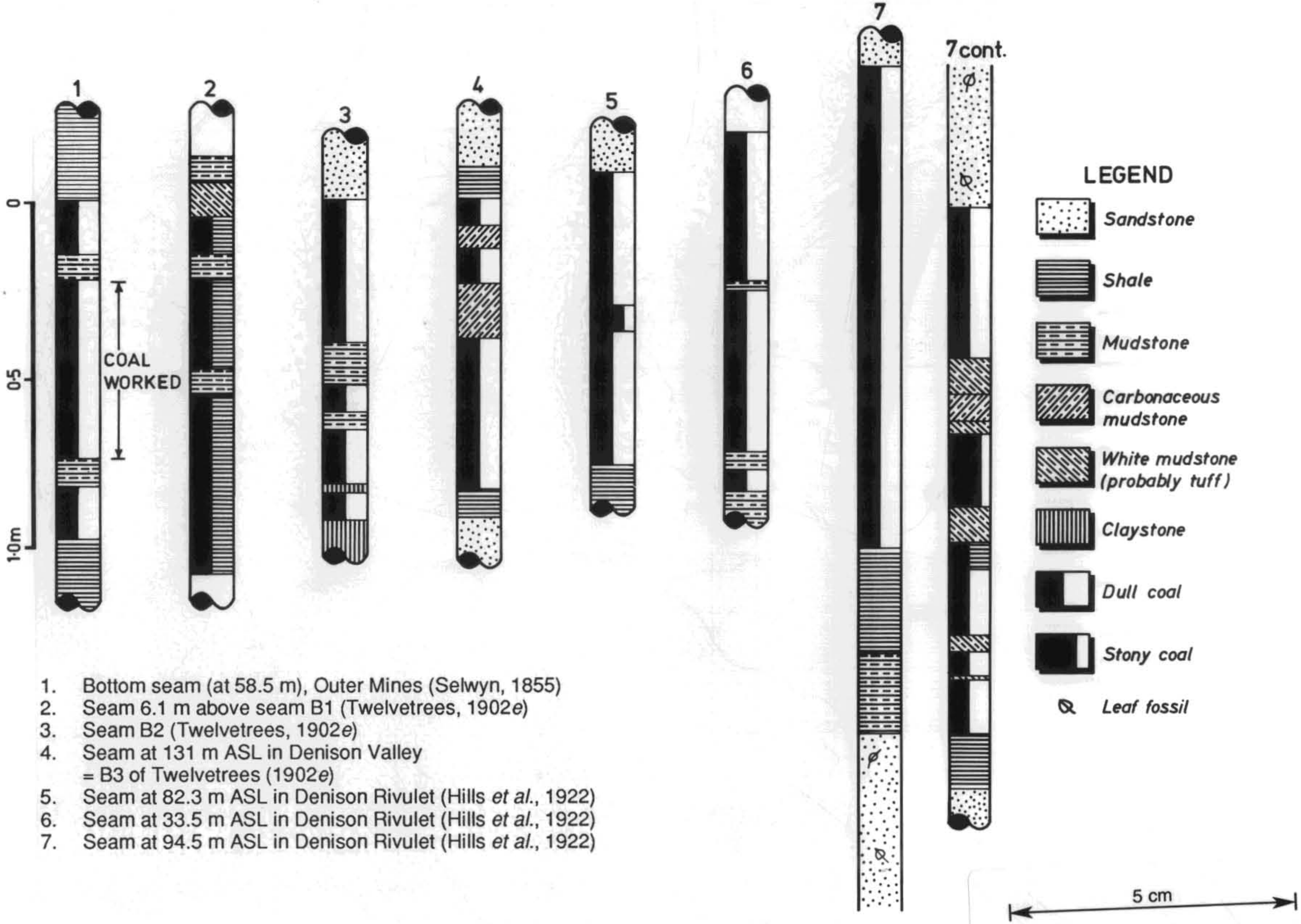

GEOLOGICAL SKETCH MAP
DENISON RIVULET COALFIELD
C. A. BACON 1984
Geology after P. W. Sansom (1978)
Contour interval 20 m
0
1
2 km
QUATERNARY
Sand and gravel
Dolerite boulder talus
JURASSIC
Dolerite
TRIASSIC
Lithic sandstone, mudstone, coal
UPPER PARMEENER SUPER-GROUP
DEVONIAN
Granite
Adit
Shaft
Borehole: Dept. of Mines, 1978 drilling
Geological boundary: position approximate
Major road
Vehicular track
MACLEAN
BAY
Denison
Beach
HIGHWAY
TASMAN
DENISON
RIVULET
INNER MINES
OUTER MINES
OLD
MINES
LAGOON
Gravel Pit
MOUNT ANDREW
APSLEY
RIVER
ROAD
ROSEDALE
FERNDALE
Diamond
Island

Figure 30.



1. Bottom seam (at 58.5 m), Outer Mines (Selwyn, 1855)
2. Seam 6.1 m above seam B1 (Twelvetrees, 1902*e*)
3. Seam B2 (Twelvetrees, 1902*e*)
4. Seam at 131 m ASL in Denison Valley = B3 of Twelvetrees (1902*e*)
5. Seam at 82.3 m ASL in Denison Rivulet (Hills *et al.*, 1922)
6. Seam at 33.5 m ASL in Denison Rivulet (Hills *et al.*, 1922)
7. Seam at 94.5 m ASL in Denison Rivulet (Hills *et al.*, 1922)

Figure 31. *Seam sections, Denison Rivulet.*

middle reaches of the Denison Rivulet. The two areas are separated by a fault or faults, which are concealed under alluvial cover. Correlation of these seams with those further north is not possible on the limited data available.

An outcrop of air-fall tuff in the lithic sandstone sequence at FP014686 has been dated by K-Ar geochronology on biotite extracted from the tuff at 214 ± 1 million years (Bacon and Green, 1984).

A palynological study by S. M. Forsyth of a sample of fossiliferous mudstone from approximately FP032688 revealed a palynological assemblage belonging to the *Craterisporites rotundus* Zone, which suggests correlation with the Ipswich Coal Measures and therefore a Karnian age for the sample. This is consistent with the age of the tuff, as Webb (1981) proposed a date of 215 Ma for the Karnian–Norian boundary. The spore assemblage is given in Bacon and Green (1984).

PREVIOUS MINING HISTORY

Several seams of coal were discovered in a creek bed about 6.5 km south of the Douglas River in 1843 by Jesse and Isaac Garland. On 12 March 1843, W. T. Noyes, Assistant Police Magistrate of Waterloo Point, wrote to the Principal Superintendent of Convicts saying that he had inspected the coal discoveries with the two brothers (CSO 22/84/1807).

In May 1849 the Douglas River Coal Company was formed to exploit this coal, and was granted a seven year lease on payment of a royalty of two pence per ton of coal extracted. The Government was to use these funds to erect a wharf at Bicheno and build a tramway to the proposed mine (CSO 24/104/32800). This agreement was subsequently altered, with the company paying 2d/ton royalty on the coal and an additional 2d/ton towards the provision of a tramroad (*Colonial Times*, 1 June 1884, p. 2).

Work initially commenced close to the Denison Rivulet, about one mile (1.6 km) from the sea. One shaft was sunk on the north side of the rivulet and two shafts on the southern side. The shaft on the northern bank was 15 m deep and cut "5 or 6 thin seams" (Selwyn, 1855). Two seams were worked from the two southern shafts for a short time. A seam 2.4 m thick at the 28 m level was very banded, and only a 1.2 m section of this seam was mined. A lower seam, 1.5 m thick at the 50 m level, was of better quality. The seams were cut off within 50 m to the west by a north-trending fault. The seams dipped at 1.75° to the south-west. The workings were known as the 'Inner Mines' (Gould, 1861*b*).

Transporting the coal to Bicheno (a distance of 6.5 km) proved to be very costly, and after raising some 800 t of coal, work was transferred to south of the lagoon (now Old Mines Lagoon) where four shafts and a number of bores were sunk. These workings were known as the 'Outer Mines'. Two seams were encountered in the shafts; a minor seam at 27.4 m, and a larger seam 31 m below this; from which the company extracted small quantities of coal (Gould, 1861*b*). The dip of the seams was 3° to the north-east. A wooden tramway was laid from the Outer Mines to Bicheno.

Selwyn (1855) also noted that two shafts in addition to those at the Inner and Outer Mines were dug, one at 'Badgers Bridge' by a Mr Lyne and another in a gully above the first one. The Badgers Bridge shaft intersected a thick, banded seam of poor quality coal.

The first recorded sale of coal from this area is in 1850, when ten tons were sold by auction in Hobart Town on 28 October (*Hobart Town Courier*, 30 October 1850). In 1850 coal from these workings was analysed by the Museum of Practical Geology, London (GO 1/78/373-9).

The company reported a good year in 1853 (*Launceston Examiner*, 6 September 1853), and an extension of the original lease was granted by the Lieutenant-Governor. The royalty rates on the 21 year lease were to be 2d/ton for the first 7 years, 4d/ton for the next 7 years, and 6d/ton for the last 7 years (CSO 24/104/3280).

The coalfield was described by Selwyn (1855) as the best coalfield in Tasmania. At the time of Selwyn's visit a 20 horse-power engine was being erected to aid in the mining of the central 500 mm of the bottom seam at the Outer Mines.

The mine was slow to begin production and the company spent large sums building a tramway from Bicheno to the mines, as the Government failed to complete the job. The tramway opened in December 1854. In July 1855 a bitter and scathing attack was launched on the chairman of the Board of Directors (Dr J. Milligan) by a former employee of the company, J. Thomas, who published his grievances in a pamphlet to the shareholders (Thomas, 1855).

Production from the mines was small, being 100–200 t per month. Total production from May 1854–February 1855 was 1800 tonnes. In 1858 the company folded, and the property and stock were sold (*Hobart Town Courier*, 8 March 1858). Twenty-one young English colliers brought out especially to work in the mines found their services not wanted (*Hobart Town Gazette*, 2 March 1858).

Seams upstream from the Douglas River Coal Company's workings were described by Selwyn (1855), Gould (1861*b*), and Twelvetrees (1902*e*).

An adit was dug into an outcrop of coal 1.2 m thick on the north bank of the rivulet close to the Inner Mines. Further upstream, adits were dug on three seams by the Morning Star Company in 1898. Twelvetrees (1902*e*) named the seams B1, B2 and B3. On the B1 seam (430 mm thick) a drive 4.3 m in length had been cut. Keid (*in* Hills *et al.*, 1922) described this seam as an interbedded sequence of coal and mudstone some 4 m thick, with a ply of bright coal 460 mm thick towards the top.

The B2 seam, downstream from the B3, was 1.0 m thick, of which the top 500 mm was of good quality coal. An 18 m long adit was put in on this seam on the north bank of the rivulet (Twelvetrees, 1902*e*), but was full of water at the time of Keid's 1922 visit. The B3 seam, upstream from the B1, was 860 mm thick. An adit was driven some 16.8 m on an outcrop of this seam 100 m north of the rivulet. A few smaller outcrops were described by Twelvetrees (1902*e*) and Keid (*in* Hills *et al.*, 1922).

Two leases for coal were held in the Denison Rivulet area from 1904 to 1908 by N. Weetman, but there is no record of any work being done. A mining lease covering part of the Denison Rivulet coalfield was held by the Mt John Mining Company from 1916 to 1925. During this time Keid (*in* Hills *et al.*, 1922) made an inspection and noted the previously dug adits, which he stated were dug by the Mt John Mining Company.

Leases were held from 1930 to 1932 over an area covering the former Inner and Outer Mines but there is no record of any further work being done.

Two adits may be seen in the bed of the Denison Rivulet at FP013686 and FP017687.

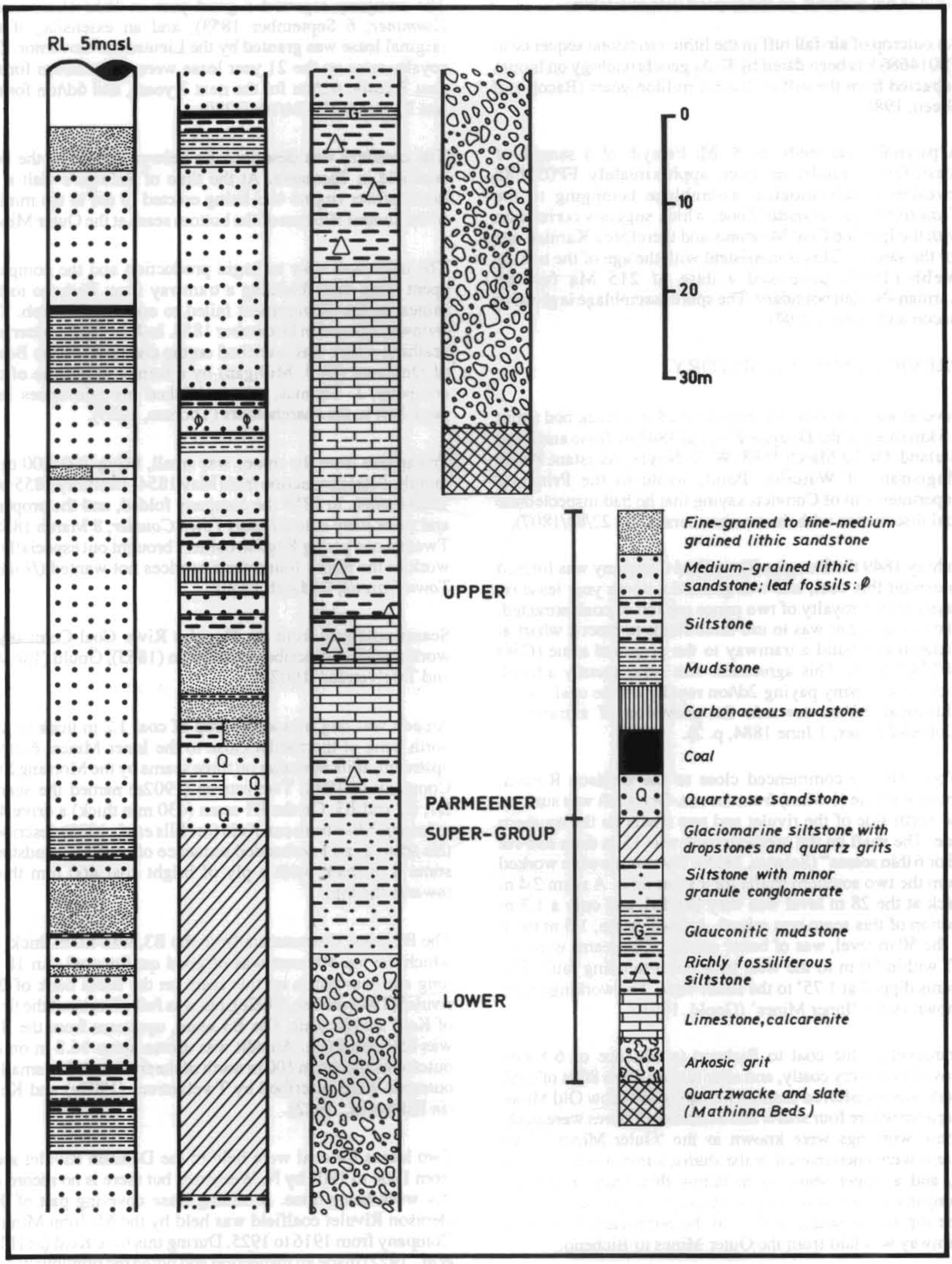


Figure 32. *Lithological log of Department of Mines diamond-drill hole DDH 5.*

Table 14. *Analyses of coal samples from the Denison Rivulet coalfield.*

Analysis	1	2	3	4	5	6	7	8
Moisture (%)		5.6	5.00	6.3	4.9	4.4		3.7
Ash (%)	14.50	6.0	6.85	5.6	13.1	17.3	44.5	18.4
Volatile matter (%)		32.4	33.0	33.5	28.9	24.8		28.3
Fixed carbon (%)		54.8	55.15	54.0	53.1	53.5		49.6
Sulphur (%)								0.37
Specific energy (MJ/kg)						23.8		26.36

1. Sample from Inner Mines, analysed at Museum of Practical Geology, London, 26 July 1850.
2. Sample from seam B1 (432 mm thick), analysed by Government Analyst (Twelvetrees, 1902*e*).
3. Sample from seam B1 (432 mm thick), analysed 1898 (Twelvetrees, 1902*e*).
4. Sample from seam B2 (500 mm thick), analysed by Government Analyst (Twelvetrees, 1902*e*).
5. Sample from seam B3 (760 mm thick), analysed by Government Analyst (Twelvetrees, 1902*e*).
6. Sample from face and tunnel at altitude 130 m on northern bank of stream; sample 533 mm thick, from two lowest plys of seam (Hills *et al*., 1922). Seam = B3 of Twelvetrees (1902*e*).
7. Raw coal, DDL seam, 2.09 m thick, GY29 (Ford and Bos, 1984).
8. Washed coal, DDL seam, 2.09 m thick, GY29; F1.70, yield 57.8% (Ford and Bos, 1984).

COAL QUALITY

Representative analyses of coal from the Denison rivulet coalfield are given in Table 14.

RECENT EXPLORATION

Although a number of drill holes were sunk by the Douglas River Coal Company in the 1850s, no records of these are available. A drilling programme for the area was suggested by Nye (1927*a*). More recently, in 1979, one hole (DOM Bicheno DDH5) was drilled by the Department of Mines near Old Mines Lagoon (fig. 32). This hole was one of several drilled to provide control points for an extensive gravity survey of the East Coast coalfields (Leaman and Richardson, 1981). One hole (GY29) was drilled in 1982 by the Shell Company of Australia during a coal exploration programme in EL 5/61. Details of coal intersections encountered are given in Ford and Bos (1984). Historical accounts of the early discovery and mining in the area are given by Milligan (1849), Selwyn (1855), Gould (1861*a*), Twelvetrees (1902*e*), and Keid (*in* Hills *et al*., 1922). The coalfield has been mapped by Sansom (1979).

POTENTIAL FOR FUTURE EXPLORATION

Combined with the Douglas River and Dalmayne coalfields to the north, the area is of interest for further exploration. The coal reserve of the coalfield cannot be calculated on the information available, but is likely to be quite small.

The Llandaff Coalfield

SUMMARY

The Llandaff coalfield is located on the slopes of Buster Ridge, south-west of Bicheno. A number of prospecting adits and shafts have been sunk in this coalfield but no mining venture eventuated. The coal is of Triassic age. Because of the thin nature of the seams and the small lateral extent of the coalfield, the area is of minimal interest for future exploration.

LOCATION AND ACCESS

The Llandaff coalfield is located around the southern and eastern slopes of Buster Ridge, 10 km south-west of Bicheno. The township of Llandaff [FP007558] lies on a flat plain, between the scarp of the Central Eastern Highlands (of which Buster Ridge is a part) to the west and low granite hills adjoining the coastline to the east. Most of the outcrops of coal known from this coalfield have been found in or around Steep (Lynes) Creek. However, some outcrops have been recorded on the northern flanks of Buster Ridge and on the flat valley floor of the Apsley River in the area around the confluence of Blindburn Creek with the Apsley River. The area of the Llandaff coalfield is traversed by the Tasman Highway and many secondary farm and forestry roads.

GENERAL GEOLOGY

The area has been examined by Twelvetrees (1902*e*), Hills *et al*. (1922), Leaman (1978), and Bacon (1979). The geology of the area is shown in Figure 33.

The coal seams which are of interest in the Llandaff coalfield form a minor component of the Late Triassic lithic sandstone sequence, which forms the uppermost interval of the Upper Parmeener Supergroup. The sequence is composed dominantly of lithic sandstone with minor interbedded mudstone, siltstone, claystone, rare tuff and occasional coal seams.

Stratigraphically, the coal-bearing sequence overlies glaciomarine sequences of the Lower Parmeener Supergroup in the Llandaff area. These marine rocks disconformably overlie a basement of Devonian granite.

Dolerite intruded the sedimentary pile during the Jurassic and now caps most of the plateau country of the Central Eastern Highlands (including Buster Ridge). Dolerite talus thickly covers the steep slopes of Buster Ridge while the flat-lying country around Llandaff (the wide valley of the Apsley River) is covered by sand and alluvium.

Drilling in the eastern part of the coalfield has shown that the lithic sandstone sequence rests directly on the granite basement.

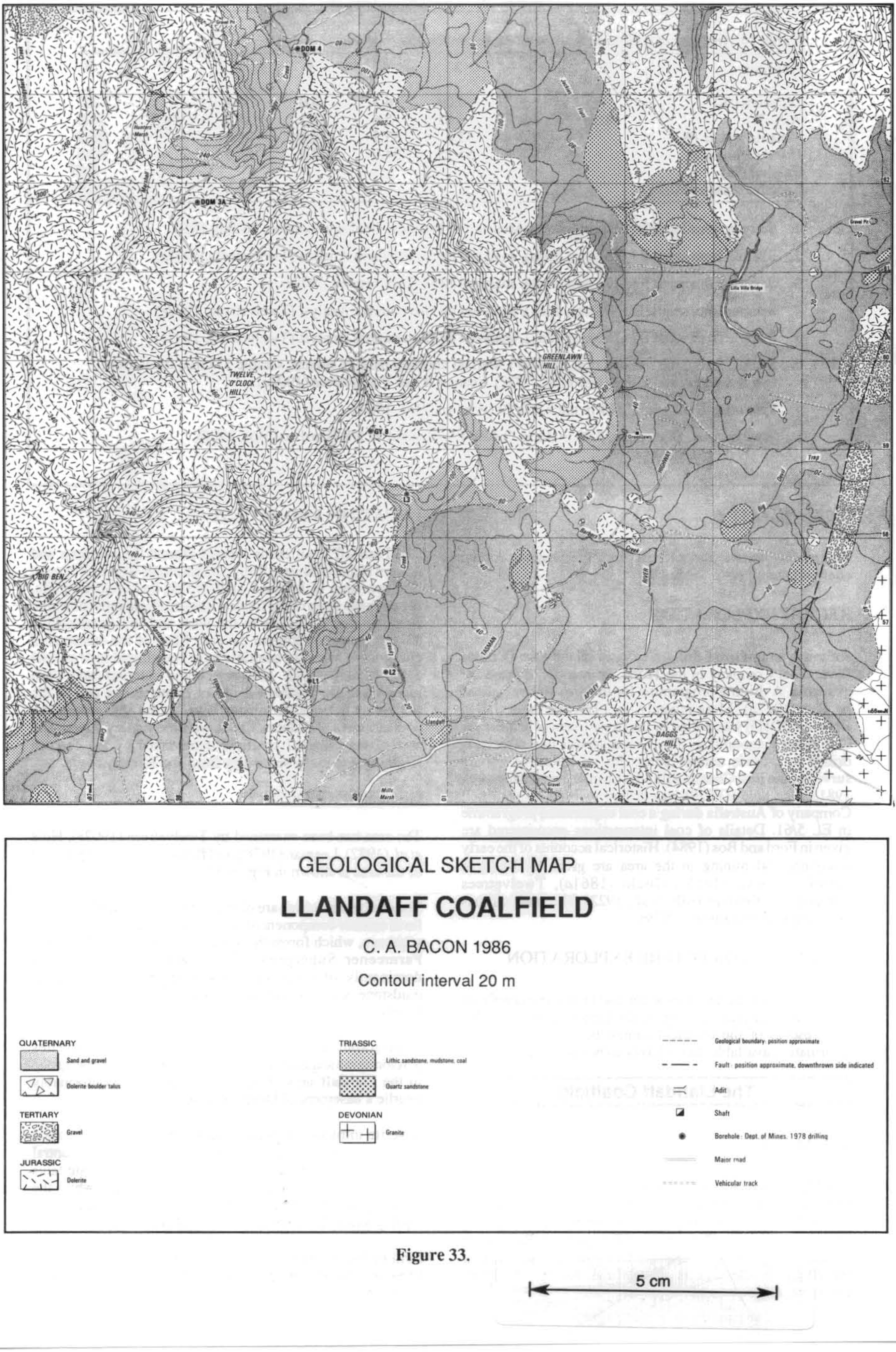

DOM 4
DOM 3A
TWELVE O'CLOCK HILL
GREENLAWN HILL
BIG BEN
DAGGS HILL
L1
L2
Lilla Villa Bridge
HIGHWAY
RIVER
TASMAN
APSLEY
Mills Marsh
Llandaff
GEOLOGICAL SKETCH MAP
LLANDAFF COALFIELD
C. A. BACON 1986
Contour interval 20 m
QUATERNARY
Sand and gravel
Dolerite boulder talus
TERTIARY
Gravel
JURASSIC
Dolerite
TRIASSIC
Lithic sandstone, mudstone, coal
Quartz sandstone
DEVONIAN
Granite
Geological boundary: position approximate
Fault: position approximate, downthrown side indicated
Adit
Shaft
Borehole: Dept. of Mines. 1978 drilling
Major road
Vehicular track
5 cm

Figure 33.

A large north-trending fault exists west of Llandaff. The eastern fault block is composed of granite, while granite abuts dolerite from FP055656 to FP060622. Coal-bearing sediments overlain by alluvium are faulted against the granite from FP060622 to FP040550. A more detailed account of the geology is given in Bacon (1979).

PREVIOUS MINING HISTORY

No coal mining has taken place in the Llandaff coalfield, although various outcrops of coal have been opened up by adits during the course of intermittent prospecting activities.

Coal was found in the Llandaff coalfield in 1843 by two ticket-of-leave convicts, Jesse and Isaac Garland, who reported finding coal on Schouten Island, south of the Douglas River, and near the Apsley River (CSO 22/84/1807, p. 142). The two brothers concentrated on the Schouten Island coal, and the Apsley River outcrop was left undisturbed.

Twelvetreees (1902*e*) described a number of outcrops of coal in Pikes Creek (a tributary of Lynes Creek) and Steep Creek (Lynes Creek), which run in a south-easterly direction off Buster Ridge onto the flats surrounding the Llandaff township. The seams exposed were all less than 1.0 m thick.

The Morning Star company drove an adit into an outcrop of coal on the south bank of Steep (Lynes) Creek in 1898 for a distance of six metres. An adit was also driven on the north bank of Steep Creek and a shaft, 3.6–3.9 m deep (known as Ramsay's shaft), was sunk nearby. Another shaft (Pike's shaft), sunk near the northern boundary of the township of Llandaff, was examined by Twelvetrees (1902*e*).

In Pikes Creek a seam of coal 1.0 m thick was opened up by an adit 3.9 m long. In a gully leading into Steep (Lynes) Creek a seam of coal was worked for a short time by a Mr Carhill, and a small quantity of coal was sent to Adelaide. Whilst most of the seams in the area are less than one metre thick, at one outcrop, high up in Steep (Lynes) Creek, a heavily banded seam 4.0 m thick was noted by Twelvetrees (1902*e*).

Twelvetrees also examined an outcrop of coal in Marshalls Creek, on the northern slope of Buster Ridge (Marshalls Creek is a tributary of the Apsley River).

The Mt John Coal Mining Company had driven 'a few short tunnels' on outcrops of coal in a lease one kilometre north of Llandaff at the time of a visit by A. M. Reid in 1921. No further mining activity occurred in this area.

COAL QUALITY

There are few analyses available of coal from the Llandaff coalfield. Representative analyses are given in Table 15.

RECENT EXPLORATION

Three diamond-drill holes were put down by the Department of Mines in the 1890s. The logs of these three holes (DOM Llandaff 1, 2, 3) are given in Hills *et al.* (1922).

The Shell Company of Australia drilled one hole (GY8) near Llandaff in 1978. Two holes were drilled in 1978 by the Department of Mines as control points for an extensive gravity survey of the East Coast coalfields (DOM Bicheno 4, 3A). Additional holes for the gravity survey were drilled at Apslawn (Bicheno 7) and Cranbrook (Bicheno 8), south of the Llandaff coalfield.

Table 15. *Analyses of coal samples, Llandaff coalfield.*

	1	2	3
Moisture (%)	5.80		2.9
Ash (%)	29.20	38.4	22.5
Volatile matter (%)	23.42		28.4
Fixed carbon (%)	41.58		46.2
Sulphur (%)	0.44		0.47
Specific energy (MJ/kg)			24.54

1. Sample of coal from a lease 3.2 km north of Llandaff (Hills *et al.*, 1922).
2. Raw coal, sample GY8/1 (1978), seam 2.20 m thick.
3. Sample GY8/1; F1.70 fraction; yield 61.5% at F1.70.

The area has been mapped by Bacon (1979) and included in an extensive gravity survey of the Central Eastern Highlands (Leaman and Richardson, 1981).

POTENTIAL FOR FUTURE EXPLORATION

Whilst parts of the Llandaff coalfield have not been fully investigated by drilling, the potential of the Llandaff coalfield for future exploration is limited. The known outcrops and intersections of coal show the seams to be thin and discontinuous. While the analytical data is also sparse, the samples so far analysed from this coalfield have more ash than the usual East Coast coals.

The Mt Paul Coalfield

SUMMARY

The Mt Paul coalfield is contained within a north–south striking graben on the northern end of Freycinet Peninsula. Access is poor, and only a small quantity of coal has been mined from the area.

The coalfield is dominated by Mt Paul, which is capped by Jurassic dolerite. The coal seams, of Triassic age, form a minor component of an interbedded sequence of lithic sandstone, mudstone and siltstone. The sequence crops out on the lower slopes of Mt Paul, and is faulted against a quartzose sandstone sequence which underlies the lithic sequence elsewhere on the East Coast.

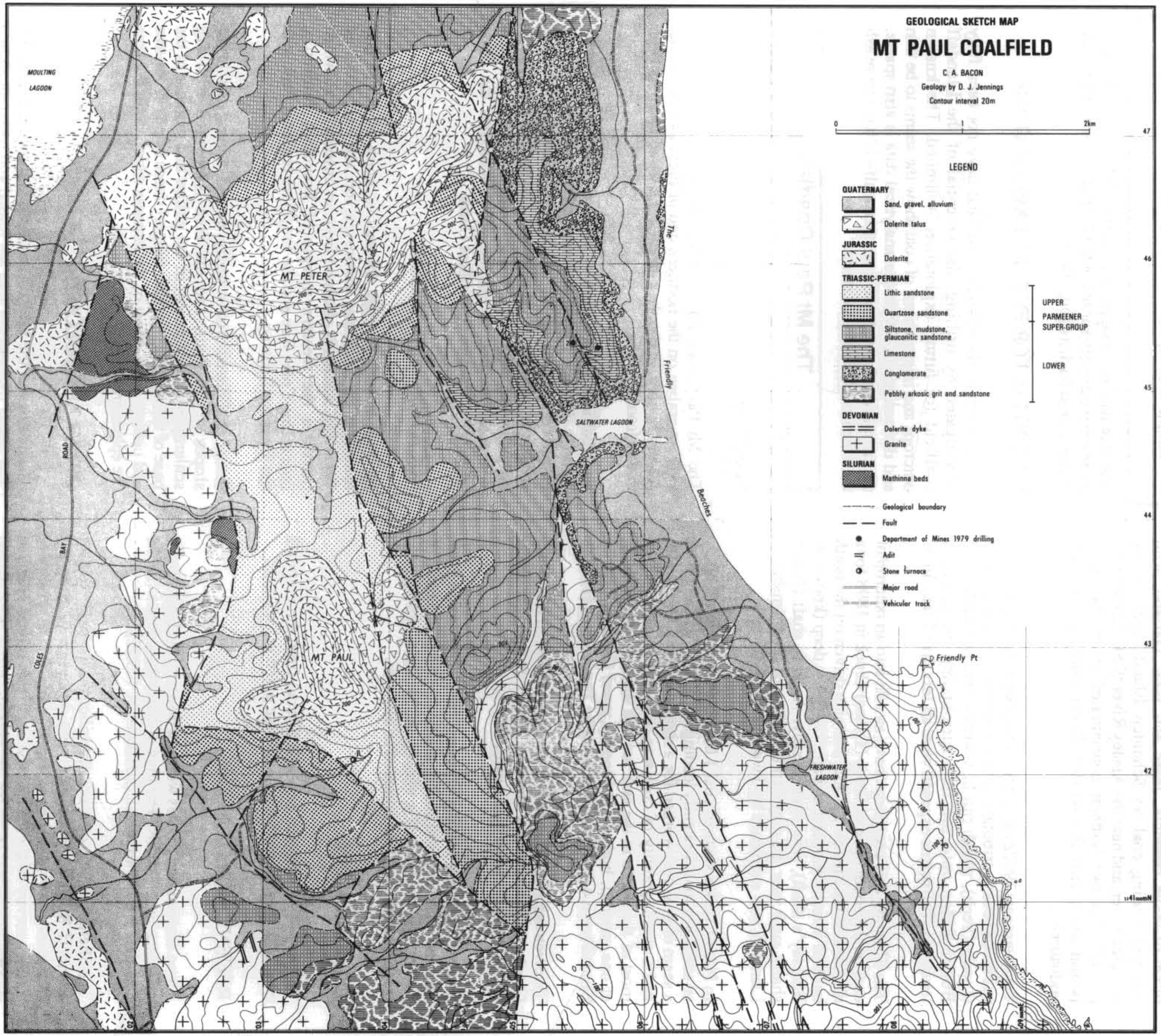
LOCATION AND ACCESS

Mt Paul is located eight kilometres north of Coles Bay township on Freycinet Peninsula, on the east coast of Tasmania. Access is obtained from an unsealed road which traverses the western margin of Freycinet Peninsula, connecting Coles Bay and the Freycinet National Park with the Tasman Highway.

Rough bulldozed tracks partly extend around the lower slopes of Mt Paul, and the area is covered with dry schlerophyll forest except in the gullies and marshes at the base of the mountain, which support dense stands of tea-tree and cutting grass. Most of the streams which drain the area are ephemeral.

GENERAL GEOLOGY

The geology of the Mt Paul coalfield is shown in Figure 34. The oldest rocks in the area are folded and metamorphosed shale and siltstone belonging to the Silurian Mathinna Beds, which have been intruded by granite of Devonian age.



5 cm

Figure 34.

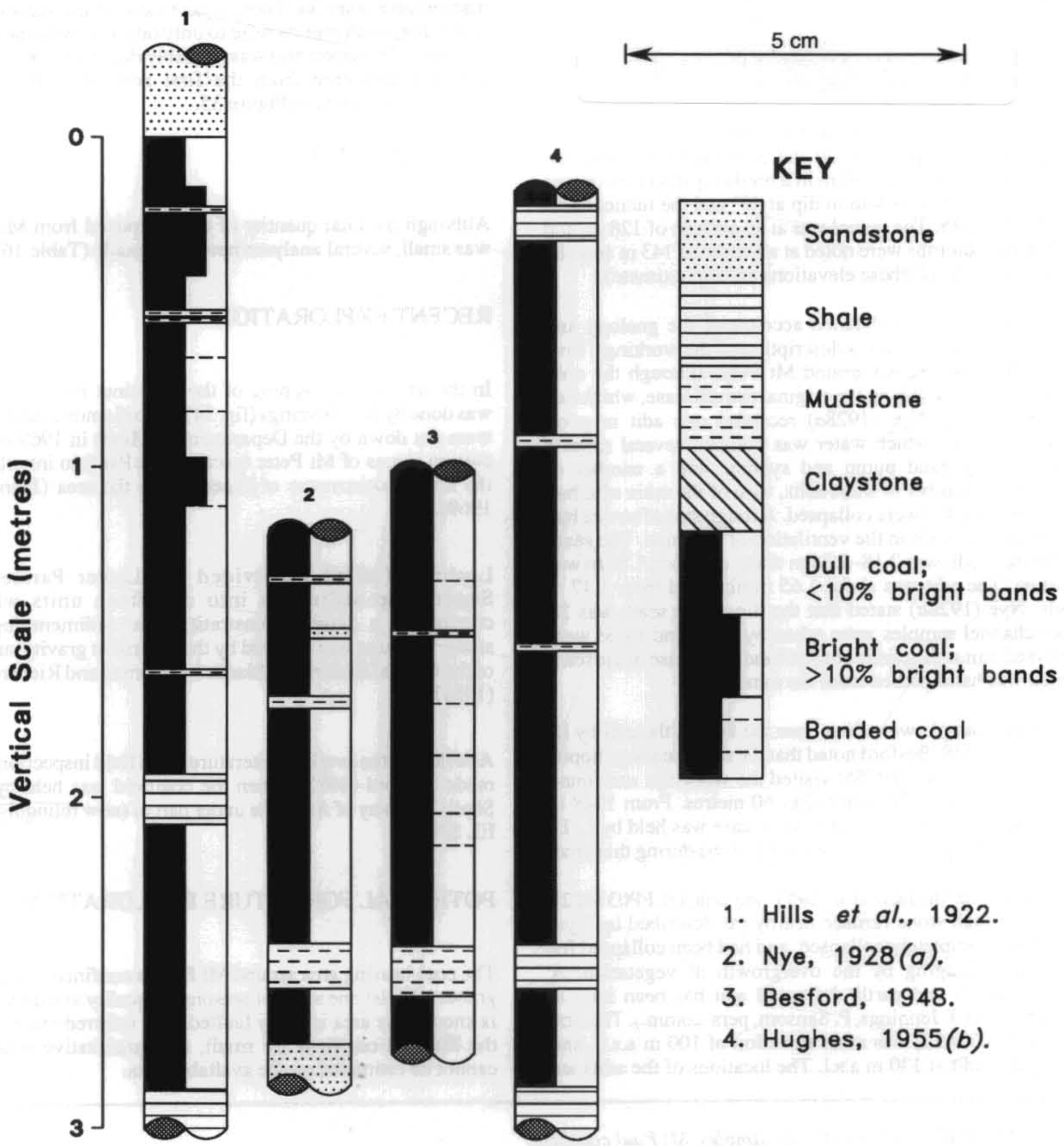


Figure 35. *Measured seam sections, Mt Paul adit.*

Groves (1966) described the granite around Coles Bay, to the south of Mt Paul, noting the most common type to be a coarse sub-porphyritic red adamellite, which encloses smaller areas of strongly porphyritic red adamellite.

Unconformably overlying the basement of folded Mathinna Beds and granite is a sequence of flat-lying sedimentary rocks which constitute the Parmeener Supergroup. The Parmeener Supergroup has been divided into a lower, dominantly glaciomarine division and an upper, dominantly freshwater division (Forsyth *et al.*, 1974).

The Lower Parmeener Supergroup in this area was divided by D. J. Jennings in 1977 into four lithological units:

(a) siltstone, mudstone and glauconitic sandstone;
(b) limestone;
(c) conglomerate;
(d) pebbly arkosic grit and sandstone.

These divisions are not meant to represent strict formations in the classical sense.

The Upper Parmeener Supergroup sediments are confined to a north-striking graben. Mt Peter and Mt Paul are both within this graben.

Elsewhere on the East Coast, massively-bedded quartzose sandstone is overlain by a sequence of dominantly lithic sandstone, with minor interbedded mudstone, siltstone and coal. In the Mt Paul area, the contact between the two sandstone sequences is invariably faulted.

Jurassic dolerite has intruded the sequence and now caps Mt Peter and Mt Paul. A body of dolerite centred at FP023465 is thought to represent a dyke. Platy, parallel fracturing of the dolerite at right angles to the slope of the hill has been noted (D. J. Jennings, pers. comm.). Such fracturing is known to occur on the margins of dykes elsewhere, where fractures form parallel and at right angles to the main axis of the dyke.

Talus mantles the higher slopes, while sand and gravel obscure outcrop towards the coast. Alluvium covers much of the flat country around the base of Mt Peter and Mt Paul.

PREVIOUS MINING HISTORY

In 1916 a Reward Lease (15P/M) for discovery of coal at Mt Paul was issued to C. J. Q. Lyne.

Hills *et al.* (1922) noted that the Mt Paul Coal Mining Syndicate was operating on the Reward Lease, and had driven a dip tunnel for 140 m in a northerly direction on one seam. The seam was said to dip at 40° and the tunnel had a grade of 1 in 15. The tunnel was at an altitude of 128 m, and additional outcrops were noted at altitudes of 143 m and 180 m above sea level (these elevations are approximate).

Nye (1928*a*) gave a detailed account of the geology and structure of the area and a description of the workings. Five leases for coal existed around Mt Paul, although the only work being done was on the original reward lease, which had changed hands. Nye (1928*a*) recorded one adit in good condition, from which water was pumped several times a week with a hand pump and syphon, and a number of trenches. A number of short adits, west of the main adit, had been driven in but were collapsed. A rough stone furnace had been erected to aid in the ventilation of the mine. The seam in the main adit was 2.18–2.34 m thick, of which 1.58 m was worked. The adit was about 1.65 m high and from 1.47 m wide. Nye (1928*a*) stated that the dip of the seam was 2°. Two channel samples were taken by Nye, and these were analysed minus the persistent dirt band at the base of the seam which was hand-picked from the mined coal.

A channel sample was taken from the face in the adit by D. Besford in 1948. Besford noted that the main heading dipped at 1 in 13. Hughes (1955*b*) visited the workings and found them to be filled with water after 60 metres. From 1948 to 1961 the area of the original reward lease was held by L. D. McRae, although no further work was done during this time.

During a field inspection in 1983 one adit [at FP037422], with the rough stone furnace nearby (as described by Nye, 1928) had completely collapsed, and had been collapsed for some time judging by the overgrowth of vegetation. A second, newer and partly collapsed adit has been seen at FP035424 (D. J. Jennings, P. Sansom, pers. comm.). The first adit [at FP037422] was at an elevation of 100 m a.s.l., and the second adit at 130 m a.s.l. The locations of the adits are marked on Figure 34. There is no record of the second adit being dug, as all reports refer to only one adit, with the stone chimney. The newer adit was probably dug after 1961. Seam sections measured from the first adit (with the stone chimney) are given in Figure 35.

COAL QUALITY

Although the total quantity of coal extracted from Mt Paul was small, several analyses have been made (Table 16).

RECENT EXPLORATION

In the late 1960s mapping of the Freycinet Peninsula area was done by D. J. Jennings (fig. 34). Two diamond-drill holes were put down by the Department of Mines in 1969 on the eastern slopes of Mt Peter (north of Mt Paul) to investigate the known occurrence of limestone in the area (Jennings, 1969).

Leclercq (1976) subdivided the Lower Parmeener Supergroup sediments into seventeen units whilst conducting a detailed biostratigraphic sedimentological study. The area was covered by the extensive gravity survey of the Central Eastern Highlands by Leaman and Richardson (1981).

A review of the available literature and a field inspection was made by Ford (1982), when the coalfield was held by the Shell Company of Australia under part of (now relinquished) EL 5/61.

POTENTIAL FOR FUTURE EXPLORATION

The coal-bearing area around Mt Paul is confined to a small graben. Whilst one seam of reasonable quality and thickness is known, the area is badly faulted. The inferred reserves of the Mt Paul coalfield are small, and quantitative reserves cannot be estimated on the available data.

Table 16. *Analyses of coal samples, Mt Paul coalfield.*

	1	2	3	4	5	6	7
Moisture (%)	1.58	1.00	1.2	1.00	0.6	2.3	1.2
Ash (%)	33.78	26.46	14.92	25.60	22.3	29.1	19.6
Volatile matter (%)	15.32	20.80	18.24	18.58	25.5	22.1	25.8
Fixed carbon (%)	49.32	51.74	55.64	54.82	51.6	46.5	53.4
S (%)	0.37	0.44	0.68	0.74	0.46	0.41	0.43
H (%)		4.06					
C (%)		56.51					
O (%)		11.60					
N (%)		0.93					
Specific Energy (MJ/kg)		23.1	22.3	22.2	26.2	23.6	27.8
Specific Gravity		1.36					

1, 2. Samples from the Mt Paul adit (Hills *et al.*, 1922).

3. Channel sample of 1.27 m of seam above basal band; from west side of adit, 15 m south of face (Nye, 1928*a*).
4. Channel sample of whole seam (1.5 m) excluding basal band; from east side of adit, 13.7 m south of face (Nye, 1928*a*).
5. Channel sample of whole seam from near the face, collected by D. Besford in 1948.
6. Channel sample of top 1.27 m coal, above mudstone band; collected by T. D. Hughes in 1955.

The Schouten Island Coalfield

SUMMARY

Schouten Island is located 1.6 km south of the Freycinet Peninsula. A large north-trending fault divides the island into two geologically distinct parts. The higher relief of the eastern part, which is underlain by Devonian granite, contrasts sharply with the more gentle topography of the western part, which is underlain by Jurassic dolerite and Parmeener Supergroup rocks.

During small-scale mining activity in the 1840s coal was won from two adits and two shafts in the northern part of the island. The island was declared a National Park in 1967 and is therefore now exempt from provisions of the Mining Act, 1929.

LOCATION AND ACCESS

Schouten island lies 1.6 km south of the southern tip of Freycinet Peninsula on the east coast of Tasmania. Access by boat is 19 km from Coles Bay or 24 km from Swansea. The principal anchorages for small boats are at Crocketts Bay or Moreys Bay on the northern coast of the island.

GENERAL GEOLOGY

The island, which has an area of 28 km^2, has been mapped by Keid (*in* Hills *et al.*, 1922), Reid (1924), Hughes (1959*b*) and Corbett (in prep.) (fig. 36).

A major north-trending fault divides the island into a rugged eastern part underlain by Devonian granitic rocks (mainly pink medium to coarse-grained adamellite), and a western part with subdued topography underlain by Jurassic dolerite and Parmeener Supergroup rocks. Quaternary deposits include recent coastal sand dunes, patches of windblown sand on coastal hills, and talus deposits fringing the extensive cap of dolerite west of the fault. Large recent landslides involving the dolerite and underlying Parmeener Supergroup rocks occur along the south-facing slopes of Milligans Hill, and the coastal plain in this area is underlain mainly by coarse dolerite blocks.

Permian rocks are exposed in a small area adjacent to the N-trending fault on the south coast, and consist mainly of grey sandy mudstone, sandstone and dropstone conglomerate. A small outcrop of Permian mudstone also occurs on the fault zone west of Moreys Bay.

Triassic rocks are exposed in coastal cliffs around much of the western part of the island beneath the dolerite cap. A lower sequence of white, thick-bedded and cross-bedded siliceous sandstone, with some micaceous mudstone units and channel deposits, is overlain by, or faulted against, an upper sequence of grey lithic-feldspathic sandstone with interbedded carbonaceous mudstone and several small coal seams. The coal-bearing sequence occurs at sea level on the northern part of the island, where the coal workings were located, and has a north-trending faulted contact against the siliceous sandstone sequence one kilometre SW of Sandspit Point. The sequence on the southern part of the island is exposed mostly along the tops of the coastal cliffs, but is down-faulted to sea level east of Cape Faure by a series of NE-trending faults. The basal part of the sequence in the latter area includes some siliceous sandstone, and two small coal seams, 380 mm and 150 mm thick, were recorded in a measured 18 m section. Several small coal seams less than 200 mm thick are exposed in the creek section one kilometre SW of Sandspit Point, in an area where silicified wood fragments (including a tree trunk 5 m long) are common.

Most of the previous coal production was from two adits (now collapsed and buried) in a small embayment flanked by dolerite 800 m west of Moreys Bay, and from two adjacent shafts at the old tramway terminus near Sandspit Point. Several exploratory shafts have been driven through the dolerite into the underlying siliceous sandstone sequence near Moreys Bay.

PREVIOUS MINING HISTORY

Coal was found on Schouten island in 1809 by a sealer, John Stacey. He also noted that some 200–300 ha of the island was suitable for cultivation (GO 39/4, p. 29). An article by a Mr. Bushby in the *Hobart Town Gazette* dated 24 February 1824 stated that there was "little doubt that convicts might be profitably employed working coal there". A lease to mine coal on Schouten Island was refused to John Graves on 23 July 1840 (LSD 1/46).

In 1843 Jesse and Issac Garland reported finding coal on Schouten Island, south of the Douglas River, and near the Apsley River. W. J. Noyes, Assistant Police Magistrate at Swansea, wrote to the Principal Superintendent of Police on 12 March 1843 saying he had inspected these finds of coal with the two brothers (CSO 22/84/1807, p. 142).

The Garland brothers petitioned Lieutenant-Governor Franklin for permission to work the coal on Schouten Island and at their other East Coast finds for a period of six months (CSO 22/84/1807, p. 146). Permission was granted on 16 September 1843 (CSO 22/84/1807, p. 149) and 200 t of coal from Schouten Island was on sale in Hobart in 1844 (*Colonial Times*, 27 August 1844).

The idea that Schouten Island would be ideal for a probation station was expressed in a letter from W. Jarrett to Lieutenant-Governor Wilmot on 11 October 1843 (GO 39/4, p. 39). The coal resources were surveyed by W. Jones whose correspondence suggests that the coal could be worked subject to the report by the Port Officer on the anchorage near the mine being favourable (CON 103/1, p. 74, 9 August 1844).

Jesse Garland stated in a letter to the Comptroller General (dated 10 September 1844) that he, together with six men, had spent the last twelve months opening and working a coal 'shaft' (probably an adit) on Schouten Island, from which only 350 t of coal had been raised. Garland sought an extension of time in which to work the mine (CSO 22/113/2385).

The extension was refused on 9 September 1844, as the Government planned to set up a probation station on the island (CSO 22/84/1807, p. 165–167).

Dr Joseph Milligan visited Schouten Island in 1848 and described the "remains of considerable workings". Milligan saw two seams, a thin "upper" seam which was not worked, and a lower (or main) seam 1.8–2.0 m thick. Two drifts (adits) had been driven in on this seam, one 45 m and the other 90 m long. The roof had collapsed in places in these workings, which Milligan (1849) described as:

> "The lower seam ..... measures 6 to 6½ feet (1.8–2.0 m) throughout. The old workings are of the following nature; one main drift a little above high water mark and nearly 6 feet by 6 feet (1.8 × 1.8 m), has been carried in the direction (SSW and WSW) or range of the seam for more than 100 yards (90 m). From this two branch galleries have been worked towards the crop so as to communicate around a massive square pillar. A narrow air course had been carried thence to the surface of the

5 cm

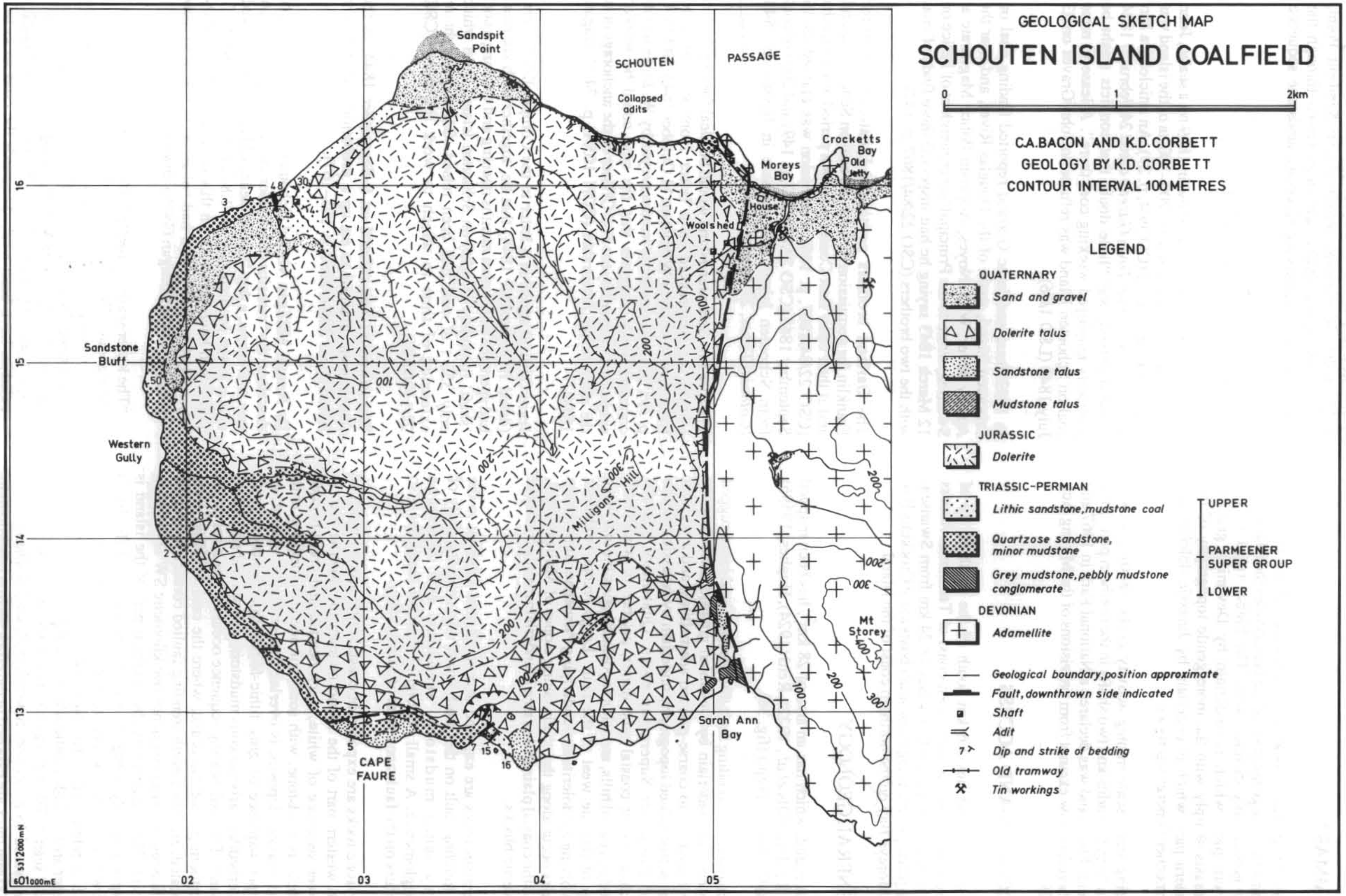


Figure 36.

bank. The drift ended abruptly, and apparently in massive clay."

The Australasian Smelting Company was formed in August 1848 with the object of procuring copper or other ore to be refined in or near Van Diemens Land (*Hobart Guardian*, 3 July 1850). The company applied for a lease to mine coal on Schouten Island for 21 years on 26 August 1848 (CSO 24/58/2076). Before the lease was granted coal was illegally mined on Schouten Island, and 60 t was unloaded from the *Lady Flora* and sold in Hobart. The lessee of the Government coal mine at Saltwater River, Alexander Clark, wrote to the Surveyor General on 16 November 1848 complaining about the newly arrived coal (CSO 24/78/2496).

A lease for seven years was granted to the company on 5 December 1848, on condition of payment of 2d/ton royalty on the coal mined (CSO 24/58/2076).

In 1849 offers were made by South Australian smelting companies to take 25 000 tons of coal per year for 21/- ($2.10) per ton (Denison to Grey, 18 May 1849).

The Australasian Smelting Company had a local board of directors (including Charles Swanston) and a committee in Adelaide (*Hobart Guardian*, 3 July 1850). The quality of Schouten Island coal was praised (*Hobart Guardian*, 10 July 1850). Swanston's company apparently formed the Schouten Island Coal Company to work the coal, and ten shares in the latter company were offered for sale in the *Hobart Guardian* of 16 July 1850.

Leases for coal were held from 1888–1892 by Signor A. G. D. Bernacchi and T. Bower. During this time Bernacchi extended the railway line, erected a jetty, and sank at least one prospecting shaft. Bernacchi intended to use the coal on Maria Island, 25 km south of Schouten Island, as a fuel at the Maria Island cement works near Darlington.

Two leases were applied for in 1921 by A. L. Luttrell, who is reported by Keid (*in* Hills *et al.*, 1922) as having sunk a number of prospecting shafts on the island. Records of leases held by the Department show that these applications were not granted.

A lease for coal was held from August 1924 to December 1925 by J. A. Bernacchi-McRae. A lease for coal was held offshore, adjacent to the island from April 1978 to October 1979 by D. P. Denison.

COAL QUALITY

A sample of coal was analysed at the Museum of Practical Geology, London in 1850 (GO 1/78, p. 379). The sample was collected by Milligan in 1849 from the main (2 m) seam mined on the island.

The results of the analyses were:

Ash	27.17%
Sulphur	0.84%
Carbon	64.0 %
Nitrogen	0.94%
Hydrogen	3.54%
Oxygen	3.50%

Reid (1924) noted that five coal seams had been found on the island. Samples were obtained from outcrops on the southern end of the island, near Cape Faure. Reid reported that using the Segar Cove Method for determining the fusibility of ash, no softening of ash was observed at 1750°C. The coal was described as brittle, with a dull lustre and cuboidal fracture. Analyses of the coal samples are given in Table 17.

Table 17. *Analyses of coal samples, Schouten Island coalfield.*

	1	2	3	4
Moisture (%)	9.0	6.5	4.2	2.5
Ash (%)	25.40	26.41	18.20	42.4
Volatile matter (%)	27.94	28.46	19.10	16.10
Fixed carbon (%)	33.66	48.25	58.50	38.96
Sulphur (%)	0.27	0.34	0.57	0.34

1. Spot sample from 'Eta Seam', 0.9 m thick.
2. Spot sample from 'Eta Seam', 0.9 m thick.
3. Sample from 'Theta Seam', 0.6 m thick.
4. Spot sample from 'Iota Seam', 0.3 m thick.

RECENT EXPLORATION

Hughes (1959*b*) reported on the coal and tin prospects of the island, which was declared a National Park on 29 March 1967.

POTENTIAL FOR FUTURE EXPLORATION

The inferred reserves of black coal are very small, and being a National Park, the island is exempt from provisions of the Mining Act (1929).

The Triabunna Coalfield

LOCATION AND ACCESS

Triabunna is located at the head of Spring Bay, 53 km south of Swansea.

GENERAL GEOLOGY

Coal has been found cropping out on the slopes of a small hill east of Triabunna. The coal is hosted in the lithic sandstone sequence at the top of the Upper Parmeener Supergroup, and is of Late Triassic age.

The hill is capped by part of a dolerite sheet, under which lies the coal-bearing lithic sandstone. This is in turn underlain by quartzose sandstone which is devoid of coal; these rocks crop out on the lower slopes of the hill, which is centred around EN770940.

PREVIOUS MINING HISTORY

Seams of coal in the Spring Bay district are mentioned by Selwyn (1855). Four shafts were sunk prior to Selwyn's visit to the area in 1854. A seam of coal 1.5 m thick was intersected in two of the shafts . Three more shafts were sunk in 1873 (Montgomery, 1891). On the recommendation of Montgomery four bores were drilled in 1891 around Spring Bay. The locations and logs of these bores are given in Hills *et al.* (1922).

COAL QUALITY

The following analysis is of pieces of coal collected near one of the old shafts in the Triabunna area (Montgomery, 1891)

Moisture (%)	4.7
Ash (%)	29.4
Volatile matter (%)	12.8
Fixed carbon (%)	52.2
Sulphur (%)	0.9

RECENT EXPLORATION

Apart from minor quantities of coal removed during prospecting activities no mining has occurred in this locality.

POTENTIAL FOR FUTURE EXPLORATION

The potential for future exploration in this area is very limited.

The Buckland Coalfield

LOCATION AND ACCESS

Two coal occurrences are known in the Buckland area; one in the valley of the Back River near to the property 'Stonehurst', about 10 km north-east of Buckland; and the other in the area between Tiger Hill and Mt Douglas, about 11 km north of Buckland. The latter area was known as French's Prospect.

GENERAL GEOLOGY

The coal occurrences have been mapped by Blake (1958) and are included on the Department of Mines 1:63 360 series Buckland map sheet.

The coal in the Back River area is hosted in lithic sandstone of the Upper Parmeener Supergroup and is of Late Triassic age. The lithic sandstone is confined to a small down-faulted block, with the total potential coal-bearing area being confined to one square kilometre or less.

PREVIOUS MINING HISTORY

The occurrence of coal near the Back River was noted by Milligan (1849) and Selwyn (1855). Several seams of coal in the Back River and ".... round Buckland in several places ...." were examined by E. Williams in 1862. The area has also been described by Johnson (1888).

Selwyn (1855) records two seams in the area "together four foot thick". A shaft was sunk in 1874 by a Mr Robinson near the Back River (Montgomery 1891). Reid (*in* Hills *et al.*, 1922) inspected the various prospecting activites in 1921, and found three (old) shafts and two recently dug adits.

Early this century two drill holes were put down in this area. The logs are given in Hills *et al.* (1922). Bore A was sunk ".... about a mile south west from Brockley House ...." [around EN638878]. Bore B was sunk ".... at a point 10 chains south west from Robinson's shaft ...." [around EN632843]. The second bore did not intersect any coal.

French's prospect is located to the west of the Back River prospect, on the slopes of Tiger Hill. French was awarded a Reward Claim for coal in 1922 for his discovery of coal.

Reid (*in* Hills *et al.*, 1922) inspected an adit dug on a 0.6 m thick seam of coal in 1921. This coal is also hosted in the lithic sandstone sequence of the Upper Parmeener Supergroup, the extent of which, like the Back River prospect, is confined to a small fault block of only a few kilometres in area. The lithic sandstone is faulted against older quartzose (Ross) sandstone which is devoid of coal.

COAL QUALITY

Available analyses of coal from this area are given in Table 18.

Table 18. *Analyses of coal samples, Buckland coalfield.*

	1	2	3	4
Moisture (%)	2.6	3.58	3.24	11.56
Ash (%)	8.0	11.18	37.82	17.48
Volatile matter (%)	15.1	16.00	16.30	24.62
Fixed carbon (%)	73.6	69.24	42.64	46.34
Sulphur (%)	0.7	0.58	0.42	0.39

1. Pieces of coal collected from near an old shaft, Back River area (Montgomery, 1891).

2, 3. Samples from seams in Back River (Hills *et al.*, 1922).

4. Sample from 2' (0.6 m) seam exposed in adit on French's prospect (Hills *et al.*, 1922).

RECENT EXPLORATION

Some efforts were made in 1945 to interest the Acting Prime Minister, F. M. Forde, into approving the opening of a mine at Buckland on the old Tiger Hill (French's) Prospect, however no mining eventuated.

Leases were held in the Back River area for coal in 1980 but no further work ensued.

POTENTIAL FOR FUTURE EXPLORATION

The potential for future exploration is very small.

PART 3: THE TASMAN PENINSULA COALFIELD

The Saltwater River Coalfield

SUMMARY

The first mine to be operated in Tasmania was a coal mine, opened by the Colonial Government, on the Tasman Peninsula. The workings, known as the Saltwater River Coal Mine, were actually situated four kilometres north of the Saltwater River, close to Plunkett Point. The mine operated from 1834–1877, producing coal for the Hobart market. The Government leased the mine to Alexander Clark in 1848, after which time convict labour was not used to mine the coal. The coal is of poor quality and the area of the coalfield is limited to a small faulted block of lithic sandstone. Whilst the coalfield is of historical significance, its economic importance is negligible.

LOCATION AND ACCESS

The Saltwater River coalfield is located on the northern part of Tasman Peninsula, close to Plunkett Point [EN581405]. The area is traversed by a number of unsealed roads. Currently the area is classed as an Historic Site and is exempt from the provisions of the Mining Act, 1929. The area adjoining and to the north of the Coal Mines Historic Site is classed as a Nature Reserve (Lime Bay Nature Reserve) and is similarly exempt from the provisions of the Mining Act, 1929.

GENERAL GEOLOGY

The coal at Saltwater River is of Triassic age and forms a minor component of a fluviatile sequence of interbedded lithic sandstone, mudstone and claystone of the upper part of the Upper Parmeener Supergroup. These sediments are confined to a small, 0.5 km wide fault block, extending in a north-westerly direction from Plunkett Point.

The area has been examined by Reid (*in* Hills *et al.*, 1922), Brill and Hale (1954), and Gulline (1984). The area around Coal Mine Hill was mapped in detail by S. M. Forsyth and the author for this report. The geology is shown in Figure 38.

Good outcrops are exposed on the coastline, although few outcrops occur further inland. Magnetometer traverses were made over Coal Mine Hill to determine the position of the western boundary of the dolerite body covering the hill. Rock type classifications are as outlined in Forsyth (1984*a*).

The known stratigraphy of Parmeener Supergroup sediments is given in Figure 37. Not all of these rock units are represented in the Saltwater River coalfield. Contacts between rock units in this coalfield are almost invariably faulted, although the stratigraphic position of each rock unit is known from mapping elsewhere in the State.

The oldest rock in the area is glaciomarine mudstone with common dropstones (Pu or Ferntree Formation) of the Lower

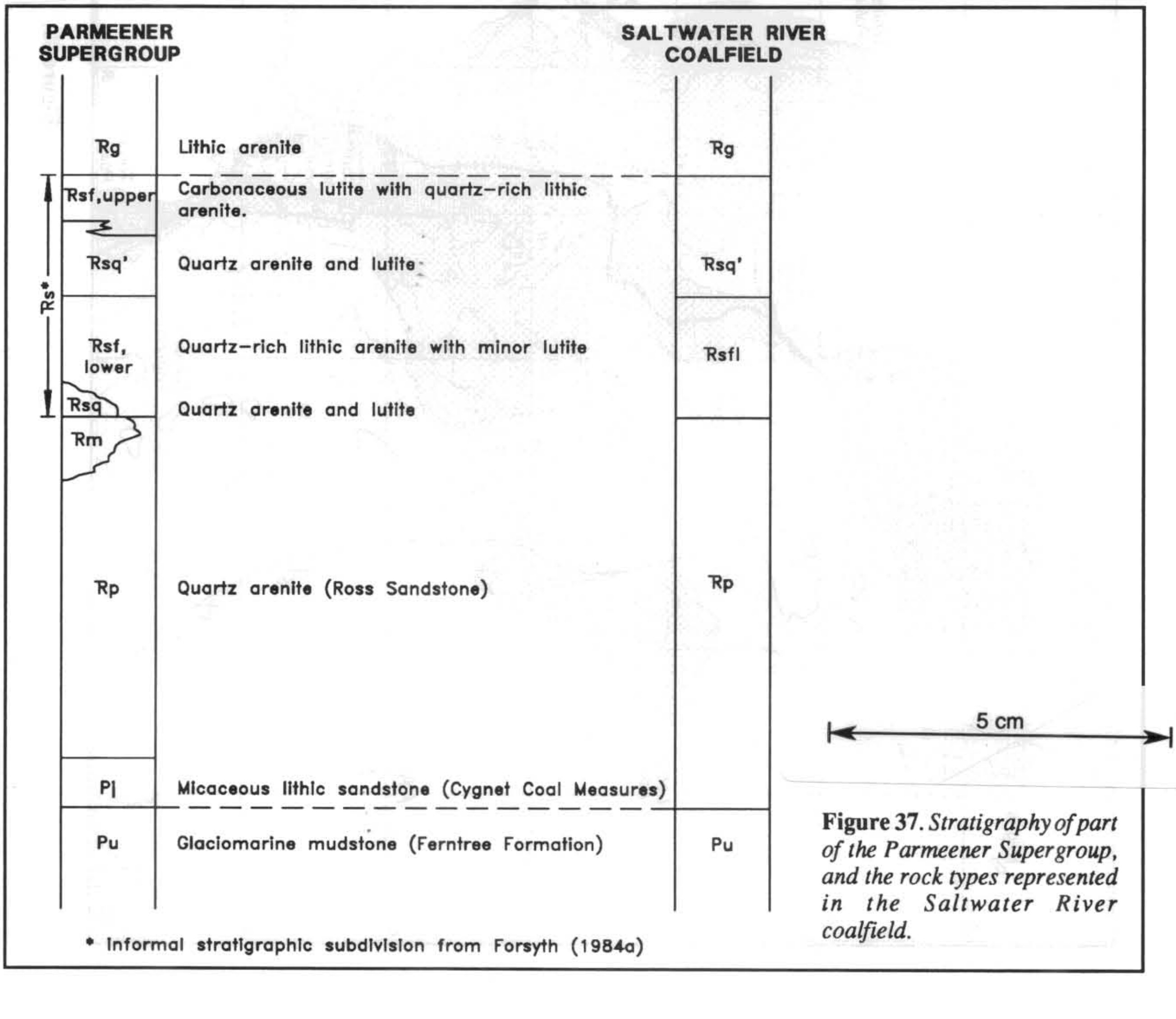


Figure 37. *Stratigraphy of part of the Parmeener Supergroup, and the rock types represented in the Saltwater River coalfield.*

5 cm

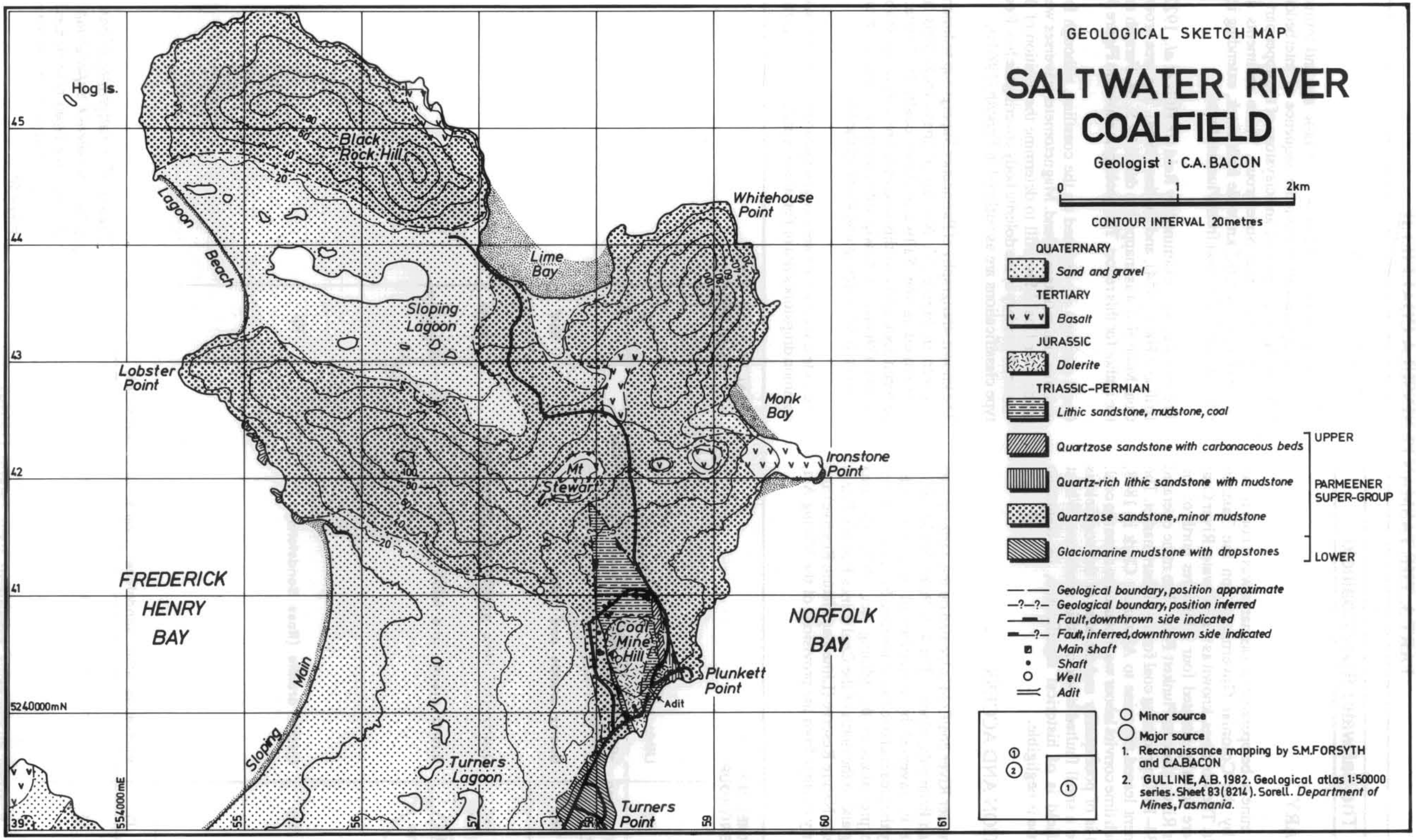


Figure 38.

Parmeener Supergroup. North of Turners Point [EN581396] this mudstone is faulted against quartzose sandstone (Rp), which is in turn faulted against lithic sandstone (Rg) near Coal Mine Hill. The lithic sandstone (Rg) block, in which the coal seams are confined, has been downfaulted and is partly capped by dolerite.

Outcrops of stratigraphically younger Rsq' (quartz arenite with minor lutite) and Rsfl (quartz-rich lithic arenite with minor lutite) occur east of Coal Mine Hill. The boundary relationships of these units with the younger lithic sandstone (Rg) are not clear from field observation.

Dolerite has intruded the Parmeener Supergroup sediments. Near Coal Mine Hill the intrusion appears to be a dyke spreading out into a sill to the east. The dyke-like appearance of the intrusion can be seen on the foreshore at EN584399. Magnetometer traverses show the western boundary of the dolerite mass to be steeply dipping, while the northern and eastern boundaries were less clearly defined. The main shaft [at EN581405] was sunk through a thin dolerite cap. Small dykes are recorded at the eastern end of Lime Bay and north of Sloping Main beach by Brill and Hale (1954).

Basalt caps some of the low hills in the area, such as Mt Stewart and the two smaller hills west of Ironstone Point. A volcanic centre has been identified 800 m west of Lime Bay (Brill and Hale, 1954).

Alluvial sand covers much of the area. From exploratory auger holes the sand cover near Plunkett Point is known to be more than 10 m thick (Cromer *et al.*, 1979).

PREVIOUS MINING HISTORY

Coal was discovered on the western bank of Norfolk Bay (near Plunkett Point) in February 1833 by two surveyors, Woodward and Hughes (GO 33/16/265). In 1834 a mining operation was commenced by the Colonial Government to extract the coal. This was the first successful mining venture to be started in Tasmania. The initial mine development was supervised by a convict named Lacey, who gained his freedom from the successful planning and operation of the mine. Coal was being sold in Hobart for 10 shillings to 19 shillings ($1.00 to $1.90) per ton by June 1834 (CSO 412/9273, 13 June 1834).

By 1837 two shafts and one adit connecting with one of the shafts had been dug. Various 'galleries' were driven off the two shafts to provide working places. Four cells, having the approximate dimensions 1 m × 2 m × 2 m were dug at the base of one of the shafts, and these nasty 'cubby holes' were used as punishment cells. Dr John Lhotsky, a Polish explorer, visited and reported on the mine in February 1837. His report (CSO 5/72/1584) included a geological section of a 24 m deep shaft dug in sandstone and shale with plant impressions; a neat, detailed map of the coal mining area; and a geological map of Forestier and Tasman Peninsulas, showing, in colour, areas of 'trap' (dolerite), greywacke (Permian mudstone), and sandstone and coal measures. This is the earliest attempt at a geological map anywhere within the State (Bacon and Banks, 1989). Lhotsky made some very sensible suggestions for the working of the mine, including keeping records of strata cut in boring and sinking, and the naming of the various adits, shafts and galleries.

In March 1837 Sir John and Lady Franklin visited the mine and Lady Jane recorded in her diary a most detailed description of the workings, buildings, jetty and her general impressions of the place. She noted fires burning at the entrance to the coal mine (possibly these were to assist in ventilation; an old method of mine ventilation was to build a stone chimney and light a fire at the entrance of an adit or shaft, so the fire would create a draught, sucking air out of the adit/shaft and letting fresh air flow into a second entrance). Lady Jane proceeded into the

> "farthest hole in the cliff (an adit) to right straight passage, sides supported by wooden posts, support cross rafters for keeping up flat roof with coal, get on here slightly stooping .... go on 78 yards (70 m) to cached rock, a sort of small hall where at further end on floor is circular shaft to lower gallery with wheel on each side worked by men ....".

Production was then 35 t per day from two seams. Coal was conveyed by baskets from the lower galleries. The baskets emptied automatically into small carts which then ran on rails along the adit to the jetty (Brand, in prep).

A visit to the mine was made in 1842 by David Burn, who described the unpleasant working conditions (Burn, 1892):

> "Next morning I descended the main shaft along with Captain Booth; it is 52 yards (47.5 m) deep. The winch was manned by convicts under punishment. One stroke of the knife might sunder the rope, and then .... however it has never been tried, deeds of ferocity being very infrequent. A gang on the surface worked the main pump and another below worked a horizontal or slightly inclined draw pump which threw water in the chief well .... The seam has been excavated 110 yards (100.5 m) from the shaft also several chambers diverging left and right. The height of the bore is four feet (1.2 m). The quality of the coal partakes much more of anthracite than of bitumen, it flies a great deal but produces intense heat. The miners are esteemed the most irksome punishment the felon encounters because he labours night and day eight hours on a spell. Continuous stooping and close atmosphere caused our party to be bedewed with perspiration. I cannot therefore wonder at the abhorrence of the compulsory miner in loathing what I conceive to be a dreadful vocation....".

Administrator La Trobe visited the mine in October 1846, whilst examining the state of the convict service, and records that production was then 300 tons per week. Out of the 403 prisoners present, 196 worked at the mine. La Trobe also commented on the 'unnatural crimes' committed by the miners whilst working underground (Brand, in prep).

The Reverend Fry visited the mine in late 1847, noting that 83 men worked underground (the other 100 or so being employed at the mine, on the surface). There were still around 400 prisoners in total at the settlement. Fry (1850) described the working conditions:

> "... we groped our way with difficulty along passages which were said to be five miles (8 km) in length. The roof in many places was so low that we were obliged to creep along the passage beneath it. The air was so confined that our lamps could with difficulty be kept burning and several of them went out. A few lamps at long intervals were attached to the walls, but seemed only like sparks glimmering in the mist, and not many yards from them the passage was in perfect darkness. There were 83 men at work in the mines when I visited them, the greater number employed in wheeling the coal to the shaft to be hoisted up. They worked without any other clothing than their trousers and perspired profusely. The men in the mine were under the charge of a prisoner-overseer and a prisoner constable".

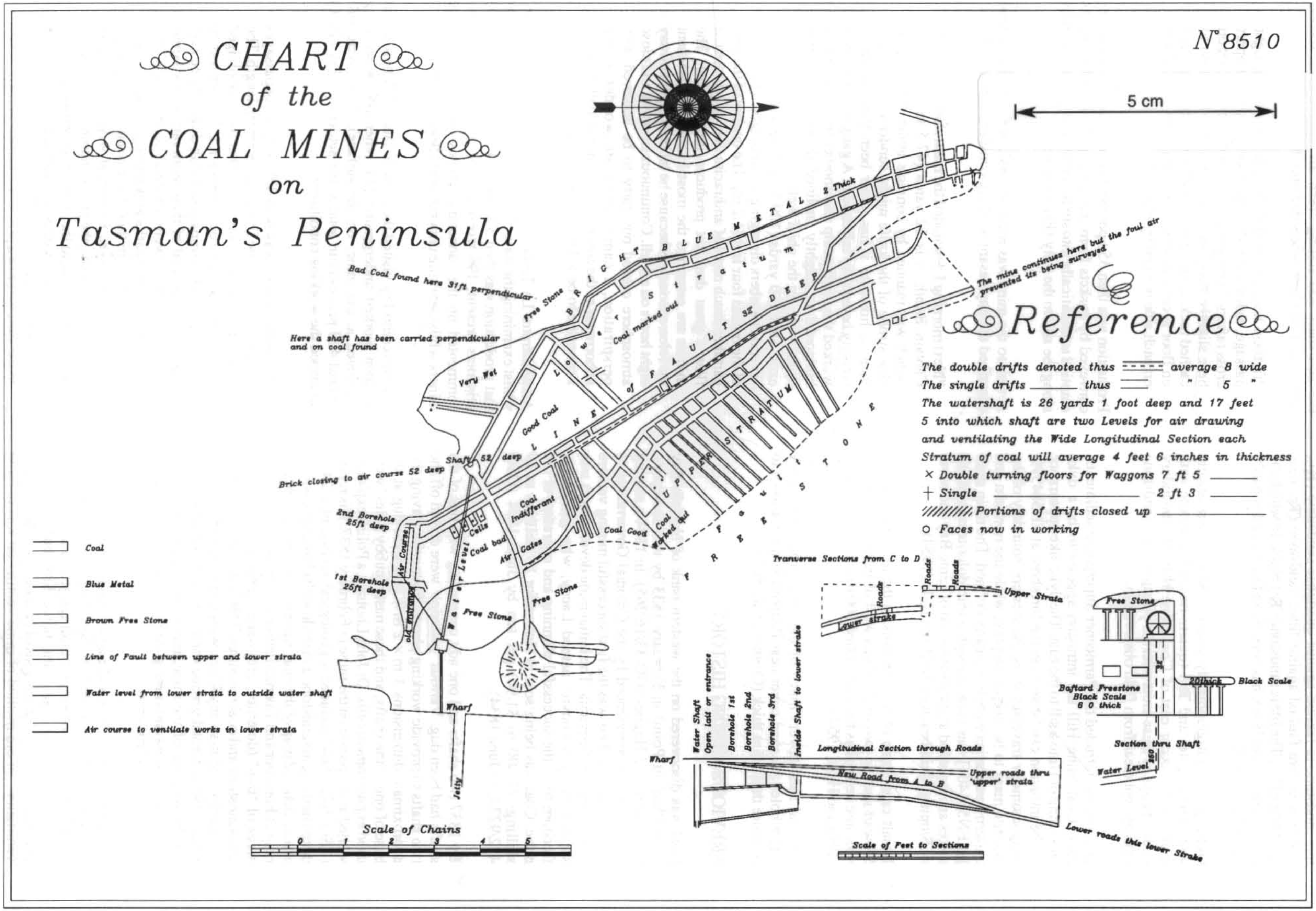


CHART of the COAL MINES on Tasman's Peninsula
N° 8510
5 cm
Reference
The double drifts denoted thus average 8 wide
The single drifts thus " 5 "
The watershaft is 26 yards 1 foot deep and 17 feet
5 into which shaft are two Levels for air drawing
and ventilating the Wide Longitudinal Section each
Stratum of coal will average 4 feet 6 inches in thickness
× Double turning floors for Waggons 7 ft 5
+ Single 2 ft 3
Portions of drifts closed up
○ Faces now in working
Coal
Blue Metal
Brown Free Stone
Line of Fault between upper and lower strata
Water level from lower strata to outside water shaft
Air course to ventilate works in lower strata
Bad Coal found here 31ft perpendicular
Here a shaft has been carried perpendicular and on coal found
Brick closing to air course 52 deep
Shaft 52 deep
2nd Borehole 25ft deep
1st Borehole 25ft deep
BRIGHT BLUE METAL
2 Thick
Lower Stratum
LINE of FAULT 52 DEEP
UPPER STRATUM
FREE STONE
Free Stone
Very Wet
Good Coal
Coal marked out
Coal Indifferent
Coal bad
Coal Good
Cells
Air Gates
Air Course
Water Level
Wharf
Jetty
The mine continues here but the foul air prevented its being surveyed
Scale of Chains
0 1 2 3 4 5
Tranverse Sections from C to D
Roads
Upper Strata
Lower strata
Water Shaft
Open lait or entrance
Borehole 1st
Borehole 2nd
Borehole 3rd
Inside Shaft to lower strata
Longitudinal Section through Roads
New Road from A to B
Upper roads thru 'upper' strata
Lower roads thru lower Strata
Scale of Feet to Sections
Free Stone
Baftard Freestone Black Scale 6 0 thick
Black Scale
Section thru Shaft
Water Level

Ruins of old Government store and jetty at Saltwater River [State Archives of Tasmania]

To be sent to work at the coal mine was regarded as a punishment by the convicts at Port Arthur, although the work at the mines was no more severe than at Port Arthur and the rations were the same (Besford, 1958). The punishment rate was, however, high. Hartwell (1954) notes that for the year 1847, 1400 punishments were meted out to the 400 employees. These included 728 sentences of solitary confinement with bread and water, given out by the Superintendent, while the Magistrate imposed 672 punishments of flogging, sentencing to chains, or periods of solitary confinement.

The quality of the coal mined was a source of constant complaint. The first shipment of coal arrived in Hobart on 10 June 1834 and was tried in the Kings Yard in place of the charcoal that was then used in the forges, but was found to be unsuitable for this purpose. The cargo of coal was eventually sold in small lots, fetching prices from 15 shillings to 19 shillings ($1.50 to $1.90) per ton. The second shipload to arrive, on 7 July 1834, was inspected by the Port Authority and found to be "12 or 13 tons and better quality than the last".

Mining continued despite the apparent poor quality of the coal. Production was 3395 t in 1834, increasing to 8600 t in 1839 and 10 600 t in 1840. Production dropped to 8000 t in 1842 (Booth, 1962). The coal always sold for a lower price than the New South Wales coal, due to the inferior quality of the product. In 1839 the Saltwater River coal was selling in Hobart for 11 shillings to 12 shillings ($1.10 to $1.20) per ton, while N.S.W. coal sold for 30 shillings ($3.00) per ton.

Convicts were sent to the coal mine as punishment until 1840. From 1840 to 1848 the convicts working at the mine were those on probation, and they were released at the end of their probationary periods (Booth, 1962).

A steam engine, designed and erected by Alexander Clark, was installed in 1842. Prior to this, coal was raised up shafts by a winch which used convict labour (Ford, 1932), and two pumps for removing water from the workings were also manned by convicts. The mine headings were only 1.2 m high and the ventilation was poor. The roof, which was composed of shale, was supposed to be left, but was often taken to make the working conditions easier (*Advertiser*, 9 August 1839, p.3).

Lempriere (1839) recorded that two jetties had been built to allow vessels to be loaded. Convicts wheeled wagons, each containing 90 kg of coal, along tram lines to the ships. At the time of Lempriere's visit 150 convicts were employed at the mines as follows:

Miners not under sentence	27
Miners under sentence	2
Blacksmiths, carpenters, masons	18
Servants, woodcutters, signalmen	36
Labourers	67

Some eleven miners were employed in getting the coal, and their daily quota was 2700 kg or thirty wagon loads each. In addition to the two shafts at Coal (Plunkett) Point which comprised the Saltwater River mine, a shaft was sunk at nearby Five Mile Beach in 1830 (Lempriere, 1839), although this area was not developed further.

In 1848 the management of the coal mines changed dramatically. Tenders were called for the lease of the mine and Alexander Clark (the engine builder) became mine lessee. Clark was forbidden to use convict labour underground (CGF 10591/4, 30 September 1848). Work continued in an orderly fashion and must have been profitable, as the mine continued to operate. The lease was taken over in 1851 by James Fulton (who had been Assistant Superintendent at the mine from 1843–1848). This lease expired in 1856, and the new tender was won by William Nichols and John Thomas (Brand, in prep). These two seem to be the only private owners who failed to "make the mine pay". The old workings were evidently worked out and a new shaft sunk, but no coal was found.

The lease was re-advertised on 16 March 1858, and this time James Hurst was the successful tenderer. Hurst arrived in Van Diemens Land as a prisoner who had been convicted with his father on the charge of highway robbery. Both father and son arrived on the *Woodford* in August 1828. James Hurst was a coal miner by trade, and had worked at the mine as a convict, then as a ticket-of-leave man before his full pardon came into force in 1845. Count Strezlecki reported most favourably to Governor Franklin on Hurst's ability to superintend works (CSO 22/59/909) after his inspection of the mine, and his work was praised by Commandant Booth after Hurst repeatedly requested a salary whilst he was a ticket-of-leave man (which was refused by Governor Franklin), then an increase in salary when he was working as a free man after his full pardon came into effect.

When a new shaft was sunk in 1843, Booth wrote "....and I can only add that no one can deserve more merit for his unceasing zeal and exertion for the public service than Mr Hurst" (CSO 22/22/880). Hurst kept the lease of the mine until he died in 1877, when the mine closed. The coal was virtually all worked out, and Hurst had taken out leases at Sandfly in 1876, ordered a steam engine from the Excelsior Foundry, and quite probably intended moving his mining interest to this new location. The Sandfly venture also folded with his death.

Whilst he arrived in chains, James Hurst died a wealthy and respected citizen of Hobart. During his years as a free man, he ran an inn at Swansea (1854), bought the Travellers Rest Inn (at Hobart), built the jetty at Swansea (1855–56) followed by the building of municipal and police buildings (1860–62) before moving to Hobart to live, while one of his three sons saw to the day to day running of the coal mine.

COAL QUALITY

The only coal quality data available comes from historic sources. A sample of coal from the Saltwater River mine was analysed at the Museum of Practical Geology, London, in July 1850. A sample was taken in 1921 from one of the dumps close to the old pithead. The results of these investigations are given in Table 19.

Table 19. *Analyses of coal samples, Saltwater River coalfield.*

	1	2
Moisture (%)	-	3.42
Ash (%)	26.40	22.62
Volatile Matter (%)	-	11.08
Fixed carbon (%)	-	62.88
Sulphur (%)	1.03	0.41
Hydrogen (%)	3.34	3.32
Carbon (%)	65.33	60.52
Oxygen (%)	1.81	11.81
Nitrogen (%)	1.89	1.32
Specific energy (MJ/kg)	-	23.8

1. Sample analysed at Museum of Practical Geology, London, July 1850 (GO 1/78, p.373–379).
2. Sample from dump; Hills *et al.*, 1922.

RECENT EXPLORATION

Three leases for coal were held by prospectors from 1895–1901. Apart from these leases, no exploration activity for coal has taken place in the Saltwater River coalfield since the closure of the mine in 1877.

POTENTIAL FOR FUTURE EXPORATION

Because of the small size of the coalfield and the poor quality of the coal present, there is no potential for further exploration in this area.

Minor coal areas, Tasman Peninsula

IMPRESSION BAY (PREMAYDENA)

On the western side of Impression Bay (part of Price Bay) carbonaceous shale can be seen in the sea cliffs. Reid (*in* Hills *et al.*, 1922) records that several shafts had been sunk in this area.

SALTWATER RIVER

Just south of Saltwater River Reid (*in* Hills *et al.*, 1922) visited the remains of an old dip tunnel and air shaft. The workings were only 3.3 m above sea level.

MT COMMUNICATION

An outcrop of coal was discovered near Mt Communication [EN532323] in 1843, and an adit was driven into the coal. The seam was reported to be 1.1 m thick (CSO 22/67/1473, 7 February 1843). No further work was done in this area.

DEER POINT

Lhotsky reported a find of coal on Deer Point [EN600360] in 1837 (CSO 5/72/1584).

DUNALLEY

An outcrop of coal about 1.0 m thick, which was found 2 km south of Dunalley, is described in Hills *et al.* (1922). An adit 33 m long was driven into the seam.

KELLEVIE

The occurrence of a thin seam of coal occurring at Kellevie was noted by A. M. Reid in 1921 (Hills *et al.*, 1922).

PART 4: THE SOUTHERN TASMANIAN COALFIELDS

The Adventure Bay Coalfield

SUMMARY

The Adventure Bay coalfield is located on the western margin of Adventure Bay on South Bruny Island. The coal measures are correlates of the Cygnet Coal Measures and are of Late Permian age. A seam was worked intermittently from 1879 to the early 1890s by means of two adits and three shafts. The seam is thin (0.5 m thick) and of limited areal extent. The coalfield is of no economic importance, although the previous mining activity is of historical interest.

LOCATION AND ACCESS

The Adventure Bay coalfield is located on the western margin of Adventure Bay (fig. 39) on the east coast of the southern part of Bruny Island. Bruny Island is separated from the mainland of Tasmania by D'Entrecasteaux Channel. The island is 50 km long with a 9 km long isthmus connecting North Bruny Island to South Bruny Island. A vehicular ferry service runs from Kettering to North Bruny Island, whilst a network of sealed and unsealed roads provides access over most of the island.

GENERAL GEOLOGY

The coal-bearing sequence at Adventure Bay has been described by Johnston (1887), Voisey (1938), and more recently by Rigg (1970), who mapped South Bruny Island in detail.

The Adventure Bay Coal Measures have been defined by Rigg (1970) as "that formation, about 69 m thick, just north of Adventure Bay, South Bruny Island [260020], consisting of quartz sandstone, feldspathic sandstone and carbonaceous siltstone, which overlies the Ferntree Mudstone and underlies a formation of massive sandstone, the basal part of the Triassic".

The name Parmeener Supergroup was proposed in 1973 to define the widespread sequence of Late Palaeozoic and Early Mesozoic rocks across Tasmania (Banks, 1973). Subsequently the Parmeener Supergroup was divided into an Upper Division, consisting of essentially freshwater strata, and a Lower Division, consisting predominantly of glacial and glaciomarine beds (Forsyth *et al.*, 1974). The Adventure Bay Coal Measures are now part of the Upper Parmeener Supergroup and are of Late Permian age. The Permian–Triassic boundary passes through the basal part of the Upper Parmeener Supergroup. The stratigraphic sequence of Rigg (1970) on South Bruny Island is:

Triassic	
Fluviatile sandstone	Upper Parmeener Supergroup
Permian	
Adventure Bay Coal Measures	
Ferntree Group (including the Risdon Sandstone)	Lower Parmeener Supergroup
Malbina Siltstone and Sandstone	
Grange Mudstone	
Woody Island Sequence	

The sedimentary sequence has been intruded by dolerite of Jurassic age, which now covers much of the land surface of South Bruny Island. Quaternary alluvial deposits cover much of the low-lying country.

The Adventure Bay Coal Measures crop out on the shore at Adventure Bay, where a thin seam was once mined; at Sheepwash Bay [EN220075]; and at Lunawanna [EN180013] (Rigg, 1970), although no coal has been noted from the latter two localities. The Adventure Bay outcrop is small in area and is faulted to the west against stratigraphically younger quartz sandstone.

The Adventure Bay Coal Measures are correlates of the Cygnet Coal Measures (Johnston, 1887; Voisey, 1938) and are of Late Permian age. The stratigraphy and sedimentology of the sequence at Adventure Bay is described in detail by Rigg (1970), who concluded that the coal measures had been deposited in a deltaic environment, with the basal sediments being deltaic plain deposits; overlain by channel and levee sands; followed by inter-distributary silts and sands; which were finally overlain by 'back-swamp' deposits.

PREVIOUS MINING HISTORY

The location of an outcrop of coal on the shore of Adventure Bay on Bruny Island is marked on a map, dated 1823, produced by Captain Dixon who visited Tasmania in a ship named the *Skelton of Whitby*. The Adventure Bay coal was examined by Scott, Hobbs and Roberts in 1826, who remarked that any attempt to work the coal "would be attended with difficulty and expense ...., it being exposed to the lash of the sea, so that no boat could land nearer than two miles ...." (Scott *et al.*, 1826). Roberts, who was described by Giblin (1948) as a "practical coal miner", set up a salt and soap works at Apollo Bay on North Bruny Island around 1826. He may have tried to use coal as a source of fuel but no actual mining eventuated. He continued to search for coal, stating in articles in the *Hobart Town Courier* of 10 May 1833 and the *True Colonist* of 14 May 1833 that the Government had assured him "every assistance" would be given him "in the event of my success in discovering a mine worth working".

In 1841 James Clare wrote to the Chief Superintendent of Police saying he could provide a sample of the Adventure Bay coal if wanted, which was claimed to be a better coal than that being mined at Saltwater River (LSD 1/28/456).

A sample of the coal was analysed by Sir H. T. de la Beche in 1850 at the Museum of Practical Geology, London (GO 1/78, p. 373–379), along with samples of coal from all over Tasmania. De la Beche pronounced the Adventure Bay and Douglas River samples to be the best of all Van Diemens Land coals. Falconer (1862) suggested that some of these results were based on 'picked' samples of coal, and ventured the opinion that "there is 1 or 1½ inches thickness of coal in each of these seams (referring to the Adventure Bay and Jerusalem coal seams) that might have been picked out to produce such results". A trial of Adventure Bay coal on board the steam ship *Monarch* gave results similar to that of the Port Arthur coal (Falconer, 1862). A summary of Scott's earlier excursion to Adventure Bay was presented to Parliament in 1861. The Lands and Surveys Department considered the field to be of no economic interest at this time (Booth, 1962), although S. Abbott gave a favourable account of the coal at Adventure Bay and at Three Hut Point (near Gordon) to the 1864 Select Committee on Coalfields. In 1879 Abbott complained bitterly that the Government had sold coal-bearing land at Adventure Bay; the coal was being worked and his mine near Gordon could not compete with the operation (LSD 1/48/214).

William Zschachner began mining coal at Adventure Bay in 1879. The mining continued until 1881 without interruption,

5 cm

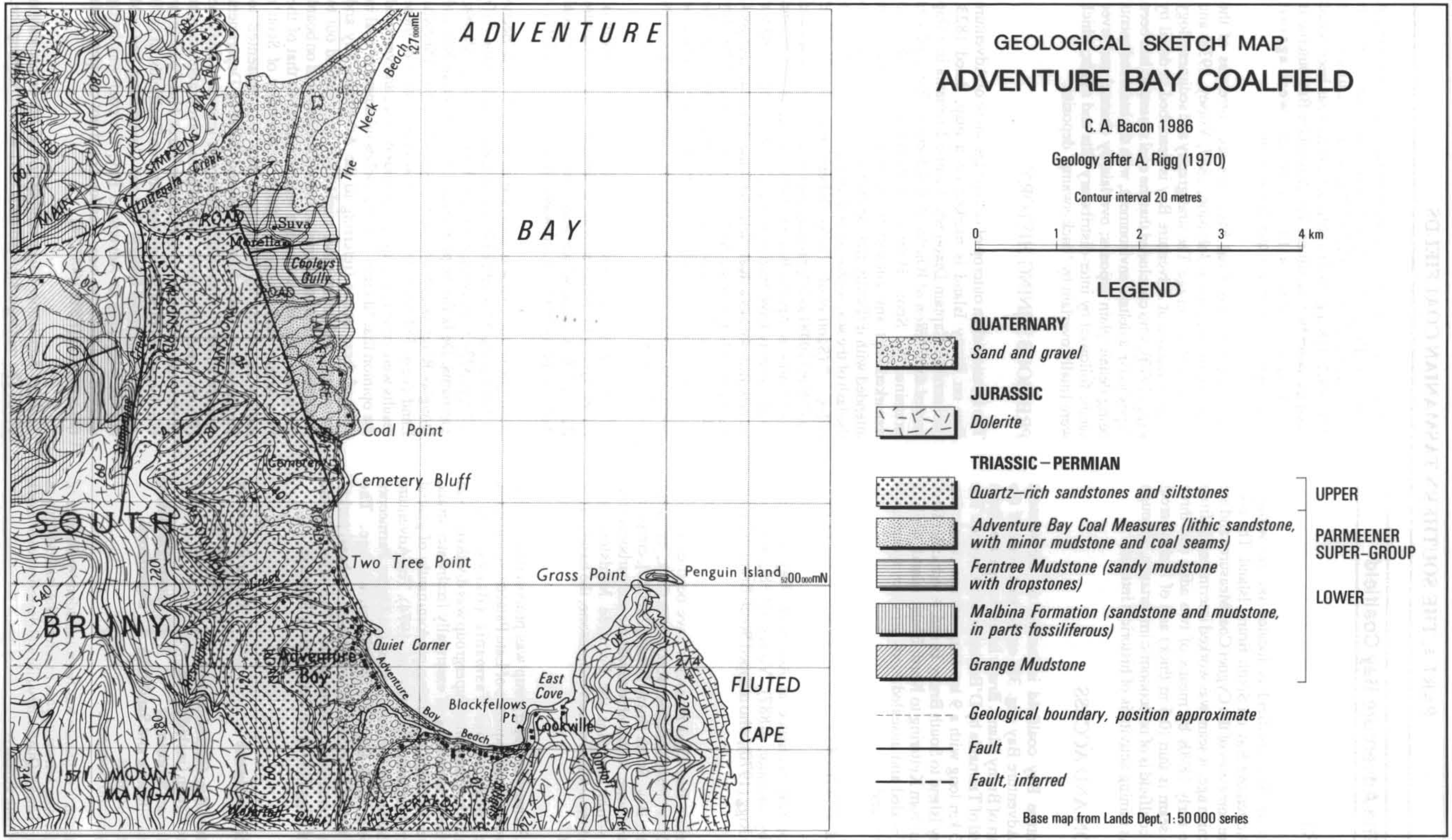


Figure 39.

and then was intermittent until the early 1890s when the mine closed (Hills *et al.*, 1922). The workings were visited by Johnston (1887) who recorded finding the plant fossils *Gangamopteris* and *Glossopteris* (among others) from near the mine.

Johnston (1887) inspected Zschachner's workings, which consisted of two shafts. The coal seam worked in each was 0.60 m thick. At the close of mining operations the works consisted of three shafts and two dip tunnels (Hills *et al.*, 1922). One of the adits and one of the shafts can still be found.

The coal from this mine was transported to Hobart by sea. The supply vessel carrying stores and mail to Bruny Island took on a cargo of coal for the return voyage to Hobart. The jetty built for the loading of coal near Zschachner's mine was demolished by heavy seas in 1881, after which time the mining was severely hampered by the loss of the loading facility.

Oil prospects on North Bruny Island have been examined by Wade (1915) and Reid (1929). A mining lease for oil was held from 1921 to 1924 on North Bruny Island.

COAL QUALITY

Very few analyses of the Adventure Bay coal are available. A number of historical analyses are given in Table 20.

Table 20. *Analyses of coal samples, Adventure Bay coalfield.*

	1	2	3	4	5
Moisture (%)	-	3.40	3.0	2.9	3.6
Ash (%)	8.67	19.50	12.9	17.9	14.8
Volatile matter (%)	-	10.60	14.2	15.7	8.2
Fixed carbon (%)	-	66.50	69.6	63.5	73.4
Total sulphur (%)	-	0.31	-	-	0.77
Specific energy (MJ/kg)	-	22.7	-	-	27.80

1. Sample analysed at the Museum of Practical Geology, London, 1850 (possibly a picked sample) (GO 1/78/373-9).
2. Basal 400 mm of seam 635 mm thick at outcrop on shoreline (Hills *et al.*, 1922).
3. Sample of coal from Adventure Bay (Johnston, 1888).
4. Sample of coal from Gardners Bay (Gordon) (Johnston, 1888).
5. Channel sample from outcrop on shoreline taken in 1985.

RECENT EXPLORATION

No work has been done in the Adventure Bay area since the closure of the original mining venture.

FUTURE POTENTIAL

Because of the extremely thin nature of the seams and the small areal extent, the Adventure Bay coalfield is of no economic importance and has no potential for further exploration.

The Cygnet Coalfield

SUMMARY

Coal in the Cygnet area is of Late Permian age and has been intermittently worked from 1880 until 1940. In 1981 one company undertook minor exploration of the area and drilled four holes. The seams are not extensive, thin (usually <1 m thick) and faulted. The inferred reserve is very small (less than one million tonnes) and the potential for future exploration is negligible.

LOCATION AND ACCESS

The Cygnet coalfield is situated on the western flanks of Mount Cygnet [EN133173] and Heeneys (also spelt Heaneys) Bluff [EN147197] about eight kilometres east of the township of Cygnet, which is about 55 km by sealed road south of Hobart.

GENERAL GEOLOGY

The geology of the coalfield is shown in Figure 40. The coal seams at Cygnet are part of the Cygnet Coal Measures, which is the lowest of three divisions of the Upper Parmeener Supergroup.

The upper division of the Upper Parmeener Supergroup in south-eastern Tasmania is a lithic sandstone sequence with mudstone, siltstone, claystone, workable coal seams, and rare tuff. A Triassic age has been established for these strata by the floral assemblages described by Townrow (1962). Vertebrate remains from these rocks are described by Cosgriff (1974) and Banks *et al.* (1978). These rocks do not crop out in the Cygnet area.

The middle division of the Upper Parmeener Supergroup consists of massively bedded, white, clean, well-sorted sparkling quartz sandstone which often shows features such as ripple marks and large-scale cross-bedding.

The lowest division of the Upper Parmeener Supergroup is the Cygnet Coal Measures, which are "of variable thickness consisting of massive, well-sorted, current-bedded, poorly-cemented, feldspathic arenite layers with subordinate beds of mudstone, carbonaceous mudstone and, in places, thin workable coals" (Farmer, 1979*a*). A Permian age is indicated for these rocks by the presence of *Glossopteris* and a *Dulhuntyspora* microflora (Lewis, 1940; Banks and Naqvi, 1967; Balme, 1962).

The Cygnet Coal Measures is underlain by a series of glaciomarine and freshwater rocks belonging to the Lower Parmeener Supergroup. The divisions are from the base: A lower glaciomarine sequence (Lower Marine Sequence); a lower freshwater sequence (Lower Freshwater Sequence); and an upper glaciomarine sequence (Upper Marine Sequence). The Lower Freshwater Sequence is not present in the Cygnet area (Farmer, 1979*b*) where the Upper Marine Sequence (Ables Bay Formation, Risdon Sandstone, Minnie Point Formation, Deep Bay Formation) paraconformably overlies the Lower Marine Sequence (Bundella Mudstone, Woody Island Siltstone).

The Ables Bay Formation consists of siltstone, sandy siltstone, and minor sandstone beds with frequent dropstones and rare fossil horizons, with minor beds of pebble and granule conglomerate. The Minnie Point Formation is a very variable, fossiliferous, marine siltstone and sandstone with many dropstones. The Deep Bay Formation is an interbedded sequence of highly fossiliferous marine mudstone, siltstone, and sandstone with many dropstones.

The Bundella Mudstone is a fossiliferous marine mudstone with siltstone layers and numerous dropstones. The Woody Island Siltstone is a dark grey, poorly-bedded, sparsely fossiliferous, friable, glendonitic siltstone (Farmer, 1981). Cretaceous syenite has heavily intruded rocks in the Cygnet area, although no syenite is known close to the mine workings. Jurassic dolerite caps Mount Cygnet and is faulted against the sedimentary sequence to the east of Heeneys

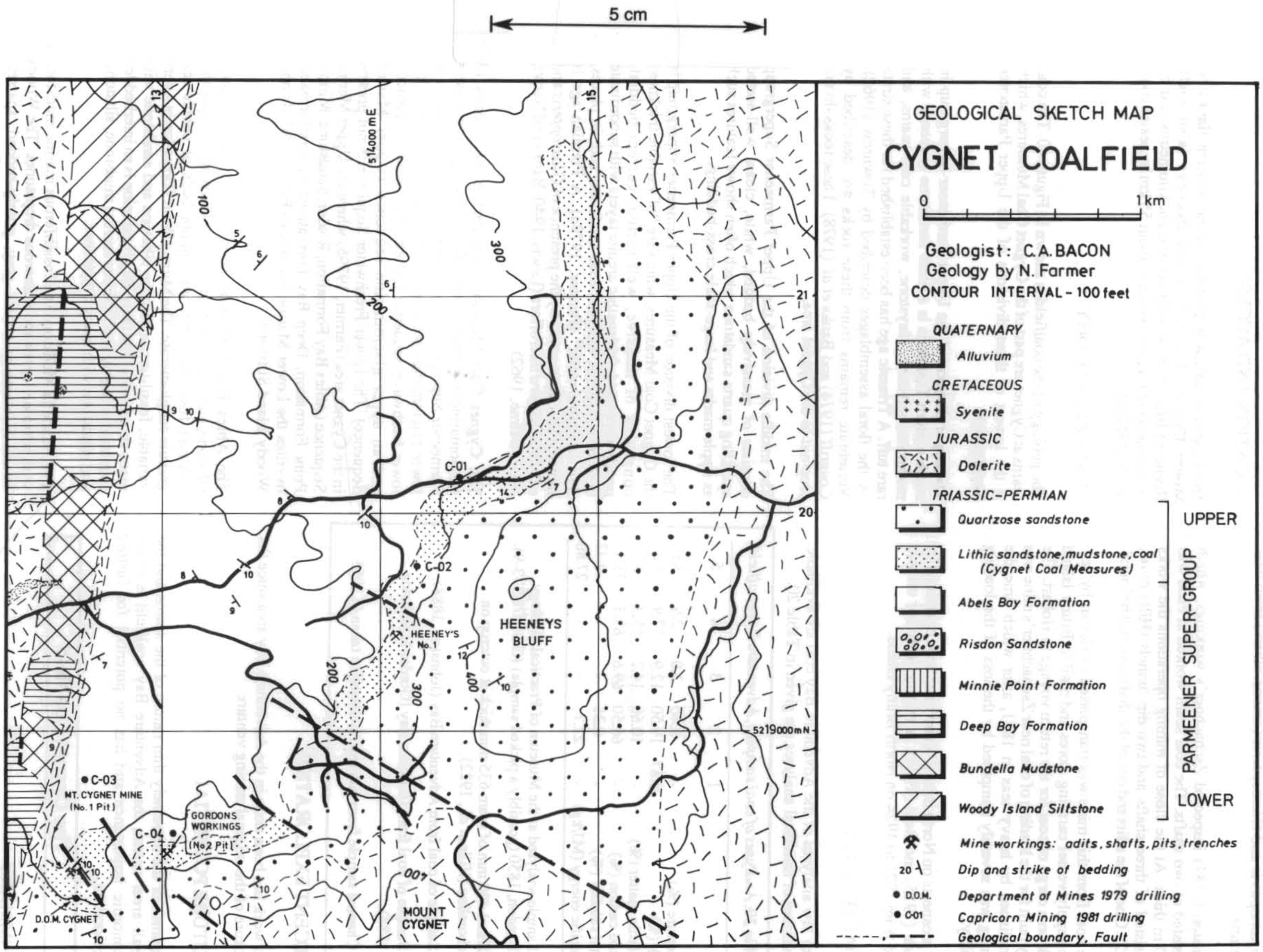

5 cm
GEOLOGICAL SKETCH MAP
CYGNET COALFIELD
0
1 km
Geologist: C.A. BACON
Geology by N. Farmer
CONTOUR INTERVAL - 100 feet
QUATERNARY
Alluvium
CRETACEOUS
Syenite
JURASSIC
Dolerite
TRIASSIC-PERMIAN
Quartzose sandstone
Lithic sandstone, mudstone, coal (Cygnet Coal Measures)
Abels Bay Formation
Risdon Sandstone
Minnie Point Formation
Deep Bay Formation
Bundella Mudstone
Woody Island Siltstone
UPPER
LOWER
PARMEENER SUPER-GROUP
Mine workings: adits, shafts, pits, trenches
Dip and strike of bedding
D.O.M. Department of Mines 1979 drilling
C-01 Capricorn Mining 1981 drilling
Geological boundary, Fault
514000 mE
5219000 mN
HEENEYS BLUFF
HEENEY'S No. 1
MT. CYGNET MINE (No. 1 Pit)
GORDONS WORKINGS (No 2 Pit)
D.O.M. CYGNET
MOUNT CYGNET
C-01
C-02
C-03
C-04

Figure 40.

Bluff. The small area of Cygnet Coal Measures outcrop is badly disrupted by faulting.

PREVIOUS MINING HISTORY

At the time of Thureau's visit in 1881 only minor mining activity was present on the slopes of Mount Cygnet. The next inspection appears to have been by Twelvetrees (1902*a*), when a dip tunnel had been advanced 270 m into the slopes of Mount Cygnet. By 1922 a number of operators had prospected the area and a large number of trenches, adits and shafts had been dug at widely spaced points along the outcrop for a distance of five kilometres, although not always in a methodical manner.

Mt Cygnet Mine

Thureau visited this mine in 1881 and described two seams (Thureau, 1881*b*). The upper seam was said to be 5 feet (1.6 m) thick and a lower seam 64 feet (19.5 m) below this was 3 feet (900 mm) thick, from which a section 2'4" (0.71 m) thick was mined. Both seams had been opened by prospecting adits some 30 yards (27 m) long.

Twelvetrees (1902*a*) also described two seams at the Mt Cygnet mine, but gives the thickness of the upper seam as approximately 3 feet (900 mm), with the seam measuring 3'6" (1.07 m) to 3'9" (1.14 m) thick in places, but nowhere exceeding 4 feet (1.2 m). A seam 25 feet (8.3 m) below this was said to contain one foot (300 mm) of coal. The first seam, which was worked from 1881 to 1895 and reopened in 1897, is the one described by Thureau (1881*b*) as being 5 feet (1.6 m) thick, but this is most probably an overestimate of the thickness. The production in 1901 from this mine was 3000 tons. A deep tunnel had been advanced 270 m into the outcrop and headings had been driven east and west.

The mine was described in Hills *et al.* (1922), at which stage the tunnel had been advanced to 1160 feet (354 m). The seam measured at the working face was 3'7" (1.09 m) thick. Some 20 acres (8 ha) of ground had been worked out.

A second dip tunnel (on the same seam) had been driven for over 300 feet (90 m), with a number of headings leading from the main tunnel. These workings were known as 'Gordons' or 'No. 2', and the seam here was 3'3" (1.0 m) thick.

Heaney Mine

Two 'strike tunnels' were reported to have been driven into coal in the early 1900s on the western slopes of Heeney Bluff. The first tunnel (Heaney No. 1) worked a seam of coal 30 inches (0.9 m) thick and was separated by a fault from Heaney No. 2 workings some 300 m to the north-east (Hills *et al.*, 1922).

Berry's Mine

Approximately 1.3 km north-west of the Heaney No. 2 tunnel a seam 12–14 inches (0.30–0.35 m) thick was exploited in minor workings known as Berry's. Mining had apparently ceased here some years before the 1922 inspection (Hills *et al.*, 1922).

Gordon's Workings

A new adit close to the old 'Gordon's Workings', and given the same name, was opened in 1939. A small tonnage of coal was mined, reportedly for metallurgical purposes. The mine closed in 1940.

COAL QUALITY

Analyses of coal samples from the Cygnet area are given in Table 21. These analyses would be spot samples of seams rather than whole seam sections.

Table 21. *Analyses of coal samples, Cygnet coalfield*

	1	2	3
Moisture (%)	1.4	9.29	9.99
Ash (%)	16.4	17.71	18.77
Volatile matter(%)	12.7	18.52	19.76
Fixed carbon (%)	69.5	54.47	51.48

1. Twelvetrees (1902*a*), Mount Cygnet mine.
2. General Geological Services (1981*b*), Heaney mine.
3. General Geological Services (1981*b*), Heaney mine.

RECENT EXPLORATION

In 1979 the Department of Mines drilled a borehole in the vicinity of the old Mount Cygnet mine. Detailed results of the drilling are given in Farmer (1979*b*). The hole proved the Cygnet Coal Measures to have a minimum thickness of 35.20 m at that point.

In 1981 General Geological Services carried out a brief exploration programme on behalf of Capricorn Mining Limited. Four holes were drilled in the Mount Cygnet area (General Geological Services, 1981*a*.

POTENTIAL FOR FUTURE EXPLORATION

Due to the apparent small area of potential reserves, the faulted nature of the terrain, and the thin seams (1.0 m thickness of the main seam worked), the potential for further exploration of this field is poor. The quality of the coal would appear to be reasonable, although mudstone bands occur and cause the coal to be 'dirty'. Steamships used a mixture of Cygnet coal and wood to reduce the ash problem (Hills *et al.*, 1922). There may be enough coal for local consumption but not for any large-scale mining venture. The *in situ* reserves are classed as very small inferred reserves, probably less than one million tonnes.

The Strathblane Coalfield

SUMMARY

Minor prospecting and mining activities followed the discovery of coal in the Strathblane area in 1908.

No promising results were obtained during a 1976 exploration programme aimed at determining the potential for an economic deposit of open-cut black coal in the area.

The area of the coalfield is limited and reserves are very small.

LOCATION AND ACCESS

The original coal leases which comprised the Strathblane (or Esperance) coalfield occupied a north-trending ridge some eight kilometres south-west of the town of Dover. Creekton Road, a forestry road, currently traverses around the ridge. Tramways originally built to serve sawmilling operations were used by mining interests in the 1920s and 1930s. The tramways were in "a decayed condition" in 1952 (Keid,

5 cm

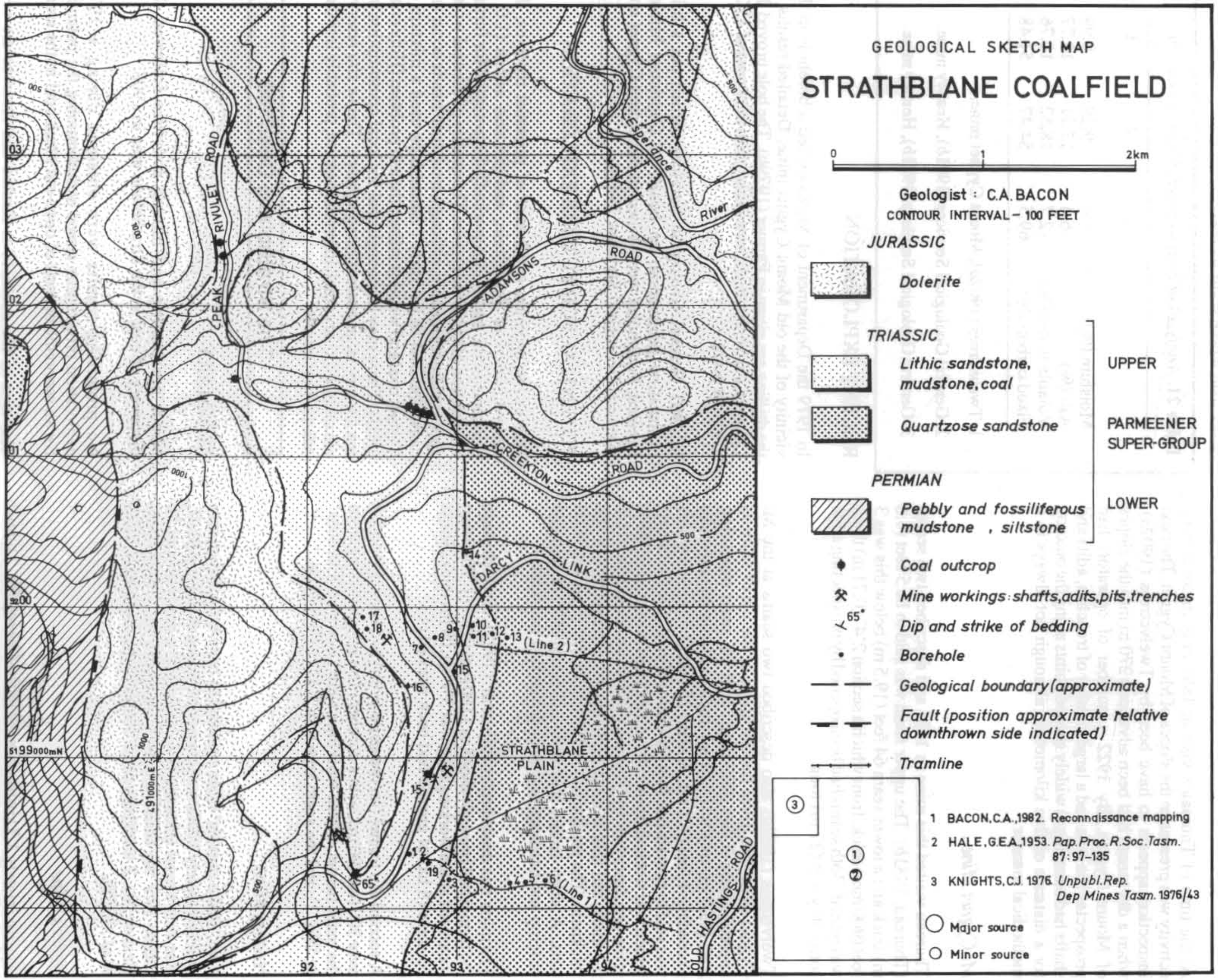


Figure 41.

1952), and in 1983 only small portions of the tramways could be found.

GENERAL GEOLOGY

The geology of the Strathblane coalfield is shown in Figure 41. The high ridge which covers most of the coal-bearing area rises abruptly to a height of 280 m from the western side of the Strathblane Plain. Creekton Creek wanders across the plains in a generally east–west direction. The ridge is capped by dolerite, which is probably in the form of a dyke (Keid, 1952). Dislocation of seams on each side of the ridge was observed by Reid (1921*a*), who stated that the working seam on the western side of the ridge dips at 18° to the north-east, while seams on the eastern part of the ridge dip to the south-west. All workings on the western side of the ridge eventually encountered dolerite.

The dolerite intruded and now partly caps a coal-bearing fluviatile sequence of dominantly lithic sandstone, minor shale, mudstone and coal of the upper division of the Upper Parmeener Supergroup. These sediments are underlain by economically barren quartzose sandstone of the middle division of the Upper Parmeener Supergroup, which crops out over parts of the Strathblane Plain and has been intersected in a number of drill holes (Bunny, 1976).

On the eastern and south-western sides of the ridge a group of coal seams could, in the 1920s, be traced for over 1.5 km. These seams were worked by a number of dip tunnels driven into the hill.

PREVIOUS MINING ACTIVITY

The Strathblane coalfield was discovered in 1908 when coal was found on the western side of the ridge. From 1910 to 1915 some 120 m of 'driving and sinking' had been done, and the work was temporarily abandoned in 1915 pending the workers (Messrs Woods and Anderson) securing more capital for the venture (Twelvetrees, 1915). Work continued intermittently on the field until 1933. A large number of pits, trenches, adits and shafts were put in on both sides of the ridge, but with most of the activity being concentrated on the eastern side. The original workings started on the western side; some were quite extensive, as was the 'main tunnel' which was a drive 2 m × 2 m running horizontally into the hill for 10 m, where coal was intersected. The tunnel then followed the dip of the coal at 20–25°, eventually linking with other minor workings (the Creek drive) to the north. Specific details of drive depths, widths, bearings (but no specific locations) of the various workings may be gleaned from Twelvetrees (1915), Reid (1921*a*) and Nye (1927*b*, *c*, 1928*b*, *c*, 1934). Nye noted a total of seven adits and three shafts, as well as a large number of trenches. Three adits were located by the author in 1982 (fig. 41).

The last commercial operation on the coalfield commenced in 1926, with the driving of two adits into the south-west part of the field. Both adits encountered dolerite, as had earlier adits on the western side of the ridge. Messrs Bond and Gepp removed pillars from these workings during 1932–33 and the lease was then transferred to W. J. Forster, who held it until expiry in 1936. Coal for domestic use was apparently being dug out of one adit close to the Darcy Link–Creekton Road junction in the 1960s.

Most of the seams worked were about 0.6–1.0 m thick. Substantial variation in seam thickness is recorded, with seams thinning from 1.6 m to 0.6 m over short distances. The average working thickness was about one metre.

COAL QUALITY

The coal is reported to be dull, black and dense with numerous bright bands (Nye, 1934). A number of analyses are listed in Table 22.

Table 22. *Analyses of coal samples, Strathblane coalfield.*

	1	2	3	4
Moisture (%)	4.7	3.1	0.64	0.74
Ash (%)	8.2	20.2	13.26	18.10
Volatile matter (%)	29.6	20.7	28.64	26.12
Fixed carbon (%)	57.5	56.0	57.46	55.04
Sulphur (%)	0.79	0.75	0.42	0.57
Specific energy (MJ/kg)	-	-	25.4	26.7

1. Representative sample of full thickness of most southerly adit, 13.7 m long on section 9651/M (Nye, 1927*c*) .
2. Sample of outcrop of coal 400 m NW of the NE corner of section 10311/M (Nye, 1927*c*).
3. Sample from screened coal, 75–100 mm in size (Nye, 1934).
4. Sample from screened coal pile from which pieces <20 mm had been removed (Nye, 1934).

RECENT EXPLORATION

In 1976 Earth Resources Australia Pty Ltd conducted an exploration programme for Australian Paper Manufacturers to determine if any economic deposits of open-cut coal could be found in Strathblane area. Two lines of holes were drilled near Strathblane (fig. 41). The most southerly line (Line A) intersected minor intervals of coal up to 0.20 m thick. The remainder of the holes in this line were devoid of coal intersections. The northernmost line of holes (Line B) yielded only 0.12 m of coal in DDH 12. The remainder of the holes intersected the quartz sandstone sequence which underlies most of the Strathblane Plain (Bunny, 1976).

In 1983/84 Marathon Petroleum of Australia Ltd explored this area (as EL 40/83). Previous work was re-evaluated and the area examined before EL 40/83 was relinquished in 1985. The coalfield is currently covered by EL 7/86 held by Conga Oil Pty Ltd.

POTENTIAL FOR FUTURE EXPLORATION

There are a number of coal outcrops and coaly traces along the road cuttings on Peak Rivulet Road. However most of these outcrops and the historical data show the seams to be thin, discontinuous, prone to abrupt changes in thickness, and not extensive. Correlation of seams cannot be made on the information available.

The quality of the coal appears to have been good. However, there is virtually no possibility of economic reserves of open-cut coal existing in the area, and because of the limited area of the coalfield and the banded, patchy, thin nature of the seams, there is unlikely to be sufficient reserves for an underground mining operation of any size, although small pockets of coal may be found and may be able to supply local domestic markets. The inferred reserves of the area are very small, probably less than one million tonnes.

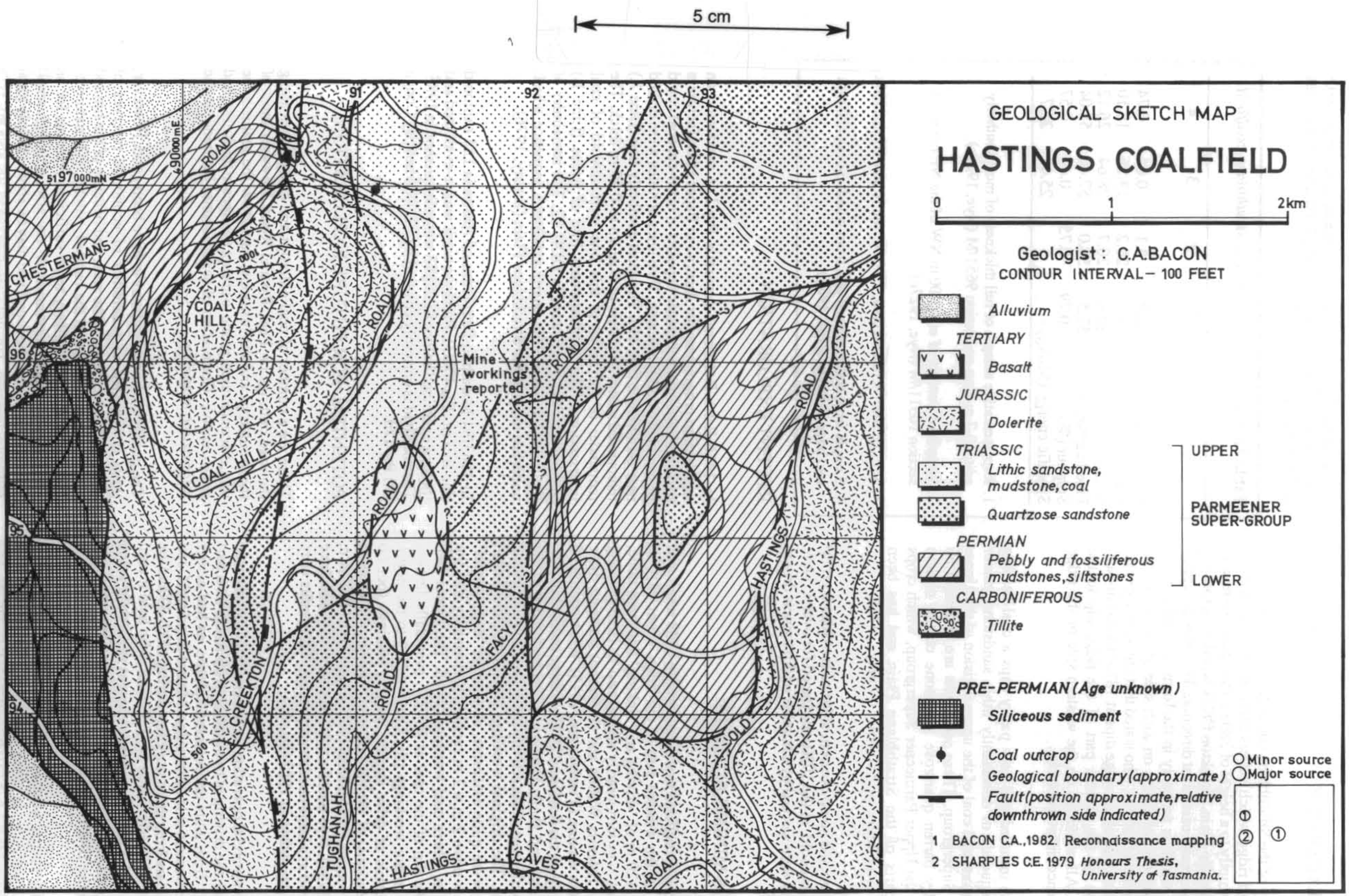

5 cm
GEOLOGICAL SKETCH MAP
HASTINGS COALFIELD
0 1 2km
Geologist : C.A.BACON
CONTOUR INTERVAL – 100 FEET
Alluvium
TERTIARY
Basalt
JURASSIC
Dolerite
TRIASSIC
Lithic sandstone, mudstone, coal
Quartzose sandstone
UPPER
PARMEENER SUPER-GROUP
LOWER
PERMIAN
Pebbly and fossiliferous mudstones, siltstones
CARBONIFEROUS
Tillite
PRE-PERMIAN (Age unknown)
Siliceous sediment
Coal outcrop
Geological boundary (approximate)
Fault (position approximate, relative downthrown side indicated)
Minor source
Major source
1 BACON C.A., 1982. Reconnaissance mapping
2 SHARPLES C.E. 1979 Honours Thesis, University of Tasmania.
91
92
93
96
95
94
5197000mN
490000mE
CHESTERMANS
ROAD
COAL HILL
COAL HILL
Mine workings reported
CREEKTON
TUGHANAH
ROAD
FACY
ROAD
HASTINGS
CAVES
ROAD
OLD
HASTINGS
1000
500

Figure 42.

The Hastings Coalfield

SUMMARY

A very small coal mine was worked near Hastings earlier this century. The area of the coalfield is limited.

LOCATION AND ACCESS

The old Hastings mine workings were situated about 5 km due north of the township of Lune River, on the eastern side of Coal Hill [about DM920960]. The area is well traversed by Forestry Commission roads. No actual workings were found during the author's 1982 search, although an adit is reported to exist beneath an old log-loading platform found near the eastern side of Creekton Road (L. Whitham, pers. comm.).

GENERAL GEOLOGY

The geology of the Hastings coalfield is shown in Figure 42. The coalfield is confined to a small block of fluviatile sediments belonging to the upper division of the Upper Parmeener Supergroup. The sediments are intruded by dolerite. To the west they are faulted against older, non coal-bearing strata and grade to the east and south into the underlying, economically barren quartzose sandstone of the middle division of the Upper Parmeener Supergroup. A small patch of Tertiary basalt covers part of the coalfield.

PREVIOUS MINING HISTORY

Mining activity started before 1900 and continued sporadically until after 1922. The exact date of closure is not known. There appears to have been one main seam with three plies, worked as three separate seams.

The succession and thickness of the 'seams' were:

1.45 m	coal (Gamma seam)
0.94 m	sediments
0.89 m	coal (Delta seam)
0.69 m	sediments
0.53 m	coal (Eta seam)

The names *gamma*, *delta* and *eta* were given by Hills *et al.* (1922), who devised a seam classification for the whole of Tasmania.

The 'seams' were worked by means of a dip tunnel on the gamma seam and a horizontal tunnel which intersected all three 'seams'. The workings reportedly showed evidence of considerable movement, resulting in the displacement of the strata.

COAL QUALITY

Twelvetrees (1902*b*, p. 239) recorded the coal as "fair but mixed with band stuff which requires separating". An analysis (Johnston, 1888, p.191), probably for part of the worked seam, is:

Moisture lost at 212°F (%)	2.5
Ash (%)	8.7
Volatile matter (%)	30.8
Fixed carbon (%)	58.0

Hills *et al.* (1922) reported that production had probably not exceeded 500 tons.

RECENT EXPLORATION

No work has been done on the Hastings coalfield since 1922. The area is currently covered by EL 7/86 held by Conga Oil Pty Ltd.

POTENTIAL FOR FUTURE EXPLORATION

Because of the limited extent of the coalfield and the thin, banded nature of the seams, the area is not considered to contain any economically viable deposits of black coal.

The Ida Bay Coalfield

SUMMARY

An adit was dug into an outcrop of coal near Ida Bay in 1892. This mining venture was very small.

LOCATION AND ACCESS

The mine workings at Ida Bay were located 100 m west of the old Hastings–Cockle Creek road about 1.8 km south of Ida Bay township. The workings were accessible by road, some 100 km from Hobart. Forestry roads currently cross the area in a number of places. The site of the old workings was later occupied by a sawmill, and sawdust piles can still be seen from the South Cape (Catamaran) Road.

GENERAL GEOLOGY

The geology of the Ida Bay coalfield is shown in Figure 43. The mine was situated in an isolated block of fluviatile sediments (belonging to the upper division of the Upper Parmeener Supergroup), bounded to the west by the Lune River fault, to the north and south by dolerite bodies, and grading to the east into the stratigraphically lower and economically barren quartzose sandstone of the middle division of the Upper Parmeener Supergroup. Lune Sugarloaf, a striking hill feature to the west, is capped with dolerite overlying fossiliferous mudstone of Permian age. A large fault runs north–south along the base of the hill. Basalt, presumably of Tertiary age, overlies both lithic sandstone and dolerite.

PREVIOUS MINING ACTIVITY

An adit was dug into a seam of coal "one mile south" (about 1.6 km) of Ida Bay in 1892. Between 1909 and 1911 some 330 tons of coal was produced from one main dip tunnel reported to be 55 m long (Hills *et al.*, 1922). Twelvetrees (1902*b*) recorded a dip of 40° at the mouth of the tunnel and noted that the seam dipped south-west at 10–11°. A band of coal 450 mm thick and known as "Schäffner's" occurs above the 'main seam'.

Another band of coal, 300 mm thick, occurs lower down the hill from the dip tunnel. A shaft "further up" the hill from the main tunnel, sunk to provide ventilation for the tunnel, was abandoned at 18 m due to blasting damaging the timber.

None of the workings were accessible in 1921 (Hills *et al.*, 1922). In a later visit, Keid (1952) located three collapsed adits, one of which yielded a section of two metres of coal interbedded with 'band stuff'. The seam dips west at 10°. The mine was originally part of a scheme to manufacture cement, but which never eventuated, and the mine closed down. Twelvetrees (1915) recorded a 1.6 m seam of good coal 50–60 m inside the main adit. The adits were not found during the author's 1982 visit to the area.

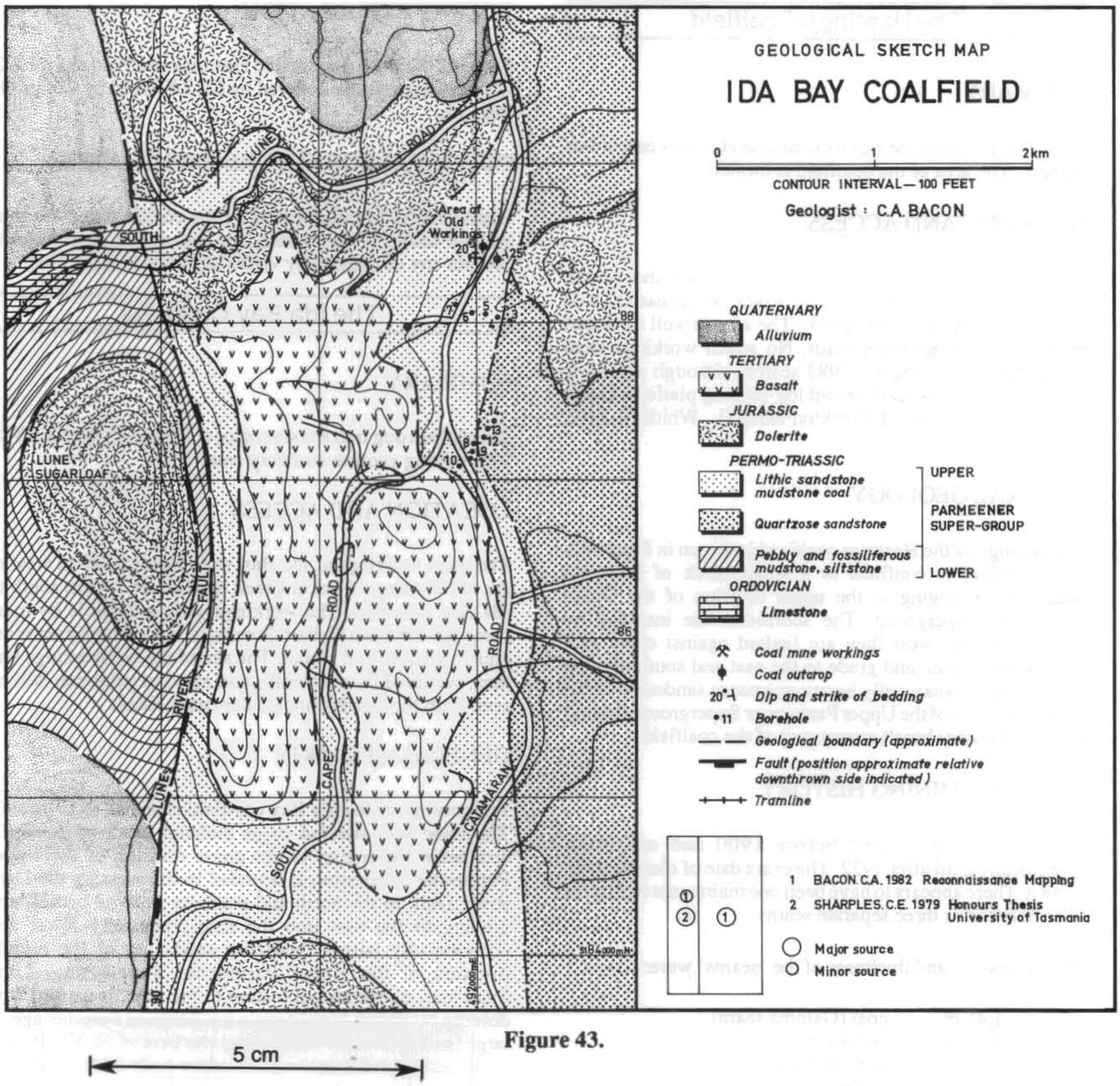


Figure 43.

Table 23. *Analyses of coal samples, Ida Bay coalfield.*

	1	2	3	4	5	6	7
Total moisture (%)	-	-	-	-	3.8	2.8	1.54
Moisture (%)	8.4	8.6	5.2	4.8	-	-	-
Ash (%)	33.3	22.8	39.3	23.3	11.8	15.9	17.54
Volatile matter (%)	-	-	-	-	28.9	14.0	10.01
Fixed carbon (%)	-	-	-	-	55.5	67.3	64.90
Total sulphur (%)	0.42	0.47	0.28	0.38	-	0.8	0.45
Specific energy (MJ/kg)	18.57	22.44	18.05	24.57	-	-	-

1. Raw coal, sample 6, 0.48 m thick, DDH CA105.
2. Washed coal, sample 6 as above, F1.6, yield 69%.
3. Raw coal, sample 1, 0.96 m thick, DDH CA109.
4. Washed coal, sample 1, as above, F1.6, yield 45%.
5. Sample from Ida Bay mine, from working face 100 feet (30 m) from entrance (Twelvetrees, 1915).
6. Sample from Ida Bay mine, 40' (12 m) from entrance (Twelvetrees, 1915).
7. Published analysis of seam by A. J. Wilcoxson (Twelvetrees, 1915).

COAL QUALITY

The coal was reported to be dirty, containing much clay and shaly matter, and was not a good steaming coal nor valuable for domestic use (Hills *et al.*, 1922). Representative analyses are given in Table 23.

RECENT EXPLORATION

In 1974–76 Earth Resources Australia Pty Ltd conducted a search for potential open-cut coal near Ida Bay for Australian Paper Manufacturers. Fifteen shallow holes were drilled in two lines. The northern line runs east from near the old Ida Bay mine, and the second runs NW–SW about one kilometre south of the old mine (fig. 43). Thin, inferior coal seams were encountered in DDH 6 (1.12 m, 1.37 m thick) and in DDH 7 (1.20 m thick). Carbonaceous mudstone horizons were encountered in Holes 8, 9, and 11 (Bunny, 1975).

Most of the holes drilled on the plain to the east of the old mine were collared in the quartzose sandstone sequence. Bunny (1974*b*) stated that the quartzose sandstone under the plain is 85 m thick. Dolerite crops out at the eastern edge of the plain, and is also alleged to occur at shallow depths in Holes 10 and 11. However, the basalt hill adjacent to Holes 10 and 11 is shown on plans in Bunny (1974*b*) as dolerite, and a coal outcrop south of the mine stated to occur "under a dolerite sill" was found under basalt.

The area was examined by Marathon Petroleum from 1979 to 1984 when the coalfield was held under EL 6/79. Gravity, magnetic and photogeological studies were made over this area, Strathblane to the north, and Catamaran to the south. Ten drill holes were put down in the Ida Bay area. Whilst a number of banded coaly intervals were encountered during drilling, only a few of these coaly intervals were of economic interest, most being in the nature of carbonaceous mudstone rather than coal. An 'inferred resource' of six million tonnes of *in situ* open-cuttable black coal in one seam has been estimated, although further work would be needed to bring this 'resource' up to measured or indicated reserve status. The coalfield is currently covered by EL 7/86, held by Conga Oil Pty Ltd.

POTENTIAL FOR FUTURE EXPLORATION

Considering the small areal extent of the coalfield, the banded nature of the coal and the relative thinness of the main seam worked (1.5 m), the potential for future development is small. There is no coal suitable for open-cut mining in the area (Bunny, 1975), and the inferred reserves of underground coal are very small, probably less than one million tonnes.

The Moss Glen Coalfield

SUMMARY

A Reward Claim for coal was awarded to G. H. Smith in 1902 over the area of the Moss Glen coalfield. Despite intermittent prospecting activities no coal mine has eventuated in this area.

LOCATION AND ACCESS

The Moss Glen coalfield was 2–3 km to the north of the Catamaran coalfield workings, stretching from a low range of hills west of the current forestry road (South Cape Road) to within 500 m of the coast at Recherche Bay (fig. 44). The area is referred to as the 'Reward Claim' in the literature and was originally held by G. H. Smith.

GENERAL GEOLOGY

The area is thickly overlain by dolerite talus on the hill slopes and alluvial soils on the plain. The South Cape Road has exposed a number of seams in road cuttings; these are marked on Figure 44. The fluviatile sequence of interbedded lithic sandstone, mudstone, claystone and dull coal belongs to the upper division of the Upper Parmeener Supergroup. Meaningful correlation with the seams exposed in the road cuttings and those at Catamaran or elsewhere is not considered possible with the limited information available.

Faulting severely disrupts the seams, as is shown by reports of 'non-discovery' of coal seams in holes drilled in order to plan coal extraction.

PREVIOUS MINING ACTIVITY

A Reward Claim was issued in 1902 to G. H. Smith. Twelvetrees (1902*b*) records that the Moss Glen Colliery Company was prospecting on the Reward Claim and had found three seams, but none of these were properly mined. The 1902 workings consisted of a number of pits and bores drilled by the Company's Mine Manager, a Mr Hardwick, together with a short tunnel 6.4 m long on the 'lower' seam and a shaft four metres deep on an 'upper' seam.

The main seam (opened in the tunnel) was reported to be 1.85 m (6'1") thick of which 1.68 m (5'6") was coal. The seam was recorded by Twelvetrees (1902*b*) as dipping at 20° to the north-west. A bore drilled about two metres from the end of the tunnel failed to strike the seam. This is probably the same seam which crops out in a drain on the forestry road, near a filled-in adit. A bore in the area (shown on Figure 44 as "area of Hardwick's bores") is recorded as having passed through 3.0 m (10') of overburden, then 7.6 m (25') of coaly sediments and bands, containing one 1.37 m thick band of stony coal, all above the level of the tunnel seam. These coaly bands are probably those which crop out along the South Cape Road to the north of the 2.0 m thick seam cropping out in the road drain.

The 'Reward Claim' lease was forfeited in 1912, due to no work having been done, and was taken over by Messrs A. E. Sherwin, Smith and others, who sank two shafts to intersect the 'upper' coaly sequence, reported by Noetling (1912*a*) to be 4.52 m (14'10") thick, of which 3.66 m (12'0") was coal and the rest shale bands.

There would appear to be two coaly horizons in the Moss Glen area; an 'upper' horizon consisting of a number of thin seams, and a 'lower' 1.85 m (6'1") thick seam, both of which are disturbed by faulting.

COAL QUALITY

Analyses from this area are included with those from the Catamaran coal field (see Table 25).

RECENT EXPLORATION

Two holes (CA104, CA112) were drilled to the north of Moss Glen, and four more between Moss Glen and Catamaran by Marathon Petroleum of Australia Ltd (EL 6/79). One hole (CA104) was abandoned in dolerite scree at 39 m, while the other (CA112) intersected no coal seams and terminated by hitting a dolerite sill at 108 metres. Holes CA108 and CA111 were drilled to the west of Moss Glen, on the South Cape Road, close to some outcrops of coal in road cuttings. Again one hole (CA108) was abandoned in scree, but the second hole (CA111) intersected two banded seams before hitting a dolerite sill. Logs of these holes and details of exploration

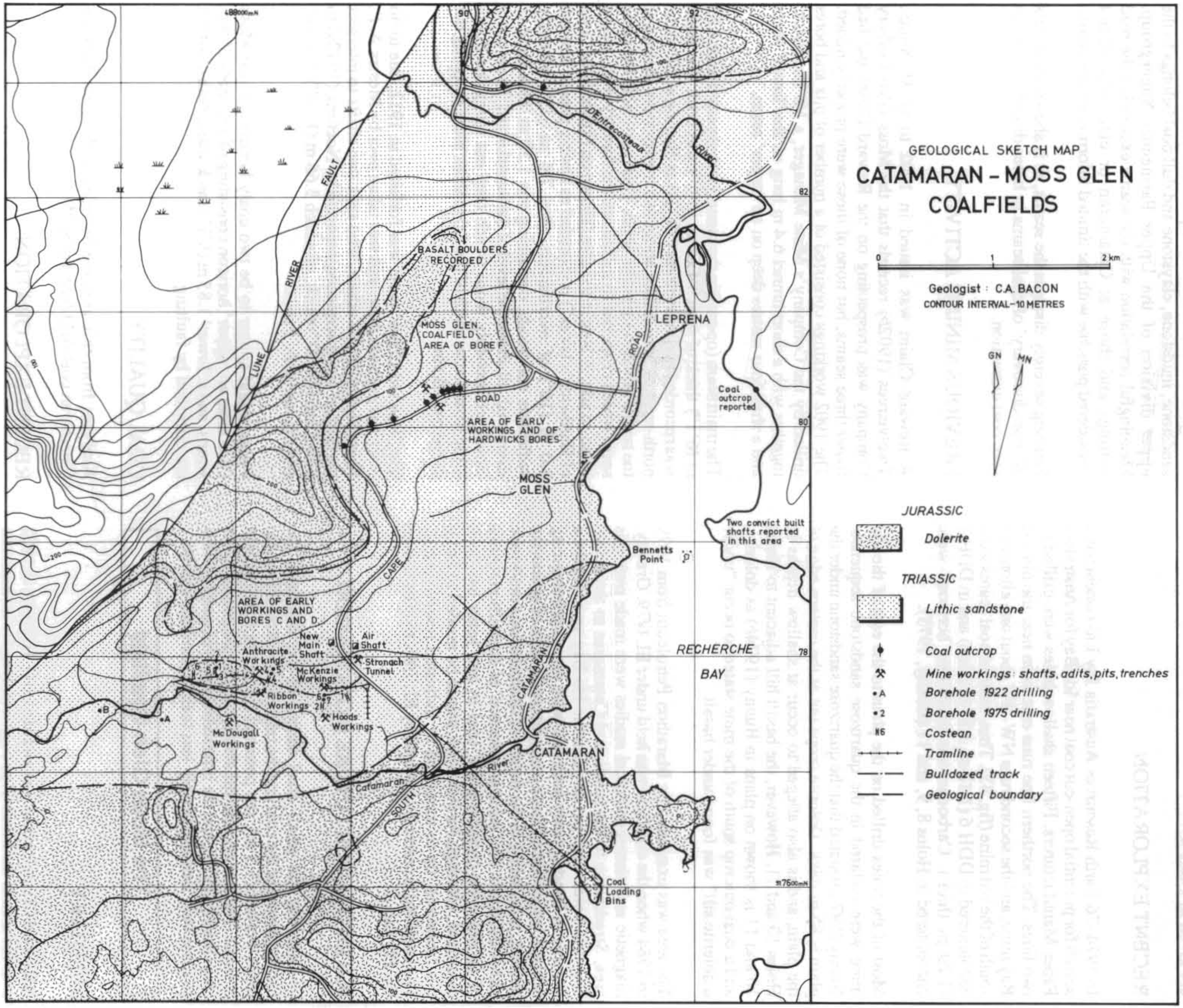

GEOLOGICAL SKETCH MAP
CATAMARAN - MOSS GLEN COALFIELDS
Geologist : C.A. BACON
CONTOUR INTERVAL-10 METRES
GN
MN
JURASSIC
Dolerite
TRIASSIC
Lithic sandstone
Coal outcrop
Mine workings: shafts, adits, pits, trenches
Borehole 1922 drilling
Borehole 1975 drilling
Costean
Tramline
Bulldozed track
Geological boundary
LUNE RIVER FAULT
BASALT BOULDERS RECORDED
MOSS GLEN COALFIELD AREA OF BORE F
AREA OF EARLY WORKINGS AND OF HARDWICKS BORES
LEPRENA
Coal outcrop reported
MOSS GLEN
Two convict built shafts reported in this area
Bennetts Point
AREA OF EARLY WORKINGS AND BORES C AND D
Anthracite Workings
New Main Shaft
Air Shaft
Stronach Tunnel
McKenzie Workings
Ribbon Workings
Hoods Workings
McDougall Workings
RECHERCHE BAY
CATAMARAN
Catamaran River
Coal Loading Bins
ROAD
CAPE
SOUTH

Figure 44.

are given in Perkins and Dunn (1984). EL 6/79 was relinquished in 1985, and the area of the coalfield is now included within EL 7/86 held by Conga Oil Pty Ltd.

POTENTIAL FOR FUTURE EXPLORATION

Although the area is known to be faulted and no coal of commercial quantity has been extracted from the field, the area, in conjunction with the Catamaran coalfield to the south, provides a better prospect for exploration than the Strathblane, Ida Bay, or Hastings coalfields.

The Catamaran Coalfield

SUMMARY

The early mining ventures in the Catamaran coalfield were characterised by massive expenditure on infrastructure, such as massive coal bins and long tramways, leaving little capital for actual mine development. A number of syndicates tried mining coal at Catamaran from the discovery of the field in 1900 to the closure of the last mine in 1939.

LOCATION AND ACCESS

The Catamaran coalfield is located on swampy ground north of the Catamaran River and immediately to the west of the South Cape forestry road. A number of workings have existed over various parts of the coalfield (fig. 44). The area is currently accessible by road, some 115 km from Hobart. After mining the coal was transported by tramway to Evoralls Point where large coal bins had been erected. Some of the major tramway is still visible to the determined seeker. Cutting grass and thick scrub obscure most of the coalfield, covering the workings and tramways.

GENERAL GEOLOGY

The hills to the west of the workings are capped with dolerite of Jurassic age which has intruded the Triassic fluviatile coal-bearing sediments belonging to the upper division of the Upper Parmeener Supergroup. Dolerite crops out to the south of the coalfield, and also to the east along the shore of Recherche Bay. Much of the low-lying land between the Catamaran and Moss Glen coalfields is covered with alluvium. The area of the old Catamaran workings is largely covered with dolerite talus, with a dolerite ridge, probably a dyke trending ENE–WSW, separating the Ribbon and Anthracite workings. Outcrop is poor and access today very limited due to thick scrub growth. Agates are reported to have been found in the soil covering the hills behind the Moss Glen coalfield (L. Whitham, pers. comm.).

Twelvetrees (1915) reported finding basalt boulders but no *in situ* basalt in the area, so the hills are probably mantled with Tertiary basalt lag covering dolerite.

There appear to be three coal seams in the Catamaran coalfield. In the area of the Ribbon workings and the main McKenzie workings, the seams are:

- an upper, poor quality seam;
- the Catamaran seam (1.2–1.5 m of banded coal and mudstone);
- the lower 'Bottom' or 'Young's' seam.

Hudson and Nye (1932) recorded two large faults; one with an upthrow to the north of 30 m between the Ribbon and Anthracite workings, and one 15 m north of the new main shaft "near the extremity of the flat", upthrown some 180 m to the north. The seams at the Anthracite workings are given (Hudson and Nye, 1932) as: the Upper seam; the Middle (= Catamaran) seam; and the Anthracite (= Young's) seam.

PREVIOUS MINING ACTIVITY

A comprehensive history of the Catamaran coalfield has been compiled by Whitham (1983).

Hoods Workings (1900–1910) were operated by Major Lloyd Hood, and consisted of a number of shafts and adits. Hood formed the Catamaran Coal Mining Company No Liability in 1905, but the workings produced only 2527 tons of coal before the capital for the venture ran out in 1906 (Whitham, 1983).

The James Workings (1910–1912) were minor works under the direction of E. C. James, who formed the Catamaran Colliery Company Pty Ltd and built the coal loading bins of 250 tons capacity in 1911 on the north bank of the Catamaran River. James appears to have spent the company's funds on extensive infrastructure arrangements, such as the coal bins, a loading jetty, and extensive tramways but not much actual geological work was done. The works closed in 1911 after producing 375 tons of coal, but opened briefly in 1912 only to be closed by the Department of Mines when underground collapses made the mine unsafe to work. Some 600 tons of coal were extracted from the workings before the collapse.

The McDougall Workings were confined to minor prospecting activity and one shaft 9 m deep south of the Catamaran River. These were abandoned by 1912.

The New Main Shaft was sunk by a syndicate from Broken Hill in 1913, under the direction of an engineer, R. C. Young, but no actual production was undertaken from the 40 m deep shaft as the work ceased in 1914 for want of additional capital.

Work recommenced in 1921 on the New Main Shaft with a new company, the Catamaran Colliery Pty Ltd. Reid (1921*b*) noted that the roof and floor of the seam being worked from the New Main Shaft (the Catamaran Seam) were very soft and the mine workings were badly affected by water, severely limiting the economic viability of the mine. The New Main Shaft is now fenced off and may be seen close to the western side of the South Cape Road, 1.5 km north of the bridge over the Catamaran River.

A new manager suggested mining from dip adits would be more economical, and in 1923 production from the New Main Shaft, which had never been great, ceased (Whitham, 1983).

The McKenzie Workings (1923–1930) commenced in 1923 with the construction of a brick-walled dip adit, the entrance to which may still be seen today. Underground workings connected these workings with the New Main Shaft, 200 m to the north. Lighting was by means of a 500 volt cable, and the coal was drawn from the working face to the main haulage tunnel by pit ponies, then hauled to the surface by a steam-powered winch, which was replaced by an electric winch in 1927. A new tramway was constructed to Evorells Point, where 1200 ton capacity coal bins were built. The mine closed due to economic troubles initiated by flooding of the works in late 1926, the workings encountering faults which proved costly to tunnel through, and a demarcation dispute on the Hobart wharves. About 18 270 tons of coal were produced in the first nine months of 1927.

The demarcation dispute was finally resolved and a new dip adit opened up close to Hoods old 1905–06 workings in 1928, when 16 000 tons of coal were produced.

Unfortunately one-third of the coal produced was termed 'slack' (i.e. apt to break up and choke most furnaces), and a market for this product could not be found. Mining activity continued until 1930, when the mine closed.

The Anthracite Workings (1927) worked the so-called 'anthracite' seam, which was only 450–500 mm of heat-affected coal. Blake (1939*a*) recorded the 'anthracite' seam as being partly exposed at intervals in seven pits over a distance of 300 m. A small tunnel, 99.4 m long, was dug to work this seam in 1927, the seam dipping to the north at "about 1 in 4" (Blake, 1939*a*).

The Ribbon Workings (1931–1934) were opened in 1931 when the New Catamaran Collieries Pty Ltd opened a new mine close to the north bank of the Catamaran River. The seam worked here was actually Young's seam, below the Catamaran seam. Ratten Drive was driven upwards from the Ribbon Workings to work the Catamaran seam, and for a time both seams were worked.

Keid (1952) located the approaches to the dip tunnels, driven in a north-westerly direction on a dip of 10° "near to the river and west from main dip tunnel". The collapsed entrance to one adit could still be seen in 1982.

Stronach Tunnel (1934–1939) was located east of the New Main Shaft and was the last area worked in the Catamaran field. The tunnel portal was dug in 1931 by a Mr Stronach, but no further work was done until 1934. Mr Algie Smith of Moss Glen worked out this mine, which he said was driven in on the dip of the seam for more than 275 m before a fault was encountered.

COAL QUALITY

There are large variations in the ash contents of the historical analyses, ranging from 3% to 30% ash, depending on the actual piece of coal analysed. The historical analyses (Table 24) are for selected parts of seams worked and not entire seams. More detailed analyses (Table 25) are available from cored samples of two seam intervals from the 1982 exploration (Perkins and Dunn, 1984).

RECENT EXPLORATION

A costeaning and drilling programme in 1974–75 by Earth Resources Australia Pty Ltd for Australian Paper Manufacturers was aimed at delineating potential open-cut coal in the Catamaran area. The study concluded that the area was incapable of providing any appreciable quantity of open-cut coal of the quality required. Positions of the drill holes and costeans are shown on Figure 44.

The area was evaluated by Marathon Petroleum of Australia Ltd as EL 6/79. Two chip holes were drilled near to the old workings (CA115, CA118) and more holes were drilled between Catamaran and Moss Glen. Two banded seams were encountered in each hole. Logs and details of exploration are given in Perkins and Dunn (1984). The Exploration Licence was relinquished in 1985. The area is currently covered by EL 7/86 held by Conga Oil Pty Ltd.

POTENTIAL FOR FUTURE EXPLORATION

The potential for open-cut coal in any appreciable quantity is virtually nil, and the most accessible parts of the coalfield have already been well worked by underground means. However, small areas between the original workings are likely to contain limited reserves and the area north of the Catamaran coalfield (including Moss Glen) is probably worth closer inspection. The coal seams are expected to be thin, banded, discontinuous and badly disrupted by faulting. Nevertheless, the Catamaran area offers the best potential of the southern coalfields for yielding small quantities of useful coal. The inferred reserves of the coalfield are very small.

Table 24. *Analyses of coal samples, Catamaran coalfield.*

	1	2	3	4	5	6	7	8	9	10
Moisture (%)	3.0	2.2	3.46	2.80	2.34	3.14	2.95	3.65	2.92	1.32
Ash (%)	10.1	3.8	15.70	7.46	18.34	33.2	22.60	13.70	21.54	7.14
Volatile matter (%)	24.9	24.7	22.00	28.90	27.46	20.36	20.13	22.53	20.74	4.20
Fixed carbon (%)	61.2	69.3	58.84	60.84	51.86	43.30	54.32	60.12	54.80	87.34
Sulphur (%)	0.8		0.44	0.52	0.44	0.25	0.55	0.48	0.32	0.46
Specific energy (MJ/kg)	-	-		29.9	25.3	19.4	24.8	27.2		

Catamaran seam samples:

1. New Main Shaft (Twelvetrees, 1915).
2. Electric shaft (Twelvetrees, 1915).
3. From bins near James workings (Hudson and Nye, 1932).
4. Ratten drive, Ribbon workings, basal 0.64 m of seam (Hudson and Nye, 1932).
5. Ratten drive, Ribbon workings, 0.33 m from middle of seam (Hudson and Nye, 1932).
6. Ratten drive, Ribbon workings, top 0.23 m of seam (Hudson and Nye, 1932).

Youngs (Bottom) seam samples:

7. Ribbon workings, No. 2 East drive (Hudson and Nye, 1932).
8. Ribbon workings, No. 2 East drive (Hudson and Nye, 1932).
9. Middle (Catamaran) seam near Anthracite workings; seam 1.32 m thick (Blake, 1939*a*).
10. Anthracite seam, west of Anthracite workings, 430 mm thick (Blake, 1939*a*).

Table 25. *Detailed analyses of coal samples, Marathon Petroleum drilling.*

	1	2
Relative density	1.56	1.51
Total moisture (%)	6.4	5.9
Analysis basis (AD)		
Ash (%)	25.3	24.4
Volatile matter (%)	23.1	22.8
Fixed carbon (%)	45.2	46.9
Sulphur (%)	0.22	0.42
Phosphorous (%)	0.001	0.003
Specific energy (MJ/kg)	22.20	24.04
CO_2 (%)	0.31	0.20
Dry, ash-free basis		
Carbon (%)	81.90	84.90
Hydrogen (%)	4.71	5.17
Nitrogen (%)	1.64	1.43
Sulphur (%)	0.32	0.60
Oxygen (%)	11.43	7.90
Crucible swelling number	0.5	1
Gray-King coke type	A	B
Hardgrove Grindability Index	49	73
Ash fusion temperatures (°C) (reducing atmosphere)		
Deformation	1360	1250
Spherical	1590	1440
Hemisphere	1600	1490
Flow	1600+	1540
Ash analysis (%)		
SiO_2	71.5	59.8
Al_2O_3	22.0	26.2
Fe2O3	3.84	8.16
Mn_3O_4	0.09	0.38
P_2O_5	0.01	0.03
TiO_2	1.15	0.88
CaO	1.40	2.88
MgO	0.20	1.19
K_2O	0.10	0.74
Na_2O	0.01	0.08
SO_3	0.27	0.20
Trace elements (μg/g)		
Hg	0.02	0.02
V	19.2	32.6
Cd	0.12	0.08
Pb	16.1	13.8
Forms of sulphur		
Pyritic	0.08	0.17
Sulphate	0.01	0.01
Organic	0.13	0.24

1. Seam 'A', DDH CA106F (Ida Bay), coal plies only, F1.80.
2. Seam 'A', DDH CA111 (Moss Glen), coal plies only, F1.80.

Minor coal areas in far southern Tasmania

SUMMARY

A number of minor occurrences of coal are recorded, and limited prospecting work has been done in areas outside of the recognised coalfields in areas of far southern Tasmania. These small, economically insignificant deposits are of historical and regional interest only.

SOUTHPORT

The Cygnet Coal Measures crop out on the foreshore near Southport. One of the first commercial mining operations in Tasmania unsuccessfully attempted to exploit these coal measures.

In 1840, Charles Swanston and eight others approached the Government of the day for assistance to sink a shaft near Southport. The proposal was that the Government provide the labour for sinking the shaft and operating the mine, and the company provide materials and, if successful, lease the mine for 99 years at a cost of 2½% of the profits (Executive Council Minutes, 19 May 1840). The scheme was proposed again in 1841 and 1842 (Hartwell, 1954).

The Government partly agreed to the proposal, and a shaft was sunk in 1842. Some 1300 tons of coal were brought to the Hobart market (*Colonial Times*, 17 May 1842; CSO 8/108/2279, July 1844), but the operation was not profitable and collapsed, owing the Government £4,316 ($8,632) (GO 1/54, 9 May 1844, p. 90).

The company had a brief period of 'paper prosperity' in 1840, when shares rose from ten shillings ($1.00) to £10 ($20) each (*Hobart Town Courier*, 1840). However on the collapse of the company, the shareholders could not be traced and the Government was forced to forfeit the sum owing (GO 33/78, p. 713–717, 31 March 1853). Government Surveyor Jones commented in a letter to the Colonial Secretariat Office that the coal was taken from the beach outcrop and not from any regular working, so the coal was dirty (CSO 8/108/2279, 13 July 1844). The affair became known as the "Southport Swindle" (Booth, 1962), and speculation remains that the proposers made a tidy profit from the scheme. Swanston was at the time one of two Attorneys General for the Colonial Government, and was later involved in coal mining on Schouten Island as well as many other industrial ventures.

Milligan (1849) noted that a shaft was sunk near Southport "half a mile (800 m) from the Southport station .... some beds of shaly matter were penetrated but coal was not obtained". This description most probably refers to Swanston's shaft.

A diamond-drill hole was put down at Southport in July 1893 for the Southport Coal Prospecting Association. The hole was drilled to 186.7 m, at a point "70 chains (1.4 km) north of The Narrows and one chain (20 m) west of the beach, at 30' (9.1 m) asl" [i.e. approximately at DM971908]. The log of the hole is given in Twelvetrees (1902*b*). No coal was intersected.

SOUTH CAPE

Coal was first discovered in Tasmania in 1793, when a 100 mm seam of coal was found by a party from Labillardiere's expedition whilst on route from Recherche Bay to Mt La Perouse.

In 1824, I. Scott, R. Roberts and J. Hobbs embarked on a tour of discovery around Tasmania with two boats and twelve convicts. Three seams of coal were seen cropping out in a cliff at South Cape Bay. An expedition to examine the coal in 1826 returned with the opinion that the coal was of poor quality (LSD 1/48/208, 25 October 1826).

The seams were described by Milligan (1849). Two shafts were sunk 450 m inland from the cliff but no coal was intersected. Of the seams in the cliff, one about one metre thick was of the most interest and of better quality than the other two seams, although even this better coal was full of pyrite and stony matter.

RANDALLS BAY

Thureau (1881*b*) briefly mentioned two shafts sunk to the south of the Cygnet coalfield. One shaft was sunk at Randalls Bay [EN100120] where a very small seam (125–150 mm thick) was cut. Another shaft was sunk between Randalls Bay and Mt Cygnet but no economic coal was discovered. Both these shafts were sunk in the Cygnet Coal Measures.

ADAMSONS PEAK

Four small seams of coal and black shale cropping out in a creek below the plateau Adamsons Peak, to the north of the track leading to the forestry lookout, were seen by Hughes (1955*c*). The seams varied from 450mm to 1.2 m in thickness. A sample from the 1.2 m seam, described as "coal with some black shale", gave the following analysis:

Moisture (%)	3.0
Ash (%)	46.5
Volatile matter (%)	14.5
Fixed carbon (%)	36.0
Sulphur	0.47
Specific energy (MJ/kg)	16.2

The seams are part of the Cygnet Coal Measures and are of Permian age.

LUNE RIVER

In 1922 a coal bed of three seams containing three metres of coal was opened up by means of a shaft on the north bank of the Lune River. Hughes (1955*c*) recorded that some shallow shafts were full of water at the time of his visit. The coal is of Triassic age.

FLYNNS CREEK

Thureau (1881*b*) referred to this area as being six miles (9.5 km) north-east from 'Picnic Victoria' on the Huon River. This area, around EN089376 and EN090368, is near Flynns Creek. The coal was recorded as being 1.12 m thick at the adit entrance, and 1.2 m at the end of the 5.5 m long adit. The coal measures are part of the Triassic Kaoota Coal Measures.

GORDON

The Cygnet Coal Measures crop out on the seashore near Gordon [EN195100]. A Mr Abbott extolled the virtues of the Three Hut Point coal to the Senate Select Committee on Coalfields in 1864. On 10 June 1870 he wrote to the Melbourne Chamber of Commerce trying to find a market for his coal from the Rockwood coal mine (between Three Hut Point and Long Point) near Gordon (LSD 1/48/310). Abbott had a drive 60 m long and was sinking a shaft at this time. In 1879 Abbott complained to the Government of the day that coal-bearing land at Adventure Bay was being sold and the coal worked, and he could not compete with these operations (LSD 1/48/214). The area was inspected by Reid (*in* Hills *et al.*, 1922), who recorded that the seam was 200–250 mm thick.

RECHERCHE BAY

Across the bay from the Moss Glen coalfield, near Coal Pit Bight [about DM928800], two shafts and a drift (an adit) were dug by a company in the 1840s in search of coal. Milligan (1849) visited the site but could not examine the workings as they were full of water. The main shaft was circular and masonry lined. The coal seam mined from these workings was less than 0.6 m thick and of inferior quality (Hills *et al.*, 1922).

The Kaoota (Sandfly) Coalfield

SUMMARY

The Kaoota Coal Measures are of Triassic age and contain a number of seams up to two metres thick. The coal was worked from 1881 to 1971 with two mines, the Wallsend and the Sandfly, producing most of the coal. The average production from the Sandfly mine, which closed in 1971, was less than 2000 t per year. Four drill holes were drilled by the Department of Mines in 1895–96, a further four by the Department in 1970, and three in 1973. Five holes were drilled as a result of company exploration in 1981. The inferred reserves are very small, probably less than two million tonnes. The potential for the area is limited.

LOCATION AND ACCESS

The Kaoota coalfield is located close to the township of Kaoota, 5 km south of Sandfly, which may be reached via the Southern Outlet Road (23 km from Hobart).

GENERAL GEOLOGY

The geology of the Kaoota area is given in Figure 45. The Kaoota Coal Measures is a lithic sandstone sequence with subordinate mudstone and thin workable coal seams. The sequence contains a Triassic flora (Farmer, 1985). The coal measures belong to the upper division of the Upper Parmeener Supergroup. Below the Kaoota Coal Measures is the quartzose sandstone of the middle division of the Upper Parmeener Supergroup. This is a clean, white, sparkling, quartz sandstone which usually shows massive current-bedding.

The lowest division of the Upper Parmeener Supergroup comprises the Cygnet Coal Measures, but these rocks do not crop out in the immediate area around Kaoota.

Jurassic dolerite has intruded the sediments in the form of dykes and transgressive sheets. Dolerite caps the hill at EN125367, around which mining was first concentrated, and probably underlies the block of country which comprises the coalfield, as deep holes drilled in the area have encountered dolerite at depth. Dolerite talus thickly blankets some slopes.

The area of potential coal reserves is likely to be faulted, as both major mines (the Sandfly and the Wallsend) had their workings interrupted by faulting.

PREVIOUS MINING HISTORY

The Kaoota coalfield has been periodically mined by a number of syndicates since 1876. While there were two major mines in the coalfield, these were made up of a large number of adits, new adits being dug as older adits were abandoned, with the name of the mine remaining the same. The Sandfly mine has had no less than eleven adits; seven adits were named 'No. 3 workings', 'No. 7 workings' etc., while four were named 'No. 1 adit', 'No. 2 adit', etc. The positions of those workings which are known are shown in Figure 45.

James Hurst, lessee of the Saltwater River mine, took out the first lease (911) in the Kaoota coalfield in March 1876 (DOM lease files). He was quickly followed by other eager potential miners; William Montgomerie and Cornelius Denehy took up leases in July 1877, just after Thomas Owen Goldsmith took up a lease in March of that year (DOM lease files). Hurst had grand plans for the area, and together with his solicitor, Lucas, he petitioned the Government asking to be given land

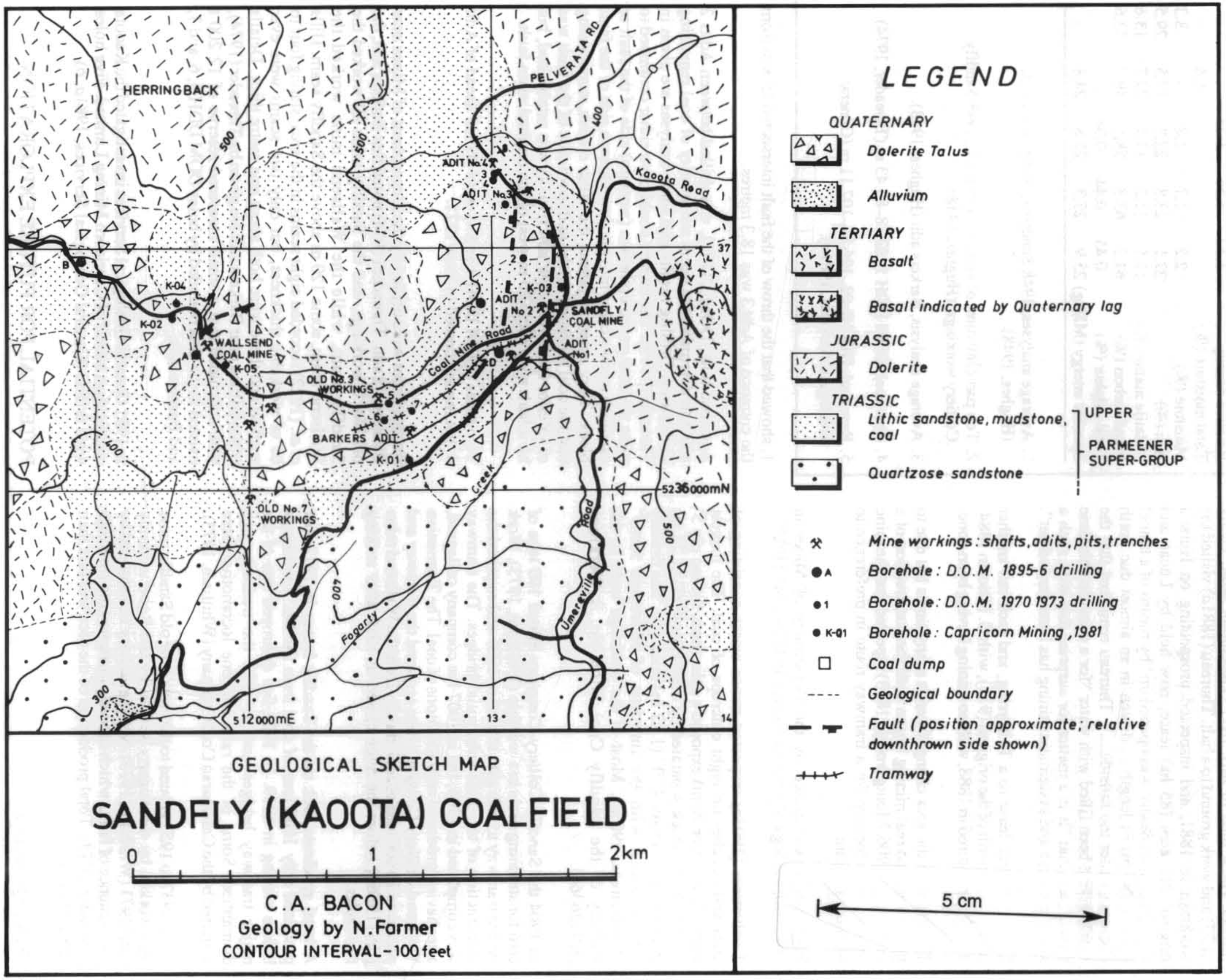

HERRINGBACK
PELVERATA RD
Kaoota Road
ADIT No.4
ADIT No.3
ADIT No.2
ADIT No1
SANDFLY COAL MINE
WALLSEND COAL MINE
OLD No.3 WORKINGS
BARKERS ADIT
OLD No.7 WORKINGS
Coal Mine Road
Creek
Fogarty
Umaraville Road
K-01
K-02
K-03
K-04
K-05
5236000mN
512000mE
13
14
37
300
400
500
GEOLOGICAL SKETCH MAP
SANDFLY (KAOOTA) COALFIELD
0
1
2km
C.A. BACON
Geology by N.Farmer
CONTOUR INTERVAL-100 feet
LEGEND
QUATERNARY
Dolerite Talus
Alluvium
TERTIARY
Basalt
Basalt indicated by Quaternary lag
JURASSIC
Dolerite
TRIASSIC
Lithic sandstone, mudstone, coal
Quartzose sandstone
UPPER
PARMEENER SUPER-GROUP
Mine workings: shafts, adits, pits, trenches
Borehole: D.O.M. 1895-6 drilling
Borehole: D.O.M. 1970 1973 drilling
Borehole: Capricorn Mining, 1981
Coal dump
Geological boundary
Fault (position approximate; relative downthrown side shown)
Tramway
5 cm

Figure 45.

in return for building a tramway to North West Bay (HAJ 1877 33:28). The coal was opened up by means of an adit, work on the tramway started, and a locomotive was built by Alexander Clark at the Excelsior Foundry especially for the project. Hurst died in July 1877 (*Tasmanian Mail*, 7 July 1877) and work ground to a halt. Thureau (1881*a*) visited the workings in 1881, and inspected prospecting on Hurst's original 210 acre (85 ha) lease, now held by Lucas and Gough. 'Hursts Seam' was opened up "by means of a tunnel 80 feet (25 m) in length ... driven in an almost due north direction under the hillside....". Thureau remarked that the working had been filled with water "for a considerable time past..." and that "it is a matter for surprise that with such a seam not more and systematic mining has been carried out".

Lucas sold this lease to a T. Myring, and took out another lease, to the north of the original (911), with G. Elliot in 1884. This lease expired in 1888, with no mining having been done.

The leases in the area changed hands many times but due to poor access no real mining began until the construction of a tramway in 1906. Montgomery (1893) reported that the mine owners were looking for a tramway route in preference to working the mine.

Four holes were drilled by the Department of Mines in 1895–96, the logs of which are given in Hills *et al.* (1922).

Twelvetrees (1903*a*) inspected minor works consisting of adits and trenches on eight outcrops of coal. The longest tunnel (1 chain or 20 m) exposed a split seam, the top ply 5' 0½" (1.54 m) thick separated by a fireclay 4' 0" (1.22 m) thick from the lower 4' 0" (1.22 m) thick ply. The fireclay was "charged with the imprints of Mesozoic ferns" (Twelvetrees, 1903*a*). Most of the workings were in the vicinity of the Sandfly Coal Mine No. 3 Workings [EN126366].

In 1904 the Sandfly Colliery Company mined 100 tons of coal for steaming trials in a warship (Whitham, 1973). Work on the tramway to Margate started in 1905 and required the construction of ten quite substantial bridges. The tramway was completed in 1906, but in 1907 the company collapsed, after having produced only 8500 tons of coal. The Tasmanian Wallsend Colliery Company then acquired the tramway and produced 16 000 tons of coal, mostly from the Wallsend mine [EN119364] before the mine closed in 1910 after striking two faults.

A local syndicate took up the Sandfly leases in 1917, but produced only 1600 tons of coal from the No. 3 workings before closing in 1919. In 1920 fire destroyed one of the major tramway bridges and in 1922 the tramway was dismantled. Some of the rails and one locomotive were acquired by the Catamaran Coal Company (Whitham, 1973).

From 1937 to 1957 ground to the east of the old Sandfly mine was worked by the Fogarty's, then by the Roberts family until 1971 (Whitham, 1973). Mining activity was stopped by the existence of faults which severely disrupted the workings (Threader, 1973). Total production of the area was less than 80 000 tonnes.

COAL QUALITY

Representative analyses of samples from the Kaoota area are given in Table 26.

Table 26. *Analyses of coal samples, Kaoota coalfield.*

	1	2	3	4	5
Relative density	1.52	1.56	1.53	-	-
Total moisture (%)	-	-	-	5.6	-
Moisture (%)	2.2	1.7	1.8	-	3.3
Ash (%)	22.1	23.8	22.3	17.5	29.5
Volatile matter (%)	11.5	11.2	17.4	27.7	13.6
Fixed carbon (%)	64.2	63.3	58.5	49.7	53.6
Total sulphur (%)	0.45	0.44	0.36	-	-
Specific energy (MJ/kg)	25.9	25.3	25.8	24.8	-

1. Average analyses, 1948 Sandfly Colliery workings, (Hughes, 1948).
2. Top part (380 mm) of seam 1.14 m thick, 1948 Sandfly Colliery workings, (Hughes, 1948).
3. Average analysis, Barkers adit (Hughes, 1948).
4. Raw coal, DOM DDH 5, 82.48–83.43 m (Threader, 1974).
5. Raw coal, DDH K-02, 106.34–107.11 m (General Geological Services, 1981*a*).

RECENT EXPLORATION

In 1970 the Department of Mines drilled holes near the No. 3 adit of the Sandfly mine to ascertain the throw of a fault encountered by the mine owners. The first hole, DOM DDH 1, showed that the throw of the fault intersected 15.8 m from the entrance of Adit 3 was 18.3 metres.

A second hole, DOM DDH 2, was drilled between Adits 2 and 3 to determine the depth and quality of coal remaining in this area. Drilling results and some analyses are given in Threader (1973). The owners could have either continued to mine the coal on the upthrown (western) side of the fault or establish a new access into the downthrown side of the fault block. They opted to pursue the latter course, maintaining that the coal remining on the upthrown side of the fault was of inferior quality. A new adit (No. 4) was established, but hit a fault zone some 20 m west of the original main fault.

Two holes (DOM DDH 3 and 4) were drilled ahead of Adit 4, but mining ceased in June 1971.

Further holes were drilled by the Department of Mines near Barkers old adit. Threader (1974) noted that Barkers adit, the old No. 7 workings, and the Sandfly mine all worked the Sandfly seam, while the Wallsend mine worked the Wallsend seam, some 120 m above the Sandfly seam. Hills *et al.* (1922) recorded eight seams in the area, stating four to be of workable thickness, but only two seams were ever worked and these were both about one metre thick. Details of the drilling near Barkers adit are given by Threader (1974), who concluded that a small measured reserve of 12 200 t existed in the area bounded by holes DOM DDH 5, 6, and 7, and Barkers adit.

In 1981 General Geological Services investigated the Kaoota coalfield on behalf of Capricorn Mining Limited. Five holes were drilled (General Geological Services, 1981*a*, *b*).

POTENTIAL FOR FUTURE EXPLORATION

As the main seam worked (the Sandfly seam) was only 0.75 m thick on average and the small areal extent of the coalfield is badly faulted, the prospects for future mining in the Kaoota field are not great. Limited quantities of useful coal are likely to be found in the area around Barkers adit and west of the Sandfly mine adit 4. The *in situ* reserves are classed as very small inferred reserves, probably less than two million tonnes.

The New Town Coalfield

SUMMARY

The New Town coalfield was situated on the foothills of Mt Wellington in the Hobart suburb of New Town (fig. 46). Coal was mined for domestic purposes from a number of collieries last century. The coal was of poor quality and the seams very thin. The coal is of Triassic age. The coalfield is of no economic importance but is of some historic interest due to the early mining activity.

LOCATION AND ACCESS

Thureau (1883*a*) described the coalfield as being located "on the north-eastern slopes of spurs or foothills descending from Mt Wellington". This area is currently a residential district (New Town / Mt Stuart) of Hobart. All adits and shafts are now inaccessible.

GENERAL GEOLOGY

The area of the New Town coalfield has been mapped by Banks *et al.* (1965) and Leaman (1972*b*) as part of much larger mapping projects. The lithic sandstone sequence in which the coal seams occur is confined to a small downthrown fault block, bounded on the east and west by faulted contacts with dolerite, and to the south and north by intrusive dolerite bodies. The coal seams occur in the lithic sandstone sequence, which forms the youngest part of the Upper Parmeener Supergroup, and are of Late Triassic age.

PREVIOUS MINING HISTORY

Coal was discovered in the New Town area in 1827 (*Hobart Town Gazette*, 12 May 1827). A second seam was discovered in 1829 (*Hobart Town Courier*, 9 March 1829). No prospecting work followed these initial discoveries and the field lay abandoned for some years. A shaft was sunk (unsuccessfully) for coal at the Cascades in 1829 (*Colonial Times*, 6 March 1829).

In 1851 the New Town coalfield was rediscovered by Z. Williams (Booth, 1962), who later figured prominently in the development of the Mersey coalfield. In August 1851 the first coal from the area was on sale, being from the Davey mine owned by a Mr Luckman (*Hobart Town Courier*, 9 August, 1851), followed by coal from William's Triumph mine two months later (Booth, 1962). In 1852 Williams was in partnership with R. Collins, and the pair were accused of mining outside the boundaries of their lease to take coal from underneath the Queens Orphan School (now the site of St John Park Hospital). They obtained permission to take this coal on payment of a royalty (Booth, 1962).

In 1852 Williams sold his interest in his Triumph mine to Collins (Booth, 1962) and moved to work in the Mersey coalfield, where after being involved in mining for a time became the publican at Ballahoo Creek, near Tarleton (Ramsay, 1958). Collins accused the owners of the neighbouring Davey mine of taking some of his coal and a Government surveyor was sent to settle the issue. After Collins' death his widow sold the mine to Thomas Holden (Booth, 1962).

A shaft was sunk at the Cascades in 1865 by a Mr Newman on the property of a Mr Delgraves. The shaft was sunk from the floor of a disused quarry, and apart from a few coalified plant fragments no coal was found (Wintle, 1865).

Two German miners, W. Zschachner and W. Glischki applied for a lease near the Queens Orphan School in 1872, as did Ebenezer Sims and James Stuart. Zschachner later opened a mine at Adventure Bay.

Interest in the field dwindled, and by 1876 only two leases were held in the area (Booth, 1962), although interest must have been renewed by 1883, when Thureau inspected a number of collieries working in the area. Thureau (1883*a*) recorded that three mines were in operation at the time of his visit. Mr Tim Meredith's mine was worked by means of a horse whim and a shaft 60 m deep, employing five men and a whim boy; the Enterprise Coal Mining Company's mine consisted of a shaft 33 m deep from which coal was raised after being hewn from a seam 660 mm thick. Steam winding equipment was used at this mine. Ebenezer Sims' coal mine consisted of one shaft, which intersected two seams. From the upper seam, which was 760 mm thick, sixteen tons were raised per week by five miners. The Rosetta and Jarvis mines are mentioned by Thureau (1883*a*), who stated that they were abandoned.

During the 1880s a small mine was run by Dr Benjafield in the vicinity of Benjafield Terrace. Miners were brought out from Wales to operate the mine, but the venture was not a success.

A shaft was sunk in 1886 at Old Beach, just north of Mt Direction on the eastern shore of the River Derwent. A coal seam 600 mm thick was intersected. Johnston (1888) recorded a variety of Triassic plant fossils from shale overlying the seam.

Leases were re-marked over parts of the New Town coalfield in the 1890s. Coal was mined from the old Enterprise mine during 1910 (330 tonnes), 1911 (30 tonnes) and 1912 (25 tonnes). All previously held leases over the New Town coalfield have now expired.

COAL QUALITY

Two analyses are available from this coalfield (Table 27). Both Thureau (1883*a*) and Krause (1884) stated that the coal was of poor quality. The coal is described in Hills *et al.* (1922) as being "... a shaly, fissile, anthracitic variety altered by the metamorphic effects of the diabase intrusive...." and was used solely as a domestic fuel. Krause (1884) described the 'coal' at New Town as "...no seam of coal has been discovered at New Town. The material raised and sold as such is a carbonaceous shale".

RECENT EXPLORATION

Since the closure of the mines worked briefly last century, there has been no further mining activity in the field apart from one episode of mining at the Enterprise colliery from 1910 to 1912. No leases are held in the area and no further interest has been shown in the coalfield.

POTENTIAL FOR FUTURE EXPLORATION

The area of the New Town coalfield is now a residential district and as such is exempt from the provisions of the Mining Act, 1929. The coalfield is of no economic importance.

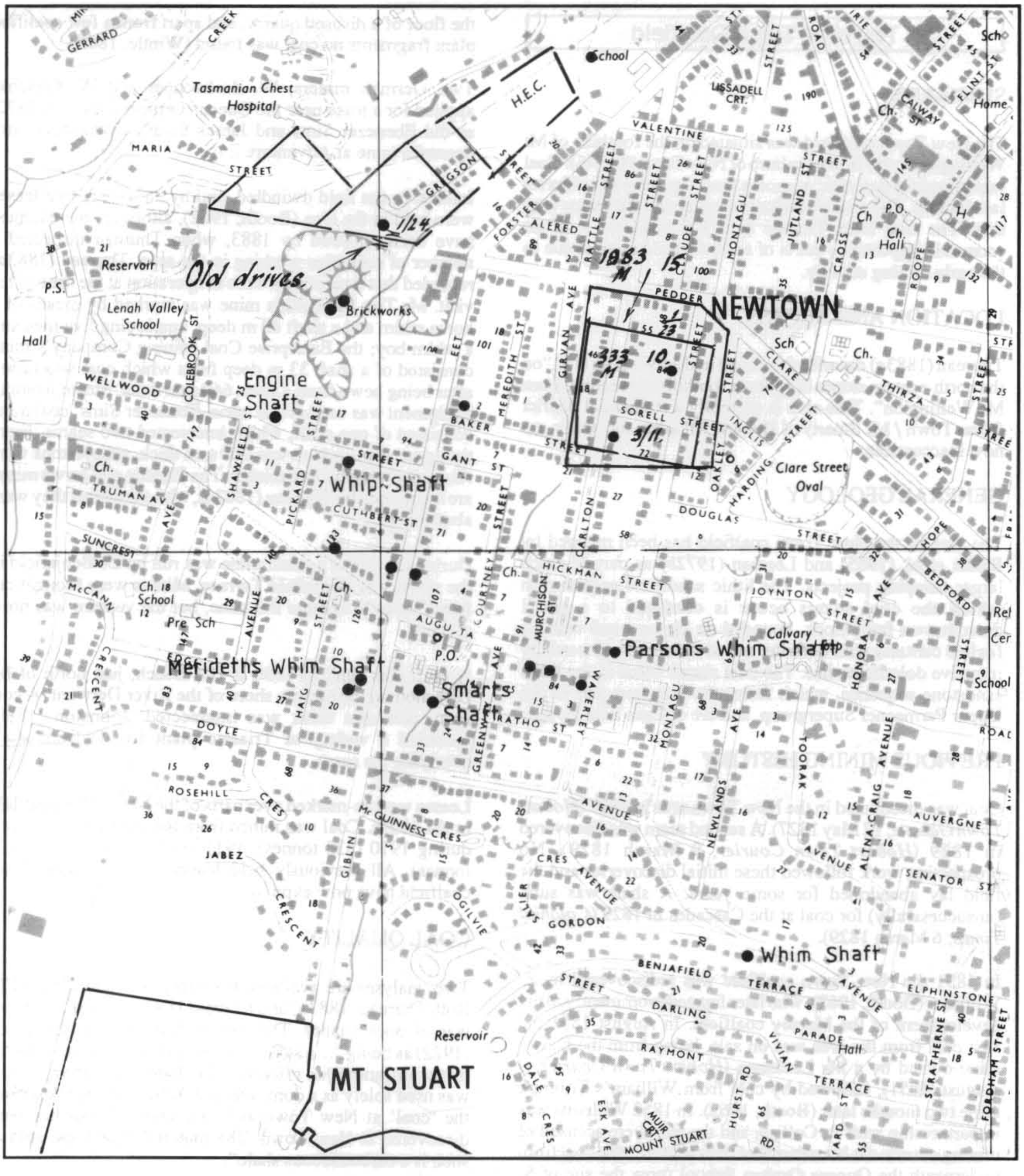


Figure 46. *Map of the New Town area, showing locations of known shafts.*

5 cm

Table 27. *Analyses of coal, New Town coalfield.*

	1	2
Moisture (%)	3.7	8.6
Ash (%)	29.3	16.8
Volatile matter (%)	13.9	15.6
Fixed carbon (%)	53.1	59.0

1. Sample of coal from one of the New Town collieries (Johnston, 1888).
2. Sample of coal from Brock's shaft, Old Beach (Johnston, 1888).

PART 5: THE DERWENT VALLEY COALFIELDS

The Langloh (Lawrenny) Coalfield

SUMMARY

This coalfield, in the Upper Derwent Valley, is of limited lateral extent. The coal-bearing ground is confined to a small fault block, and part of the prospective ground is overlain by Tertiary basalt. A dolerite sill forms a floor to the fault block. Three seams, each 1.0–1.5 m thick, occur in a stratigraphic interval of 4.5–6.0 metres. The top two seams were mined together in underground workings known as the Langloh Colliery from 1938 until 1963. A measured reserve of four million tonnes of *in situ* black coal, suitable for extraction by open-cut mining, has recently been defined. The coal is similar in quality and petrographic character to other Tasmanian Triassic black coals.

LOCATION AND ACCESS

The coalfield is situated in the middle reaches of the Derwent Valley, on the eastern side of the River Derwent between the townships of Hamilton and Ouse. Access is by sealed road from Hobart, a distance of 85 kilometres. Many unsealed secondary roads service the area.

GENERAL GEOLOGY

The coal-bearing ground in the Langloh coalfield is part of a dominantly lithic sandstone sequence interbedded with minor mudstone and coal seams. The sequence is of fluviatile origin and is part of the lithic sandstone sequence of the Upper Parmeener Supergroup. Examination of the microflora from mudstone associated with the coal seams suggests that the sequence belongs to the *Craterisporites rotundus* Zone, and hence is Karnian in age (S. M. Forsyth, pers. comm.).

The lithic sandstone sequence is underlain by a quartzose sandstone sequence which is devoid of coal. The sandstone is confined to a wedge-shaped fault block, bounded on the west by a Tertiary graben and to the east and south by Jurassic dolerite. The geology of the area is shown in Figure 47.

Jurassic dolerite has intruded the sandstone sequence and now forms a 'floor' to the fault block, as drill holes in the coalfield have encountered dolerite at depth. This underlying dolerite sill dips at 4° towards the south. Tertiary basalt flows cover the lithic sandstone sequence to the north, and a basalt neck occurs on the western margin of the coalfield. This basalt neck or plug is related to a system of faults, the largest of which defines the eastern edge of the Tertiary graben (Morrison and Bacon, 1986).

COAL GEOLOGY

Three coal seams exist in the coalfield. The seams are 1.0–1.5 m thick and usually show abrupt, non-erosional roof and floor contacts, although in some intersections the upper seam (A) has an erosional top marked by a mud-pebble conglomerate which filled scours in the underlying peat. The three seams are separated by grey silty mudstone units. The mudstone between seams A and B is typically 200 mm thick, while the mudstone between seams B and C is usually 1.0–1.5 m thick (Morrison and Bacon, 1986). The top two seams were worked together with the intervening mudstone band in the old Langloh Colliery.

PREVIOUS MINING HISTORY

Selwyn (1855) inspected a 0.3 m thick outcrop of coal 11 km above New Norfolk (near Plenty) and commented that a seam of coal 2.5 m thick was known to crop out near Hamilton. The coal in the area was rediscovered when a well was sunk through sandstone for water near the Langloh Park homestead, and some small-scale mining activity followed. Thureau (1883*b*) recorded that the well was sunk "years ago" and whilst no mining was in progress at the time of his visit miners, who had some years previously extracted small quantities of coal for domestic and other purposes, supplied the information that the seam was 1.07 m thick and 12.2 m below the ground surface. Thureau recommended that the area be drilled to determine the quality and quantity of coal available.

In 1891 the well (or shaft) was enlarged, and a quantity of coal was raised and sent for analysis and practical testing by various consumers of coal, such as the railways. Four holes were drilled in the coalfield in 1892. The logs are given in Montgomery (1894) and again in Hills *et al.* (1922).

By 1922 the prospecting activity in the area consisted of two shafts. One was the old enlarged well, and the second a shaft which had been sunk near the Kimbolton homestead.

Mining by the Langloh Coal Mining Company commenced in 1938. The initial attempt to open a mine was by development from the shallow shafts, but this approach was quickly abandoned in favour of driving a dip tunnel into the seam. The leases, held by H. E. Brock for the Langloh Coal Mining Company, were transferred to M. E. Gorringe for the Hamilton Coal Company in December 1942. Mining was continued by the latter company until 1963.

Two diamond-drill holes were drilled in the coalfield in 1939, eight between the years 1944 and 1946, and three in the period 1955–1956 as an aid to mine planning.

Mining was by the bord and pillar method and the coal was used in local industry, by the railways, and as a domestic fuel. The mine employed between four and twelve men and produced between 2000–8000 tonnes of coal per year. As the workings were fairly shallow, percolating water from the ground surface was a continual problem. The montmorillonite-rich mudstone forming the roof and floor of the seam reacted with water to produce difficult mining conditions for most of the life of the mine.

COAL QUALITY

The Langloh coal is similar in quality to Triassic coals found elsewhere in Tasmania. Montgomery (1894) recorded details of various tests made on the Langloh coal, and commented favourably on the results of trials of the coal in steam-raising purposes for industrial use. A number of analyses of coal from this area are given in Table 28.

Tests on core from the 1939 drilling showed a yield of 2.8 gallons (12.7 litres) of crude oil per ton of coal from a sample from DDH 1 (1939) Seam No 1 (2.3 m thick). Fusibility of the ash of the coal was also determined on the 1939 core samples and found to range from 1250°C to above 1350°C.

Petrographic analysis of coal from this area shows that the environment of peat deposition was similar to that of other Tasmanian Triassic black coals. The coal is rich in inertinite, with minor vitrinite and cutinite. In some parts of the coalfield the coal has been heat-affected by intrusive Jurassic

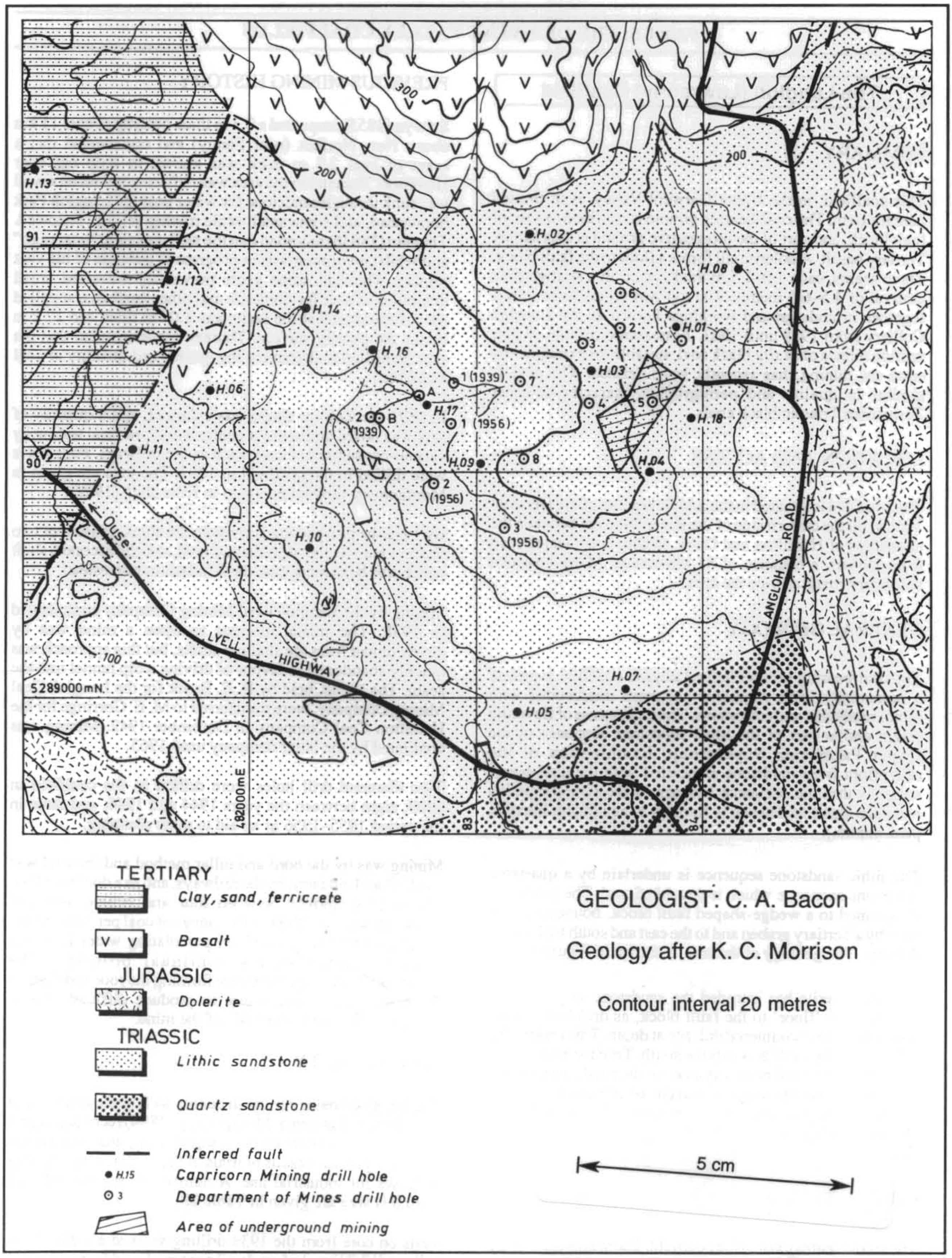


Figure 47. *Geological sketch map of the Langloh (Lawrenny) coalfield.*

Table 28. *Analyses of coal samples, Langloh coalfield.*

	1	2	3	4	5	6	7
Moisture (%)	4.8	5.2	2.64	2.11	2.94	2.04	4.0
Ash (%)	20.3	15.5	20.24	19.06	30.60	18.14	6.2
Volatile matter (%)	24.5	23.2	17.26	24.32	24.36	24.90	23.5
Fixed carbon (%)	50.4	56.1	59.86	54.51	42.10	54.92	66.3
Total sulphur (%)	0.3	-	0.37	0.38	0.59	0.35	-
Chlorine (%)	0.02	-	-	-	-	-	-
Phosphorous (%)	0.003	-	-	-	-	-	-
Specific energy (MJ/kg)	23.6	-	25.7	25.9	21.4	26.6	-

1. Bulk sample (unwashed coal); excavated from trial pit, 1985.
2. Sample from the Main Heading (not whole seam) collected in 1959.
3. DDH 1 (1939), Seam No. 2 (1.37 m thick).

4–6. Ply samples from various seam sections throughout the mine, collected in 1943.

7. Analysis of coal from shaft (Montgomery, 1894).

dolerite and the rank of the coal raised slightly. Mean maximum vitrinite reflectance of the coal varies from 1.0–3.3% as a result of this heating. Fingal coal has a mean maximum vitrinite reflectance in the order of 0.55–0.60% (Morrison and Bacon, 1986).

RECENT EXPLORATION

An exploration programme was conducted over the coalfield from 1979 to 1984 to determine the quality and quantity of coal in the area. A measured reserve of four million tonnes of coal suitable for extraction by open-cut mining has been determined over part of the coalfield. Additional reserves suitable for underground extraction exist in the coalfield but as yet have not been brought up to measured reserve status. Currently this coalfield is held under Exploration Licence 29/79 by Capricorn Mining Pty Ltd.

POTENTIAL FOR FUTURE EXPLORATION

Although of limited areal extent the coalfield has the potential to support a small-scale mining operation. The coal is similar in quality to other Tasmanian Triassic black coals, and the seam is remarkably free of dirt bands. This coalfield has considerable potential for further development.

The Mt Lloyd Coalfield

SUMMARY

Four thin coal seams have been recorded in the Mt Lloyd area. None have been worked extensively. The reserves are very small, the ground faulted, and prospects for future exploration are limited.

LOCATION AND ACCESS

The Mt Lloyd coalfield lies on the western flank of Mt Lloyd [DN967562], about 13 km south-west of New Norfolk, which is situated on the banks of the River Derwent and 32 km by road from Hobart. Few access tracks exist around Mt Lloyd.

GENERAL GEOLOGY

The coalfield has been examined by Burns (1959), when two holes were drilled, and was mapped in more detail by Gulline (1959) to define areas of coal-bearing potential. The coalfield has recently been remapped (Summons, 1985*a*; Forsyth and Bacon, 1987). The geology of the area is shown in Figure 48.

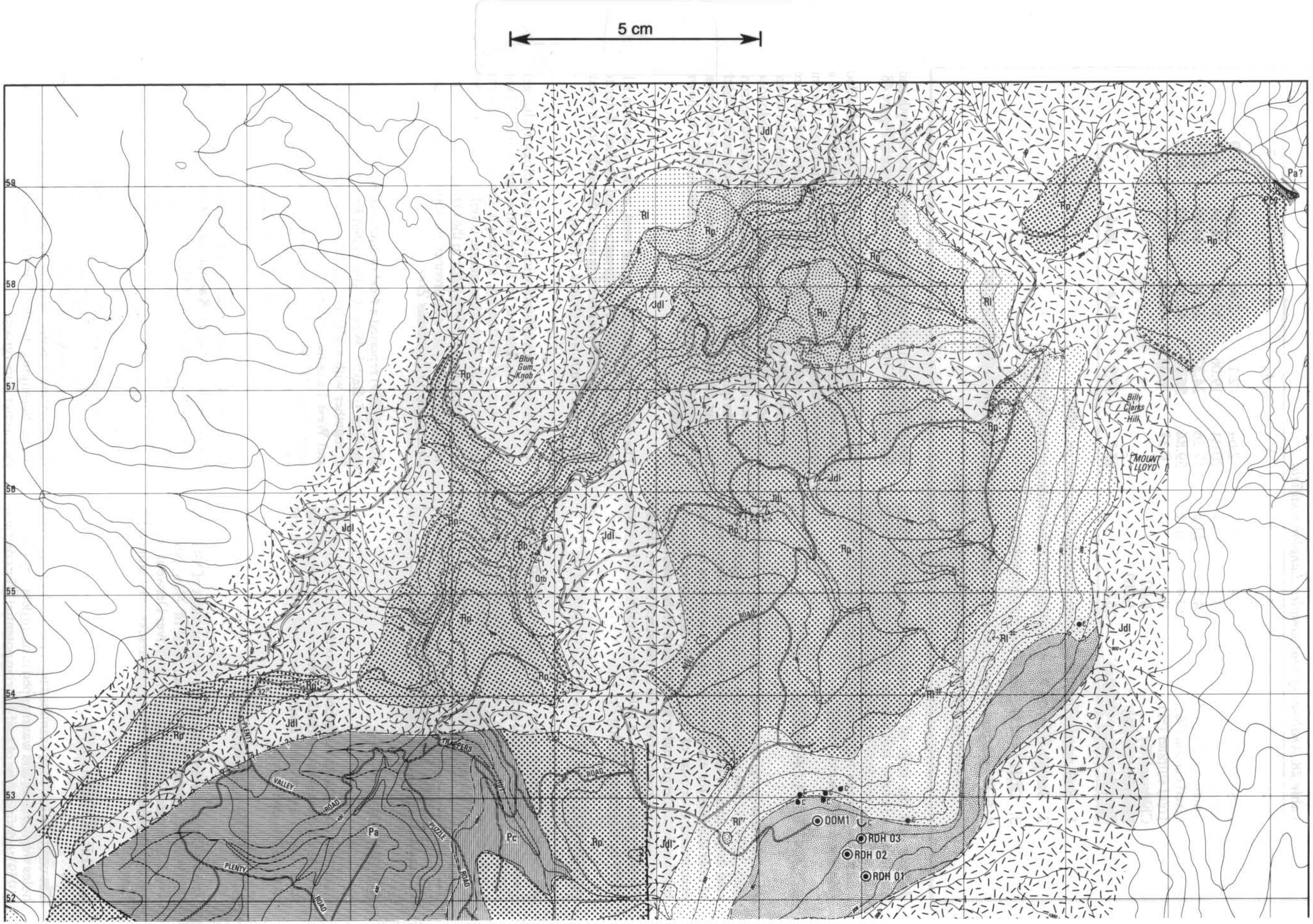
The coal seams occur in a fluviatile sequence of interbedded lithic sandstone, mudstone and siltstone which overlies a quartzose sandstone ('Ross Sandstone' equivalent). Recent field inspections, and palynological investigation of the core of the two 1959 Department of Mines diamond-drill holes, have shown that the lithic sandstone unit can be subdivided further to differentiate the coal-bearing lithic sandstone from the underlying quartz-rich sublitharenite sequences which are either devoid of or poorly endowed with coal resources. The revised stratigraphy (Forsyth and Bacon, 1987) is shown in Figure 49.

The whole sequence dips to the west, under a dolerite sill capping Mt Lloyd. Transgressive and faulted dolerite contacts bound the coal-bearing area to the north, north-west, south, and south-west (Burns, 1957*a*).

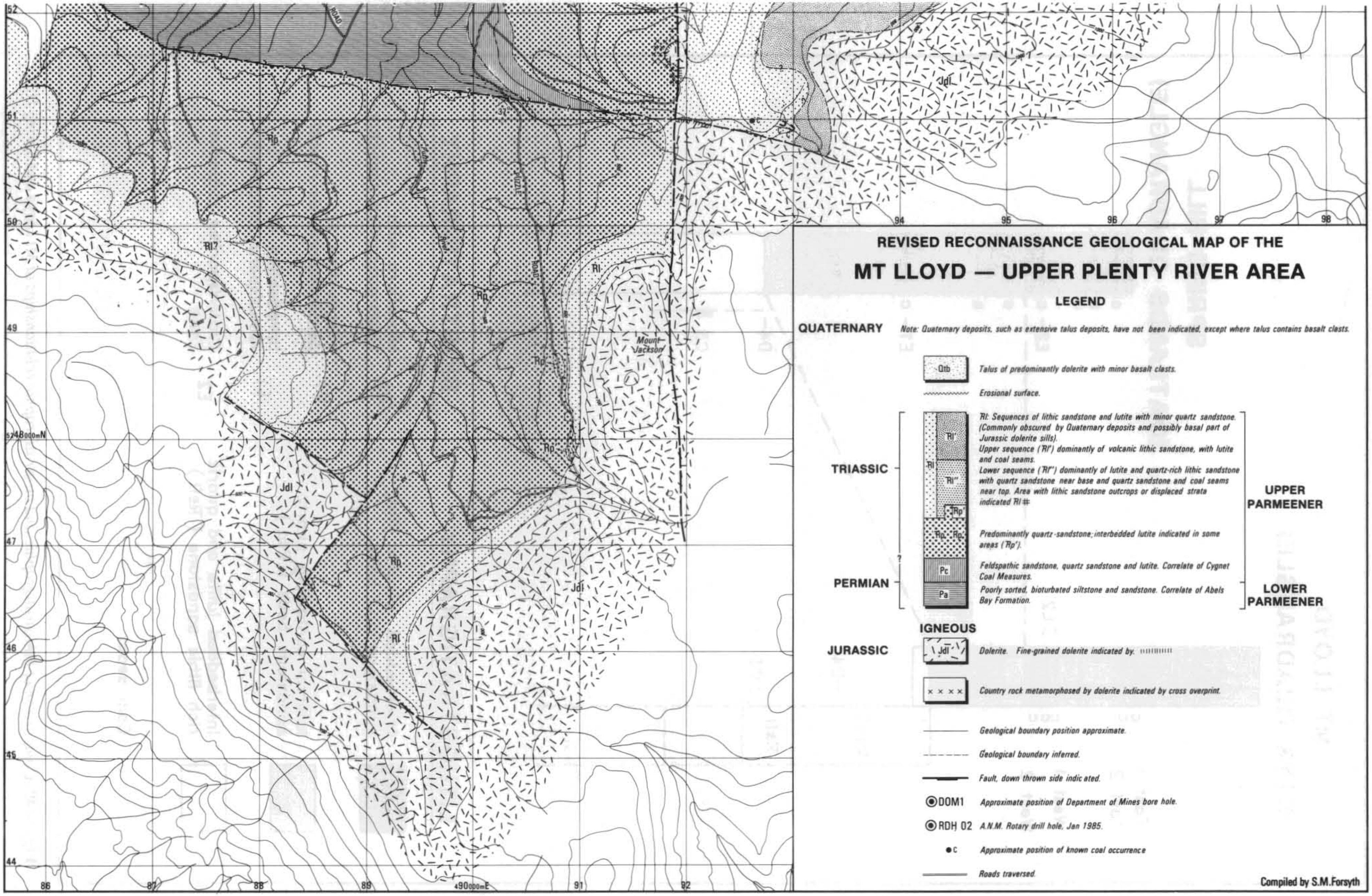
A similar sequence of lithological and palynological changes occur in the sequences at Mt Lloyd and at Spring Hill (15 km south-west of Oatlands), although the unit of quartz sandstone, lutite and lithic arenite is only 30 m thick at Mt Lloyd compared to 100 m thick in the Oatlands area. In both areas, the main coal occurrences lie above the base of the *Craterisporites rotundus* Zone.

Burns (1959) reported a total of four coal seams in the area; the East l, East 2, West 1 (also called East 3), and the West 2; together with a 150 mm thick 'seam' between the East 2 and West 1 seams. Gulline (1959) recorded a 0.56 m thick seam from the Mt Lloyd area which was not previously recorded. This seam does not appear to be extensive. All four major seams are less than one metre thick.

Earlier workers have tried to correlate the four seams at Mt Lloyd with seams at Kaoota and Hamilton, using the eight-seam classification of Hills *et al.* (1922). Burns (1959) correlated the seams at Mt Lloyd with those at Sandfly, concluding that East 1 = gamma; East 2 = eta; six inch (150 mm) = theta; West 1 = iota; and West 2 = kappa. On this basis he concluded that "two seams, alpha and beta, which may be of economic importance, are as yet undiscovered". The scheme of Hills *et al.* (1922) is far too simplified to be useful, and the seams at Mt Lloyd are totally unrelated to those at Hamilton and Sandfly, save for the fact that they all occur in rocks belonging to the Upper Division of the Upper Parmeener Supergroup.



5 cm
Jdl
Rl
Rp
Pa?
Blue Gum Knob
Billy Clerks Hill
MOUNT LLOYD
Qtb
PLENTY
VALLEY
ROAD
TRAPPERS
HUT
PUZZLE
Pa
Pc
DOM1
RDH 03
RDH 02
RDH 01
59
58
57
56
55
54
53
52



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: 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 #
Predominantly quartz-sandstone; interbedded lutite indicated in some areas (Rp').
UPPER PARMEENER
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 indicated.
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
Mount Jackson
5248000mN
490000mE

Figure 48.

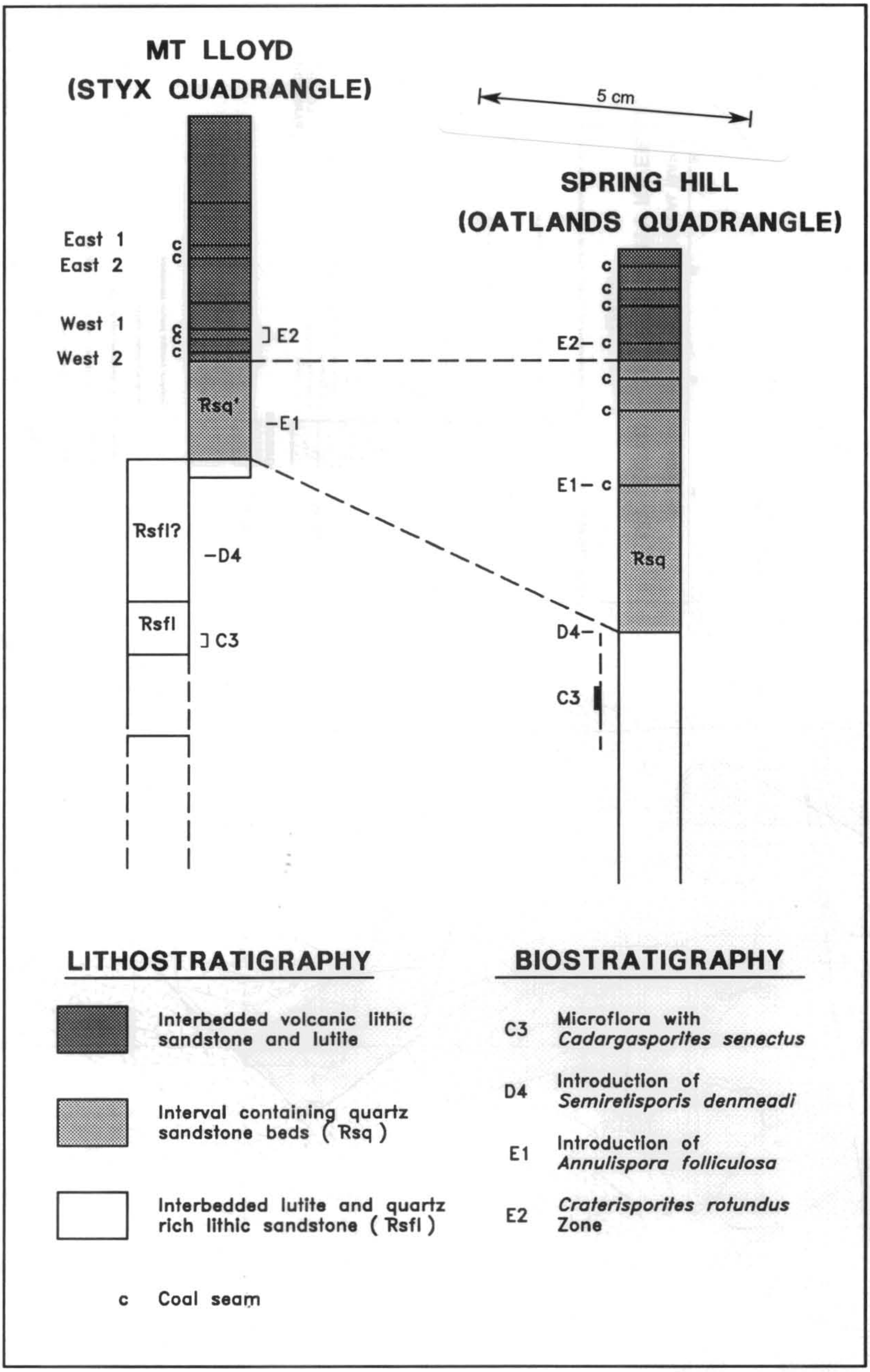


Figure 49. *Comparison of lithostratigraphic and biostratigraphic relationships at Mt Lloyd and Spring Hill.*

Petrographically the coal is similar to other Tasmanian Late Triassic black coal, being rich in inertinite (60–80%) with very small quantities of liptinite (1–2%) and vitrinite (11–18%). The coal macerals are largely derived from woody material which accumulated in a 'dry' forest swamp environment.

PREVIOUS MINING HISTORY

No actual producing mine is known to have existed on the Mt Lloyd coalfield, although prospecting works consisting of a number of pits, trenches and an adit 40 feet (12.19 m) long are recorded by Hughes (1955*d*). Two adits are marked on a plan prepared by Burns (1959). The adits have collapsed and are no longer visible.

Some coal is known to have been 'mined' by digging into outcrops. A series of pits and trenches, called 'Teakles workings', were being excavated in 1983. Five trenches were dug into the outcrop of the East 1 seam over a distance of 200 metres.

COAL QUALITY

The coal is dull, with few bright bands. The quality of the coal is fair, with the ash ranging from 22–29% for whole seam sections. The seams are very thin, usually less than one metre thick. Part of the seam exposed in trenches at 'Teakles workings' has burnt *in situ*, leaving a white-pink porous, chunky ash, in which the original banding of the coal can be clearly seen. Representative analyses of coal from the Mt Lloyd area are given in Table 29.

RECENT EXPLORATION

The Department of Mines drilled two holes through the coal measure sequence in 1959. The logs and analyses of the coal are given in Burns (1959). A mining lease (38M/53) was taken out in 1953 by Mr L. Teakle over an area around Crosswells Flat. This mining lease is still current. Prospecting activities and limited mining of the coal (chiefly digging coal from outcrop) have been intermittent on the lease for the past twenty-five years. The paper manufacturer Australian Newsprint Mills periodically took samples from the field between 1955 and 1972, including one four-tonne sample in 1957 and a twenty-five tonne sample in 1958. The analytical results are given in Parbury (1986) although the locations from which most of the samples were taken are not known.

Exploration Licence 27/79 (Capricorn Mining Ltd) originally covered a large area including the Mt Lloyd coalfield; this was subsequently reduced after literature studies. Marathon Petroleum Australia Ltd took out EL 40/83 over a large area including the Mt Lloyd area, but this was relinquished after brief reconnaissance and a Landsat interpretation of the area had been made.

In 1985 Northwest Bay Pty Ltd took out EL 1/85 over Mt Lloyd, and transferred this lease to Australian Newsprint Mills. Three holes were drilled; two were abandoned in scree and the third was drilled on Mr Teakle's lease on Crosswells Flat. Currently the coalfield is covered by Mining Lease 38M/53 held by L. Teakle, and Exploration Licence 7/86 held by Conga Oil Pty Ltd.

POTENTIAL FOR FUTURE EXPLORATION

Because of the thin nature of the coal seams, the apparent limited area of potential reserve, the rugged terrain and number of known faults, the future of the coalfield is limited. The most promising areas for further investigation (Gulline, 1959) are those known as northern flat and southern flat, south of the Mt Lloyd township. The inferred reserves of the area are very small.

Minor coal areas in the Derwent Valley

MACQUARIE PLAINS

An adit and a number of shafts were sunk earlier this century into outcrops of coal in the vicinity of the (now defunct) Macquarie Plains railway station (Hills *et al.*, 1922)

PLENTY

An outcrop of coal 600 mm thick in the bed of the River Derwent "two miles (3.2 km) beyond (the now defunct) Plenty railway station" was examined in 1922. No mining in this area appears to have eventuated (Hills *et al.*, 1922), although returns of coal transported published in the annual reports of the Tasmanian Government Railways show that 612 tons of coal were loaded at Plenty station in the years 1898 and 1899, suggesting that some coal may have been mined in this area.

Table 29. *Analyses of coal samples, Mt Lloyd coalfield.*

	1	2	3	4	5	6	7
Moisture (%)	4.6	3.1	3.1	2.9	8.0	2.0	1.7
Ash (%)	29.0	23.7	29.5	22.6	23.0	9.3	31.4
Volatile matter (%)	15.9	15.0	15.0	14.3	29.9	20.1	17.6
Fixed carbon (%)	50.5	58.2	52.4	60.2	39.1	68.6	49.3
Total sulphur (%)	0.28	0.39	0.27	0.45	0.34	0.38	-
Specific energy (MJ/kg)	22.0	25.0	23.0	25.5	20.7	-	-

1. East 1 seam, 0.89 m thick; 1959 drilling (Burns, 1959).
2. East 1 seam, 0.99 m thick; 1959 drilling (Burns, 1959).
3. West 1 seam, basal 0.99 m of seam 1.14 m thick (Burns, 1959).
4. West 2 seam, 0.33 m thick; 1959 drilling (Burns, 1959).
5. West 2 seam, 0.51 m thick; 1959 drilling (Burns, 1959).
6. West 1 seam, Teakles workings; collected 1984.
7. West 2 seam, Teakles workings; collected 1984.

PART 6: THE SOUTHERN MIDLANDS COALFIELDS

The Bagdad–Kempton Coalfield

SUMMARY

A few scattered outcrops of poor-quality coal can be found in the lithic sandstone sequence of the Upper Parmeener Supergroup in the Bagdad area. North of Kempton, a Department of Mines diamond-drill hole intersected a 2.3 m thick seam of coal of good quality. There has been no production from any of these minor coal occurrences.

LOCATION AND ACCESS

The Bagdad–Kempton 'coalfield' is situated between the towns of Bagdad [EN182800] and Kempton [EN910163], which are 39 km and 49 km respectively by road from Hobart. Access is from the Midland Highway and numerous secondary roads which traverse the area.

GENERAL GEOLOGY

The geology of the area has been mapped by Leaman (1975*b*). The fluvial lithic sandstone sequence of the Upper Parmeener Supergroup crops out in scattered localities throughout the area. Coal crops out in a number of road cuttings on the Midland Highway between the two towns although no outcrops suitable for sampling were found during a field inspection. The coal is invariably weathered, banded and of poor quality.

Coal intersected in a drill hole in the area (DOM Mt Vernon DDH 1) was examined petrographically, and found to be similar to other Tasmanian Late Triassic coals, being composed largely of inertinite (68%; primarily semifusinite and inertodetrinite) with minor amounts of exinite (7%) and vitrinite (22%). The petrographic composition is shown in Figures 50 and 51.

PREVIOUS MINING HISTORY

No mining activity has been recorded in this area. Outcrops of coal in road cuttings were noted by Hills *et al.* (1922).

COAL QUALITY

Few coal analyses are available from this area. A detailed analysis of coal from drill hole DOM Mt Vernon DDH 1 is given in Table 30.

Table 30. *Analyses of coal samples, Bagdad–Kempton area*

	1	2	3
Relative density	-	1.37	
Total moisture (%)	18.46	-	4.66
Moisture (%)	-	7.1	-
Analysis basis (AD)			
Ash (%)	23.94	14.5	12.08
Volatile matter (%)	23.74	27.2	26.17
Fixed carbon (%)	23.86	58.3	57.09
Total sulphur (%)	0.32	0.43	0.01
Specific energy (MJ/kg)	-	28.16	-
Carbon dioxide (%)	-	0.82	-
Dry, ash-free basis			
Specific Energy (MJ/kg)	-	32.94	-
Carbon (%)	-	82.7	-
Hydrogen (%)	-	4.50	-
Nitrogen (%)	-	1.47	-
Sulphur (%)	-	0.51	-
Oxygen (diff.) (%)	-	10.82	-

1. Spot sample of weathered, wet coal from outcrop (Hills *et al.*, 1922)..
2. Whole seam sample, raw coal, seam 2.3 m thick, DOM Mt Vernon DDH 1, from 204.30 m.
3. Spot sample from "Kempton road cutting", no exact location given (General Geological Services, 1981*a*).

RECENT EXPLORATION

In 1982 the Department drilled one hole (DOM Mt Vernon DDH 1) near Kempton as part of a gravity survey. Several

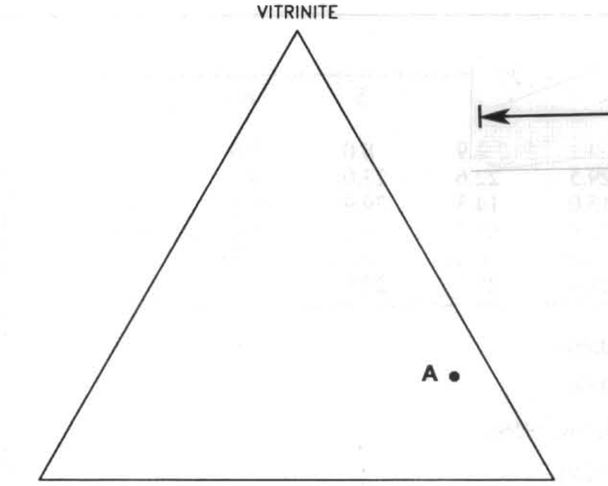


Figure 50. *Maceral composition, Mt Vernon DDH 1, Seam A.*

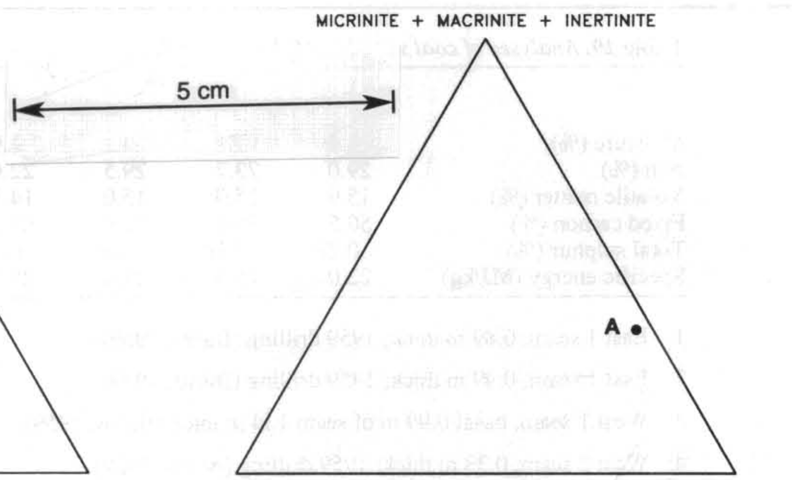


Figure 51. *Inertinite components, Mt Vernon DDH 1, Seam A.*

coal seams were intersected in this hole. Details of the seam intersections are given in Bacon (1983*b*).

The Kempton area was covered by EL 28/79, taken out by Capricorn Mining Ltd, and then by EL 19/82, taken out by CRA Exploration. No holes were drilled in EL 28/79, although a 'spot' sample of coal was taken from a road cutting near Kempton and analysed. The proximate analysis, in particular the very low ash value of 12%, hints at some similarity with the seam encountered at 200 m depth in DOM Mt Vernon DDH 1, although given the difference in altitude above sea level, the two occurrences are probably separated by a fault/s. The lateral extent of this low-ash coal is not known.

Several chip holes were drilled in EL 19/82 near Kempton by CRA Exploration. Details of the hole locations and a discussion of the exploration is given in Summons (1984).

Four holes (KP-08, KP-09, KP-10, KP-11) were drilled south of Kempton, and three (JC-09, JC-10 and JC-11) were drilled north of Kempton, near Melton Mowbray. Thin coal seams (mostly 0.5–1.0 m thick) were intersected in some of these holes, but no reserves were established and the licence has been relinquished.

POTENTIAL FOR FUTURE EXPLORATION

The potential of this coalfield to yield reserves of coal of economic importance is small. However the 2.3 m thick seam encountered in DOM Mt Vernon DDH 1 is of interest due to the surprisingly good quality of the coal. The lateral extent of this seam is not known, but as the geology of the area is broken into many small blocks by faulting, the potential for an economic reserve of coal would be small.

The Colebrook (Jerusalem) Coalfield

SUMMARY

Coal was discovered in the headwaters of the Coal River north of Colebrook (Jerusalem) in 1813. Mining on a small scale has occurred in two areas north of Colebrook, one at Coalmine Bend and the other on the west bank of Wallaby Rivulet (fig. 52). The early mining activity at Coalmine Bend, from 1842 until 1844, used convict labour. Coal was mined from this locality again from 1879 until 1890. Mining near Wallaby Creek commenced in 1891 and continued intermittently until 1921, with the same set of workings being frequently renamed.

The coal is of Triassic age and is part of the fluvial sequence at the top of the Upper Parmeener Supergroup. The area is is of limited interest for further exploration.

LOCATION AND ACCESS

Coal has been mined from two areas around the town now known as Colebrook (fig. 52). The area was originally known as Jerusalem and was still occasionally referred to by this former name in the 1950s. This rather biblical name, along with others such as Jericho, Bagdad, and Jordan, were bestowed by Hugh Germain, a private in the Royal Marines who arrived with Collins in 1804. Germain, with a companion Jorgen Jorgensen, used to go on kangaroo hunting expeditions in the lower Midlands area, taking with them only two books, the "Arabian Nights" and "The Bible", to while away the campside hours (Stancombe, 1968).

The name Colebrook is derived from an old property in the district, being a land grant from Governor Franklin and called 'Colebrook Dale'.

The first discovery of coal, and subsequent mining operations, were at Coalmine Bend [EN294946] on Coalmine Creek, four kilometres north of the town of Colebrook. Coalmine Creek is a tributary of Wallaby Rivulet, which in turn flows into the Coal River. The second phase of mining near Colebrook was in the area adjacent to the railway line on the west bank of Wallaby Rivulet, one kilometre north of Colebrook township [around EN292917].

Access to this coalfield is provided by a network of sealed and unsealed roads.

GENERAL GEOLOGY

The area around Colebrook (Jerusalem) has been examined by Strzelecki (1845), Milligan (1849), Gould (1869), Nye (*in* Hills *et al.*, 1922) and more recently by Leaman (1971, 1975*b*).

The coal occurs as thin seams in a sequence of lithic sandstone with minor lutite intervals. This rock type forms the uppermost (youngest) part of the Upper Parmeener Supergroup, and overlies a series of interbedded quartz and lithic sandstones with varying amounts of lutite.

The sedimentary sequence has been intruded by Jurassic dolerite, which now caps the surrounding hills, and the area has been greatly disturbed by faulting. Each area in which coal has been mined occurs in a down-faulted graben of the coal-hosting lithic sandstone. To the east and west in both areas the host rock type is faulted against older, quartz-rich sandstone. The geology of the area is shown in Leaman (1971, 1975*b*).

PREVIOUS MINING HISTORY

Seams of coal were found in the headwaters of the Coal River in 1813, in the district later called Jerusalem and now known as Colebrook (Besford, 1958). These seams were rediscovered by James Clare in 1841, and in 1842 Clare supervised the sinking of a shaft (at Coalmine Bend) on behalf of the Government (Booth, 1962). Government Surveyor Jones was sent to inspect the workings in 1844. Jones found four outcrops of coal, on one of which was located mine workings consisting of a drift (adit) 100 m long and a shaft 12 m deep (CSO 8/108/2279, 15 January 1844). Jones sent a list of equipment needed to open the mine to the Colonial Secretary (CSO 8/108/2279, 25 January 1844), and work started in March of that year, although by August the operation had closed and the convict workers withdrawn (CSO 8/108/2279, 11 March 1844; 21 August 1844)

Strzelecki (1845) noted the occurrence of coal near Jerusalem, and a detailed description of various outcrops and mine workings was given by Milligan (1849).

The workings at Coalmine Bend are described by Milligan (1849) as consisting of a drift (adit) 1.8 × 1.8 m and 120 m long, with various galleries branching off from the main heading and a shaft 12 m deep near the drift. Various other exploratory shafts and minor drives in the area were examined by Milligan. All workings were abandoned at this time.

Selwyn (1855) described the coal near Richmond but did not visit the Colebrook (Jerusalem) area. Gould (1869) inspected various outcrops of coal in the Colebrook (Jerusalem) area but no mining was in progress at the time of his visit. Gould sank one shaft and two bore holes in the vicinity of the Coalmine Creek workings.

In 1862 Zephaniah Williams (a convicted chartist, transported for life to Van Diemens Land and who was later

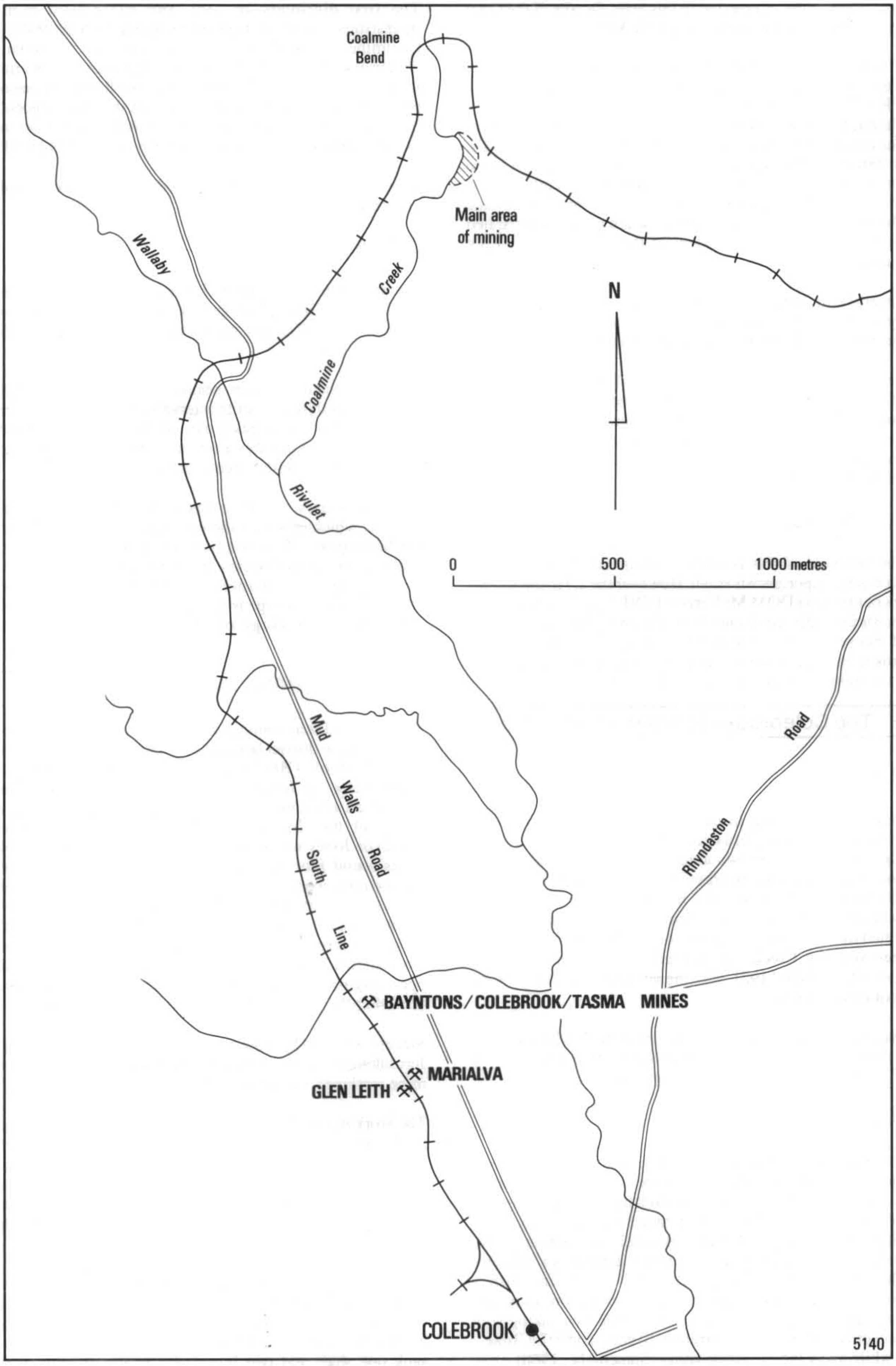


Figure 52. *Location of coal mines in the Colebrook district.*

involved with the New Town and Mersey coalfields) was directed by W. R. Falconer (of the Public Works Department) to get ten tons of coal from the seam at Coalmine Bend. Williams found the coal to be of poor quality, writing to Falconer: ".... I deem it incumbent to inform you of the state of the coal I am instructed to get 10 tons from. The seam is altogether three feet thick; but it will scarce produce two feet of clean coal. I never was more deceived than to-day; for on cutting into the seam I found it full of hard stone and of iron pyrites distributed throughout which in reality makes it good for nothing except for kitchen purposes, as it is quite impossible, without breaking the coal to pieces, to clean it. This is the coal there has been so much writing in praise of the most worthless seam of coal I ever saw. It contains some good coal. However I shall continue working it till I hear from you. In consequence of so much stone and iron pyrites scatted through it, it is very expensive getting and we can scarcely get tools to stand the cutting, in fact it is a seam that never will be worked for any purpose. Awaiting your answer with the utmost impatience".

No mining activity resulted from this 1862 inspection of the coal. However, in 1879 work began again at Coalmine Bend, the mine being known as the Jerusalem Colliery. This operation closed in 1890, although a small quantity of coal was extracted in 1894.

Additional mining activities occurred towards the town of Colebrook, on the western bank of Wallaby Rivulet (which runs into the Coal River). A bore hole was sunk in this area by the Government in 1891. The log of this hole is given in the Annual Report of the Secretary of Mines for 1891–92 and also in Hills *et al.* (1922). Three seams of coal were intersected in this bore, the thickest being 860 mm thick.

A shaft was sunk near to this bore hole, and the three seams worked. The colliery was known as Baynton's, and produced coal from 1892 to at least 1897. To the south of this mine, and on the western side of the railway, a Mr Morrison sank a shaft and named the meagre workings the Glen Leith Colliery. Coal was being produced here in 1902. In 1903 a shaft was sunk about 70 m north of the Glen Leith mine, but on the eastern side of the railway, by the Marialva Coal Mining Company NL, who in the same year took over Morrison's Glen Leith mine. However operations at the Marialva mine ceased in 1904. In 1911, a piece of ground on the eastern side of the railway line was worked by a party of twelve men for a few months. Access was gained by means of the Baynton's main shaft, and these workings were called the Colebrook Coal Mine. The venture lasted only a few months, with only 482 tons of coal being mined.

In 1919 the old Baynton's mine was reopened and renamed the Tasma Colliery. Three seams were worked, as before. Mining ceased in 1921. The exact dates of operation of the various mines, and the amount of coal produced, are not clear because of the incomplete and sometimes conflicting nature of the remaining records (Department of Mines Annual Reports 1901–1921; Tasmanian Government Railways Annual Reports; Department of Mines Underground Mine Plans 282, 223, 380).

COAL QUALITY

Representative analyses of coal from the Colebrook area are given in Table 31.

RECENT EXPLORATION

The Colebrook area was covered by EL 28/79 taken out by Capricorn Mining Ltd and later by EL 18/82, taken out by CRAE. These licences have now been relinquished. Two diamond-drill holes were drilled near Colebrook (O-07, O-09) by Capricorn Mining Ltd. The logs of these holes are given in Capricorn Mining Ltd (1982). Only very minor seams (less than 0.5 m thick) were encountered in these holes.

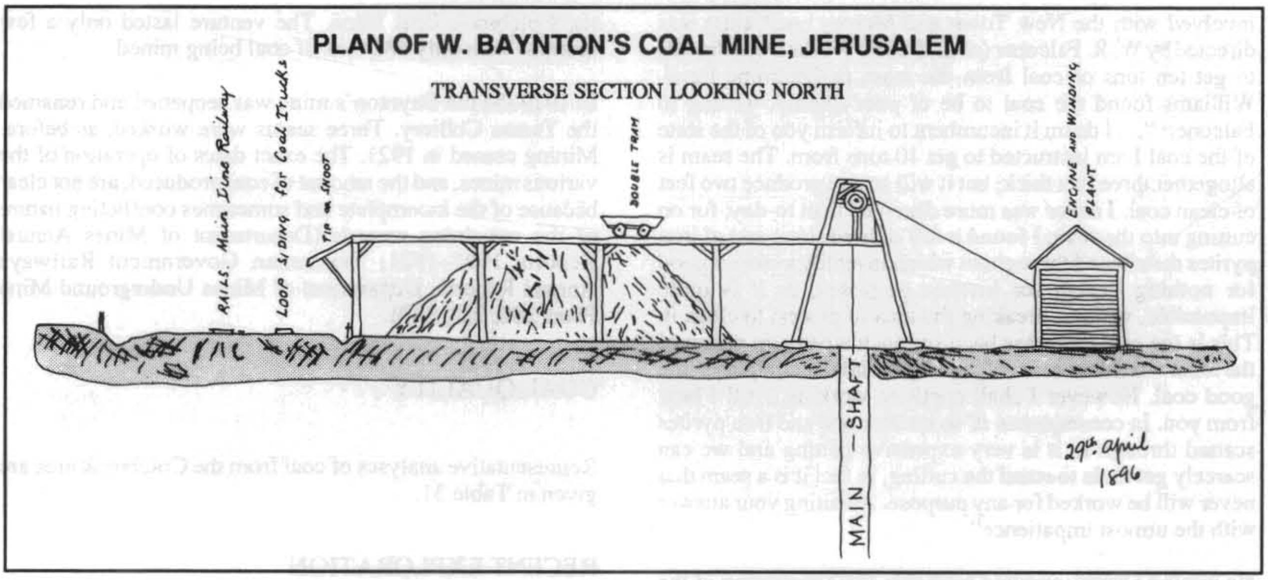
A series of chip holes were drilled in EL 18/82 by CRA Exploration in a southeast-trending graben stretching over the Campania–Colebrook–Jericho–Mt Anstey areas. Results of the exploration are detailed in Summons (1984) and CRA Exploration (1985). No analyses were made of the chip samples. Tentative "*in situ* inferred" reserves were calculated for nine separate fault blocks within the graben, each block having reserves calculated for up to three seams. The total "inferred *in situ*" reserve for all seams in all nine blocks was calculated (Summons, 1984) at 64.6 Mt (a small inferred reserve, AS2519-1982). More work would be needed to accurately define mineable deposits of coal in this area.

Capricorn Mining drilled one hole (O-05) east of the Jericho township, but no coal was encountered (Capricorn Mining, 1982).

Table 31. *Analyses of coal samples, Colebrook coalfield.*

	1	2	3	4	5	6	7
Relative density	-	-	-	-	1.66	1.61	1.45
Total moisture (%)	8.4	4.6	2.6	8.12	2.5	3.5	8.7
Ash (%)	22.4	16.4	34.4	35.54	40.8	39.3	21.2
Volatile matter (%)	26.9	28.3	29.1	11.10	14.9	7.3	23.0
Fixed carbon (%)	42.3	50.7	33.9	34.44	41.8	49.9	47.1
Total sulphur (%)	-	-	-	0.56	-	-	-

1. Sample from top seam, 1891 drill hole near Wallaby Rivulet (Secretary of Mines Report, 1891–92).
2. Sample from top seam, 1891 drill hole near Wallaby Rivulet (Secretary of Mines Report, 1891–92).
3. Sample from middle seam, 1891 drill hole near Wallaby Rivulet (Secretary of Mines Report, 1891–92).
4. Sample from top seam, 1891 drill hole near Wallaby Rivulet (Secretary of Mines Report, 1891–92).
5. Raw coal, seam 0.27 m thick, drill hole O-06, Colebrook (Capricorn Mining Ltd, 1982).
6. Raw coal, seam 0.30 m thick, drill hole O-06 Colebrook (Capricorn Mining Ltd, 1982).
7. Raw coal, seam 0.40 m thick, drill hole O-09, Colebrook (Capricorn Mining Ltd, 1982).



POTENTIAL FOR FUTURE EXPLORATION

The inferred reserves of coal in the Colebrook area are small and the area is of limited interest for further development.

The Richmond Coalfield

SUMMARY

The Richmond coalfield is situated on the banks of the Coal River, south-east of Richmond. A small mining venture commenced in 1840 but was unsuccessful. No subsequent mining has taken place in this area. The seam mined was thin (about 0.60 m thick) and of limited lateral extent. The coalfield is of minimal interest for future exploration.

LOCATION AND ACCESS

The Richmond coalfield is located south-east of Richmond, adjacent to and to the north of the mouth of the Coal River, which empties into a stretch of Frederick Henry Bay known as Pitt Water. Access is provided by a network of roads traversing the area.

GENERAL GEOLOGY

The coal-bearing strata near Richmond have been examined by Strzelecki (1845), Milligan (1849), Gould (1869), Johnston (1888), Nye (*in* Hills *et al.*, 1922), and more recently by Leaman (1971, 1975*b*).

Coal crops out on the west bank of the Coal River, south of Richmond. The mouth of the Coal River empties into a part of Frederick Henry Bay known as Pitt Water, to the south of the outcrop of coal. An adit was driven into this outcrop in 1840. The coal is of Triassic age and is hosted in the lithic sandstone sequence (the youngest unit in the Upper Parmeener Supergroup).

The geology of the coalfield is shown on the 1:63 360 scale "Geology of the Coal River Basin" map (Leaman, 1971) and the Brighton 1:50 000 geological map (Leaman, 1975*b*). A small block of Late Triassic lithic sandstone, in which the coal seams were found, is faulted against stratigraphically younger quartz sandstone to the east and covered by Tertiary sub-basalt silt and fine sand to the north and west.

A dolerite hill lies on the eastern margin of the coalfield, overlying the faulted contact between the lithic and quartz sandstones.

A hole was drilled in 1888 near to the old 1840 adit. Three thin seams of coal were intersected in this hole, the thickest being 0.68 m thick. The seam exposed in the river is 0.60 m thick and dips to the west at 15–20° (Nye, *in* Hills *et al.*, 1922).

PREVIOUS MINING HISTORY

Coal was discovered on the banks of the Coal River near Pitt Water between September 1803 and February 1804, during the very early days of the first settlement at Risdon Cove. No work was done in this area until 1840 when a Mr Bonney opened a small mine, which he tried unsuccessfully to sell. In 1841 Mr Bonney formed a company to raise and sell the coal, and approached the Government of the day for financial assistance. Various items of equipment were loaned to the company (Booth, 1962). Government Surveyor Jones visited the mine in 1844 and described the 'coal seam' into which an adit had been driven as .... "six inches (150 mm) of coal with 4 feet (1.2 m) of shale above" .... The adit, driven at an angle to the line of the dip of the seam, was full of water, and the mine had been abandoned (CSO 8/108/2279, 15 January 1844).

Milligan (1849) visited the adit and also noted that a shaft had been sunk "a few yards from the margin of the river". The shaft was also abandoned. The outcrop of coal on the west bank of the Coal River, into which the adit was driven is described by Milligan (1849) as: ".... the crop of the seam exhibits a few inches of soft carbonaceous matter, but appears to have yielded 2 feet (0.60 m) of a consumable commodity when fairly opened into".

A drill hole was put down 30 m to the west of the old shaft in 1888 (Secretary of Mines Report, 1888–89). The log of this hole is given in Hills *et al.* (1922).

No further mining activity has eventuated in this field.

COAL QUALITY

No analyses of coal samples from this coalfield are available.

POTENTIAL FOR FUTURE EXPLORATION

The Richmond coalfield has minimal interest as a target for future exploration.

PART 7: THE NORTHERN MIDLANDS COALFIELDS

The York Plains Coalfield

SUMMARY

The York Plains coalfield, located in central eastern Tasmania, is of minor economic importance. The coal is of Triassic age and is similar in quality to other Tasmanian Triassic black coals. Two seams were worked in the last mining operation on the field, the mine closing in 1947. Because of the small lateral extent of the coalfield and the limited reserves available, the potential for further exploration is small.

LOCATION AND ACCESS

The York Plains coalfield is centred around Coal Mine Hill [EP360180], six kilometres north-east of Oatlands in central eastern Tasmania. Access is by way of road running east from the Midland Highway and passing through York Plains.

GENERAL GEOLOGY

Coal at York Plains occurs within the Upper Parmeener Supergroup. The Upper Parmeener Supergroup has been disrupted by large-scale Jurassic dolerite intrusions, faulting, and to a lesser extent by Tertiary volcanic complexes. That part of the area occurring in the Oatlands Quadrangle has been mapped by Forsyth *et al.* (1976) and the geology discussed by Forsyth (1984*a*). This work was revised during mapping of the neighbouring Interlaken Quadrangle (Forsyth, 1984*c*). The geological map of the the area (fig. 53) is based on the earlier work, with some minor additions.

Excluding Permian horizons, most of the Upper Parmeener Supergroup stratigraphic units recognised by Forsyth (1984*a*) occur in the York Plains district. These stratigraphic units are:

Ꞧg — Volcanic lithic arenite with subordinate lutite and coal seams.

Ꞧsf, upper — Lutite and dominantly quartz-rich lithic arenite with minor coal seams.

Ꞧsq' — Quartz arenite and lutite with carbonaceous beds and subordinate lithic arenite and coal seams.

Ꞧs lower — Lutite with quartz-rich lithic arenite.

Ꞧsq — Quartz arenite and lutite, occasionally with quartz sandstone.

Ꞧm — Micaceous lutite and micaceous quartz sandstone, frequently with other silicified, bioturbated and mottled purple lutite.

Ꞧp — Quartz arenite with subordinate lithic-rich horizons.

The main coal seams occur within the uppermost sequence (Ꞧg) although thinner coal seams have been recorded elsewhere in the Oatlands Quadrangle in the two underlying sequences (Ꞧsf, upper and Ꞧsq'). Exotic cobble-size clasts of Palaeozoic rocks, including acid igneous rocks and fossiliferous Lower Parmeener Supergroup rocks, were first recorded from the area by Nye (1921). These clasts are derived from what is considered to be the upper one-third of the volcanic lithic sandstone sequence (Ꞧg). The occurrence of *Dicroidium odontopteroides* (Morris) Gothan, 1912 in quartz sandstone and in the volcanic lithic arenite sequence (Ꞧg) at York Plains indicates that the sequences Ꞧsq' and Ꞧg are in part in the age range of Late Anisian to Norian (Retallack, 1977). Microfloras in the lutite and quartz-rich lithic sandstone sequence (Ꞧsf, upper), 20 km further south at Spring Hill, belong to the *Craterisporites rotundus* Zone (de Jersey, 1975), and indicate a Karnian age (Forsyth, 1984*a*).

A major dolerite sheet probably underlies most of the area. At Vincents Hill [EP344225] and north of Mt Pleasant [EP408226] dolerite is exposed where is intrudes the volcanic lithic arenite sequence. Between these two areas remnant thermally-metamorphosed quartz sandstone skins above dolerite indicate that intrusion occurs at lower stratigraphic horizons. Dolerite beneath the sequence Ꞧg in Department of Mines DDH YP-2 [EP356318] may be part of this sheet, as may be dolerite in the sequence Ꞧg in Capricorn Mining DDH YP-06. The dolerite sheet is exposed along the western margin of the area and may be responsible for thermal metamorphism in an uplifted area [EP338174]. Dolerite was also intersected in a water bore near EP372186.

A thin dolerite sheet caps the volcanic lithic arenite sequence at Mt Pleasant [EP403217], the hill immediately south of Mt Pleasant, and possibly two kilometres north-west of Mt Pleasant. Thin dykes of dolerite also occur at EP348195. Dolerite occupies a fault-like fracture at EP338158.

Tertiary basalt flows and plugs are scattered throughout the area and volcanic agglomerate crops out on Pawtella Road [EP393192]. Diamond drilling at Coal Mine Hill intersected 130 m of basalt and basaltic agglomerate [EP356182].

Superficial deposits include talus derived from basalt and dolerite, alluvial fans, cobble and organic silty alluvium, lag deposits derived from Tertiary or older rocks, and silty dunes. Many of the superficial deposits have not been mapped.

The only productive coal mine at York Plains was sited in a narrow graben which passes beneath Coal Mine Hill [EP355185]. The coal occurs in the volcanic lithic arenite sequence (Ꞧg). The graben may continue northward to cross the Midland Highway. The occurrence of at least 130 m of Tertiary basalt and basalt agglomerate in DOM DDH YP-1 at Coal Mine Hill indicates the probable disruption of any coal seams extending beneath the hill.

An extensive area of volcanic lithic sandstone occurs about Mt Pleasant [EP403216], where coal has been exposed in an adit (Blake, 1936*b*) and intersected in several holes drilled as part of an exploration programme (General Geological Services, 1981*a*). Dolerite was intersected in one hole drilled on the northern slopes of Mt Pleasant at about 420 m asl. This dolerite intrusion is assumed to rise towards the north, where thermal metamorphism of sandstone is apparent and where dolerite is eventually exposed at the surface. Some dolerite intrusions in the area may be part of an overlying sheet, similar to the occurrence of an upper sheet at Mt Pleasant. Forsyth (1984*c*) inferred a fault between quartz and lithic sandstone [EP392179] but was uncertain whether the relationship could not have been conformable. If this fault exists it may form the south-western boundary of the main volcanic lithic arenite sandstone (Ꞧg) area. Further south, a series of small faults progressively downthrows the basal beds of the volcanic lithic sandstone sequence. This sequence may extend to the east of the mapped area but no coal has been noted from this possible extension.

The distribution of rocks in the plains area is poorly known because of insufficient exposure. A small area of the volcanic lithic sandstone sequence (Ꞧg) has been inferred north of York Plains Road between the railway line and the Midland Highway [EP350208]. A larger area of volcanic lithic

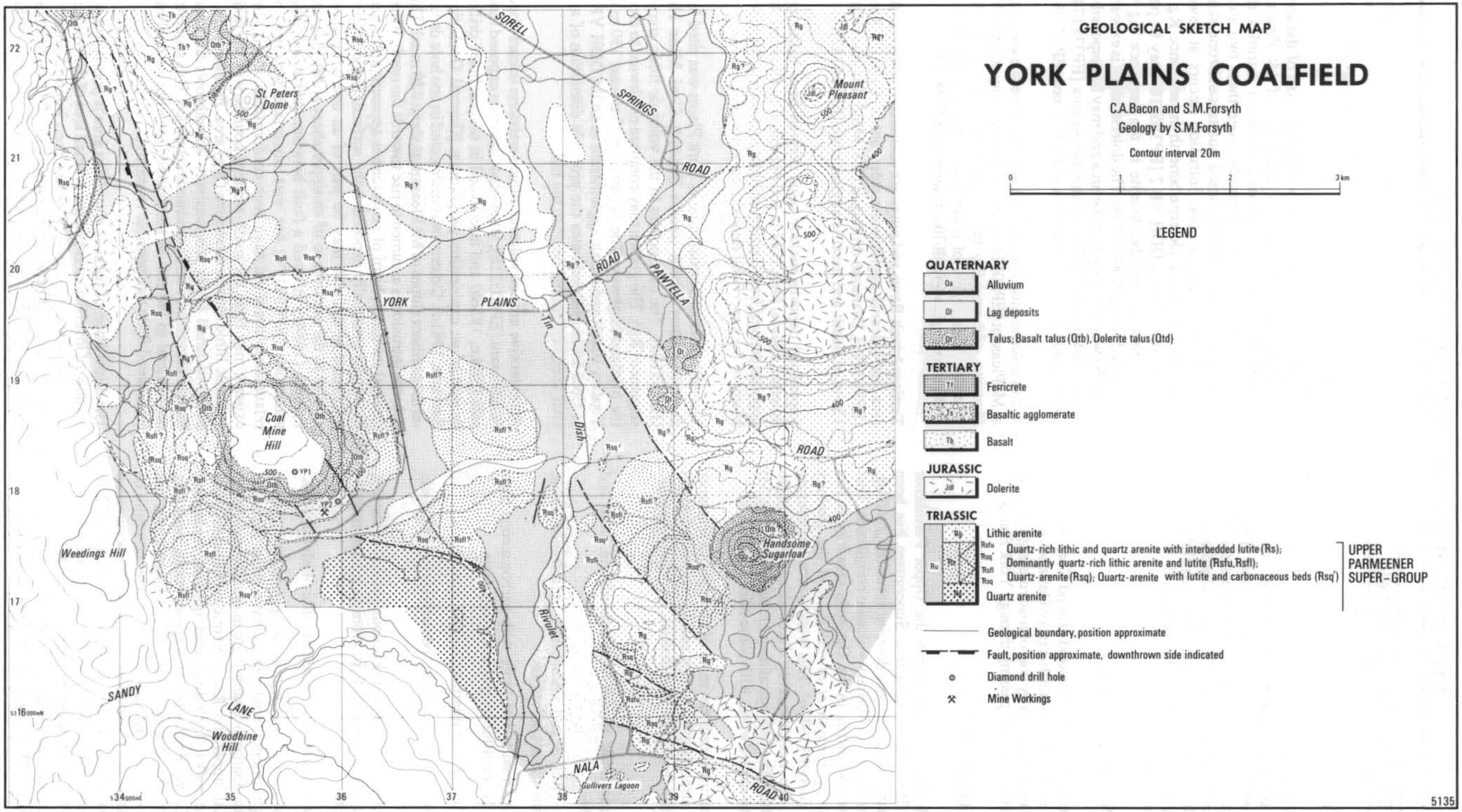

GEOLOGICAL SKETCH MAP
YORK PLAINS COALFIELD
C.A.Bacon and S.M.Forsyth
Geology by S.M.Forsyth
Contour interval 20m
0 1 2 3 km
LEGEND
QUATERNARY
Alluvium
Lag deposits
Talus; Basalt talus (Qtb), Dolerite talus (Qtd)
TERTIARY
Ferricrete
Basaltic agglomerate
Basalt
JURASSIC
Dolerite
TRIASSIC
Lithic arenite
Quartz-rich lithic and quartz arenite with interbedded lutite (Rs);
Dominantly quartz-rich lithic arenite and lutite (Rsfu, Rsfl);
Quartz-arenite (Rsq); Quartz-arenite with lutite and carbonaceous beds (Rsq')
Quartz arenite
UPPER PARMEENER SUPER–GROUP
Geological boundary, position approximate
Fault, position approximate, downthrown side indicated
Diamond drill hole
Mine Workings
St Peters Dome
Mount Pleasant
Coal Mine Hill
Handsome Sugarloaf
Weedings Hill
Woodbine Hill
Gullivers Lagoon
SORELL SPRINGS ROAD
YORK PLAINS
PAWTELLA ROAD
Tin Dish Rivulet
SANDY LANE
NALA ROAD
5135

Figure 53.

sandstone has been inferred east of the railway line, based on exposures near an underground water bore [EP370205] and cuttings in nearby water holes. The underground water bore log suggests it is the basal beds of the sequence ₮g which are exposed here, as few thick sandstone beds were recorded in the log.

Lithic siltstone and sandstone crop out south of the York Plains Road between the railway line and Tin Dish Rivulet. The sandstone appears to be quartz-rich lithic in composition, and probably belongs to the lutite and quartz-rich lithic sandstone sequence (₮sf, lower), but the existence of volcanic lithic sandstone (₮g) in the area cannot be totally dismissed. Recent underground water bores in this area intersected dolerite and possible coal.

PREVIOUS MINING HISTORY

An outcrop of coal 380 mm thick was noted by Gould (1869) in Tin Dish Rivulet, 2.5 km north-east of Coal Mine Hill. Mining at Coal Mine Hill was in progress by late 1979. A report in the *Tasmanian Mail Supplement* of 15 November 1879 described the mine, then known as the Black Diamond Coal Mine, as "very rich, apparently inexhaustible; for the side of a commanding hill has been tunnelled into, and, so far, it has been found to be one immense coal deposit". The difficulty in transporting the coal from the mine had been overcome by the laying of a 600 mm gauge tramway between the mine and the Main railway line, a distance of about 800 metres. The line was built on a descending gradient from the mine, with loaded trucks descending under gravity.

Johnston (1888) described two seams cropping out on the southern flank of Coal Mine Hill. The upper seam, 1.1 m thick, was worked from an "....open main drive running in a southerly direction from which several lateral drives diverge".

The colliery was known as Lord's Coal Mine until 1902, when operations ceased. Mining on the lower seam began in 1905, with the new mine being named the York Plains Coal Mine. The name was again changed to Greggs Colliery in 1912. A number of adits were driven into the seams along the south and south-east flanks of the hill (Nye *in* Hills *et al.*, 1922). Operations continued at York Plains until September 1947. The mine employed from two to four men and produced 600–800 t of coal per year. The coal mined was not washed, and was mainly used in the boilers of hop kilns. Mining was by hand, on a modified longwall system. As mining was done down-dip on the seam, the influx of water caused problems throughout the mine life.

An outcrop of coal exposed in a cutting on the York Plains Road near the Mt Pleasant saddle was noted by Nye (*in* Hills *et al.*, 1922) and inspected by Blake (1936*b*) after an adit had been driven in on the seam for a distance of 12 metres. Blake reported the seam to be 1.54 m thick.

Coal seams cropping out on the northern side of Coal Mine Hill were examined by Blake (1936*a*). Two seams, 300 mm and 460 mm thick respectively, had been opened up by trenching, and one seam was intersected in a prospecting shaft. Interest was expressed in 1949 in mining this coal, and hopgrowers entered into an agreement with the landowner to this end. Hughes (1949*a*) reported on the extent of the coal and on possible mining access, but no mining eventuated.

A list of coal outcrops occurring in the area is given in Forsyth (1984*a*).

COAL QUALITY

The seam mined at York Plains is similar in quality to Triassic black coal found elsewhere in the State, although depleted in volatile material, probably due to heating from the overlying basalt. Analyses from this area are given in Tables 32 to 34.

Banded seams of poor quality coal were found during exploration near Mt Pleasant. A comparison of raw and washed samples from the large-diameter drilling programme (Summons, 1985*b*) is given in Table 33.

Comprehensive chemical analyses of three of the seams in the Mt Pleasant area are given in Table 34.

RECENT EXPLORATION

Five chip holes were drilled in the York Plains area in 1980, when the ground was included in EL 28/79, held by Capricorn Mining. The results of this drilling, centred around Mt Pleasant (Holes O-01, O-02, O-03a, O-03b, O-06) are

Table 32. *Analyses of coal samples, York Plains coalfield.*

	1	2	3	4	5	6	7
Relative density	-	-	-	-	1.58	1.60	1.52
Total moisture (%)	1.7	1.8	1.9	8.4	-	-	-
Moisture (%)	-	-	-	-	2.8	2.5	2.2
Ash (%)	25.7	13.28	13.55	21.3	25.4	28.5	12.7
Volatile matter (%)	15.8	13.28	13.55	21.3	12.2	11.7	20.5
Fixed carbon (%)	56.8	57.32	60.74	48.82	59.5	57.3	64.6
Total sulphur (%)	-	0.46	0.48	0.32	0.37	0.49	0.52
Specific Energy (MJ/kg)	-	-	-	19.41	23.94	23.14	26.02
Seam Thickness (m)	-	-	-	-	0.90	2.24	2.24

1. Sample from Lords Upper Seam (Seam A) (Johnston, 1888).
2. Whole seam sample from Lower Seam (Seam B) including bands (Hills *et al.*, 1922).
3. Whole seam sample from Lower Seam (Seam B) excluding bands (Hills *et al.*, 1922).
4. Grab sample, from adit near Mt Pleasant saddle (Blake, 1936*b*).
5. Raw coal, seam A, DOM DDH YP-1 (Bacon, 1985).
6. Raw coal, seam B, DOM DDH YP-1 (Bacon, 1985).
7. Seam B, minus dirt bands, DOM DDH YP-1 (Bacon, 1985).

Table 33. *Analyses of coal samples from large-diameter drilling programme (Summons, 1985b)*

	1	2	3	4	5	6	7	8	9
Total moisture (%)	7.3	3.5	3.7	4.1	3.8	3.6	3.4	2.1	2.2
Ash (%)	55.7	18.2	21.3	38.9	21.1	24.5	43.0	16.7	19.4
Volatile matter (%)	12.6	19.3	18.7	12.3	13.9	13.7	11.6	14.4	14.2
Fixed carbon (%)	24.4	59.0	56.3	44.7	61.2	58.2	42.0 6	6.8	64.2
Total sulphur (%)	0.20	0.42	0.40	0.23	0.29	0.27	0.23	0.37	0.35
Specific energy (MJ/kg)	11.00	27.42	26.10	18.28	25.02	23.82	17.36	27.66	26.58
Seam thickness (m)	2.53	2.53	2.53	2.21	2.21	2.21	3.14	3.14	3.14
Separation density	-	F1.6	F1.7	-	F1.6	F1.7	-	F1.6	F1.7
Yield (%)		26.9	31.7		54.0	68.3		52.2	60.3

1. Raw coal, seam U, DDH 84 PT 43, 18.72–21.35 m depth; -11.2 × 0 fraction.
2. Washed coal, seam U as above, F1.6.
3. Washed coal, seam U as above, F1.7.
4. Raw coal, seam U, DDH 84 PT 44, 17.28–19.49 m depth; -11.2 × 0 fraction.
5. Washed coal, seam U as above, F1.6.
6. Washed coal, seam U as above, F1.7.
7. Raw coal, seam U2, DDH 84 PT 43, 22.80–26.04 m; -11.2 × 0 fraction.
8. Washed coal, seam U2 as above, F1.6.
9. Washed coal, seam U2 as above, F1.7.

Table 34. *Detailed analyses of samples from three seams, Mt Pleasant area.*

	Seam W 1	Seam V 2	Seam U 3	Seam T 4
Total moisture (%)	5.0	3.4	3.7	3.4
Analysis basis				
Ash (%)	54.4	50.8	39.2	49.4
Volatile matter (%)	10.1	10.0	11.2	8.2
Fixed carbon (%)	30.6	35.8	35.1	39.0
Total sulphur (%)	0.20	0.30	0.26	0.30
Chlorine (%)	0.04	0.01	0.02	
Phosphorous (%)	0.006	0.007	0.006	
Specific energy (MJ/kg)	11.81	14.42	14.54	15.48
Carbon dioxide (%)	1.45	1.49	1.72	
Dry, ash-free basis				
Volatile matter (%)	24.9	21.8	19.6	17.4
Carbon (%)	78.7	71.4	82.1	
Hydrogen (%)	4.50	5.05	4.5	
Nitrogen (%)	1.55	1.71	1.64	
Sulphur (%)	0.41	0.14	0.53	
Oxygen (%)	15.6	21.7	11.30	
Hardgrove Grind. Index	74	103	84	
Ash fusion temperatures (reducing atmosphere) °C				
Deformation	1240	1230	1245	
Spherical	1335	1320	1285	
Hemisphere	1365	1340	1305	
Flow	1455	1430	1395	

	Seam W 1	Seam V 2	Seam U 3
Ash analysis			
SiO_2	59.3	66.7	59.6
Al_2O_3	26.0	20.0	23.7
Fe_2O_3	3.48	3.46	3.80
Mn_3O_4	0.15	0.14	0.16
P_2O_5	0.03	0.02	0.03
TiO_2	0.77	1.18	0.82
CaO	4.79	3.19	6.74
MgO	3.69	2.23	2.90
K_2O	1.74	2.49	1.61
Na_2O	0.60	1.24	0.55
SO_3	0.26	0.20	0.48
BaO	0.03	0.04	0.03
Forms of sulphur			
Pyritic	0.09	0.07	0.09
Sulphate	0.01	0.01	0.01
Organic	0.07	0.03	0.17

1. Average analyses, seam W (Dickson *et al.*, 1984)
2. Average analyses, seam V (Dickson *et al.*, 1984)
3. Average analysis, seam U (Dickson *et al.*, 1984)
4. Average analysis, seam T (Dickson *et al.*, 1984)

detailed by General Geological Services (1981*a*), Capricorn Mining (1982), and are summarised in Forsyth (1984*a*). The holes were all less than 50 m deep. Several intersections of banded coal seams up to three metres thick were encountered in the drilling, with individual coal plies in these banded seams having ash contents of 20–48%. The Exploration Licence was relinquished by Capricorn Mining.

In 1982 another exploration licence (EL 18/82) was taken out by CRA Exploration over the York Plains–Mt Pleasant area. Twenty-nine slim-line holes were drilled, followed by three large (100 mm) diameter holes aimed at obtaining large enough samples of coal for washing tests. The results of this exploration, which was centred around Mt Pleasant to the east of the old mine on Coal Mine Hill, are detailed in Summons (1984) and Dickson *et al.* (1984), with the coal washing tests reported in Summons (1985*b*). Holes were 50 m or less in depth, as the explorers were only interested in locating deposits of coal suitable for open-cut mining. Up to four seams (T, U, V, W) of banded, poor-quality coal were recognised in the Mt Pleasant area. Stone bands up to 0.5 m thick are common in these seams and can be traced between adjacent boreholes. Seam U, the economically most interesting seam, commonly splits into four plies (U1, U2, U3, U4).

Reserve calculations were made on three seams U (U1+U2), V and W, with the reserves in each seam being divided between a number of small, often fault-bounded blocks. Mudstone bands greater than 0.5 m in thickness, such as the band between plies U1 and U2, were omitted from the total seam thickness value used to calculate the reserves per seam, per block.

The *in situ* reserves calculated (Dickson *et al.*, 1984) are:

Seam W (in three blocks)	8 Mt (total)
Seam V (two blocks)	2 Mt (total)
Seam U (four blocks)	33 Mt (total)

These values are for *in situ* 'coal' irrespective of the ash analysis. The majority of the U seam reserve contains more than 40% ash *(in situ)* and in parts up to 75% ash (PT 31—75% ash, PT 16/17—68.1% ash). Some of this ash can be removed by washing, as demonstrated by the large-diameter sample washing tests.

Two holes (YP-1, YP-2) were drilled in 1984 by the Department of Mines on Coal Mine Hill. Petrographic and proximate analyses of two seams in YP-1 are given in Bacon (1985). Both seams formed in a dry forest swamp habitat, similar to other Late Triassic Tasmanian coal seams.

POTENTIAL FOR FUTURE EXPLORATION

The areal extent of the coal deposit at Coal Mine Hill is very small, around 3 km^2, which has been partially worked. The coal reserves here would be in the order of 1–2 Mt (*in situ*, indicated). Some reserves of coal have been examined in the Mt Pleasant area, but reserves of coal with a raw, *in situ* ash content of less than 40% are very small. According to AS2519-1982 material which, when washed, floats at relative density 1.60, is 'taken to be coal, for the purposes of geological assessment'. The sinks 1.60 material is 'taken to comprise non-coal material'.

Washing tests indicate that a coal product of 32–34% ash could be produced with a washery yield of 68–87% (Summons, 1985*b*), and coal of this ash content has been successfully used in some Hunter Valley power stations.

The Woodbury Coalfield

SUMMARY

A small deposit of open-cut coal has been located at Woodbury, in the Midlands area of Tasmania, 12 km north of the York Plains area. The deposit was explored between 1980 and 1984, and is now held under a series of mining leases.

LOCATION AND ACCESS

The Woodbury coalfield is situated in the Glen Morey area, about 5 km south-east of Tunbridge. The area is well traversed with sealed roads and farm tracks.

GENERAL GEOLOGY

The area covering the Woodbury coalfield has been examined by Nye (1921), and more recently mapped by Forsyth (1986) as part of the Geological Atlas 1:50 000 series mapping (Interlaken Quadrangle). Most of the area of the Woodbury coalfield is covered with various types of scree or alluvium, with only minor outcroppings of the lithic sandstone sequence in which the coal seams are hosted. The geology of the Interlaken Quadrangle is described by Forsyth (1989*b*).

PREVIOUS MINING HISTORY

No mining activity has yet taken place in the Woodbury coalfield, although coal was mined on a small scale from about 1883 to 1947 at York Plains, 12 km south of Woodbury.

COAL QUALITY

Analyses of coal from the Woodbury prospect (Eshuys and Summons, 1982) are given in Table 35.

Table 35. *Analyses of coal from the Woodbury prospect.*

	1	2	3	4	5	6
Moisture (%)	4.6	3.4	4.3	4.8	1.9	1.8
Ash (%)	43.5	38.5	31.5	32.7	39.2	46.0
Volatile matter (%)	7.7	10.7	15.5	19.9	13.0	7.6
Fixed carbon (%)	-	-	-	-	45.9	44.6
Total sulphur (%)	-	-	-	-	0.25	0.24
Chlorine (%)	-	-	-	-	0.03	0.04
Spec. energy (MJ/kg)	17.0	18.8	21.1	22.4	18.7	17.4

1. Average analyses, raw coal, seam A; 0.5 m thick.
2. Average analyses, raw coal, seam B; 0.83 m thick.
3. Average analyses, raw coal, seam C; 1.87 m thick.
4. Average analyses, raw coal, seam D; 2.10 m thick.
5. Raw coal, seam A, DDH W36A, 0.78 m thick.
6. Raw coal, seam B (subseam B4), DDH W46, 0.60 m thick.

Beneficiation by washing, with yields in excess of 40%, will produce a washed product with the following characteristics (Register of Australian Mining, 1985/86):

Moisture (%)	12
Ash (%)	24
Volatile matter (%)	18
Fixed carbon (%)	46
Specific energy (MJ/kg)	21.5
Sulphur (%)	<0.5

RECENT EXPLORATION

A scout drilling programme was begun by Victor Petroleum and Resources Ltd in 1980 on Exploration Licence 31/80 held by the North West Bay Company Pty Ltd, covering a large part of central Tasmania. At this time, initial mapping for the Interlaken Quadrangle was being done by S. M. Forsyth of the Tasmania Department of Mines.

From the preliminary mapping and examination of water bore records, Forsyth delineated potential target areas near Woodbury in which coal seams may occur. These areas were subsequently drilled by Victor Petroleum, with encouraging results.

Further exploration by a joint-venture partnership of Victor Petroleum and Resources Ltd, Costain Australia Pty Ltd, and North West Bay Pty Ltd delineated a coal reserve near Woodbury using 18 chip and cored holes. Reserves of 10 Mt measured *in situ* and 15 Mt indicated *in situ* were established. The reserves are for coal which could be extracted by open-cut means, and are contained in five banded seams which have been divided into 'subseams' or coal plies, which would be mined selectively. Coal plies or dirt bands as thin as 300 mm can be mined by this method, enabling the utilisation of an otherwise unmineable resource.

POTENTIAL FOR FUTURE EXPLORATION

The Woodbury coalfield is currently held under a series of mining leases, 1070 P/M – 1078 P/M, by Costain Australia Ltd, Victor Petroleum and Resources Ltd and North West Bay Co. Pty Ltd.

The Mike Howes Marsh Coalfield

SUMMARY

The Mike Howes Marsh coalfield is situated in central Tasmania. Apart from samples taken during prospecting activities late last century no coal has been mined in this area. The coalfield has limited potential for further exploration.

LOCATION AND ACCESS

The coalfield is confined to a marsh around part of the Blackman River situated north of Mike Howes Lookout, a 740 m high hill at EP211216. Access is gained from the Interlaken Road, which branches off the Midland Highway at Oatlands.

GENERAL GEOLOGY

The geology of the area has been examined by Twelvetrees (1902*f*) and Nye (*in* Hills *et al.*, 1922). The coalfield is covered by the Geological Atlas 1:50 000 sheets Oatlands (Forsyth *et al.*, 1976) and Interlaken (Forsyth, 1986).

The coal is of Triassic age and the seams occur as a minor component of a dominantly lithic sandstone sequence, the upper part of the Upper Parmeener Supergroup. The coalfield is of limited lateral extent.

PREVIOUS MINING HISTORY

Apart from a few prospecting activities, no coal has been mined from this coalfield. The marsh, from which the coalfield is named, and a hill immediately to the south of the marsh, Mike Howes Lookout, are named after the particularly callous and brutal bushranger Mike Howe, who used the area as a base. His bushranging career lasted from 1815 until 1817.

COAL QUALITY

The only analyses available from this area (Table 36) are of an historical nature.

Table 36. *Analyses of coal samples, Mike Howes Marsh coalfield.*

	1	2
Moisture (%)	25.4	8.4
Ash (%)	21.0	10.8
Volatile matter (%)	20.2	18.4
Fixed carbon (%)	33.0	62.4

1. Weathered and waterlogged sample collected by Twelvetrees (1902*f*) from the short prospecting adit.
2. Drier sample collected from same seam (Twelvetrees, 1902*f*).

RECENT EXPLORATION

Twelvetrees (1902*f*) visited the Mike Howes Marsh coalfield in 1902, when an outcrop of coal on the northern side of Mike Howes Lookout [EP211216] had been opened up by a series of test pits and a short drive. The seam was noted to be 1.07 to 1.22 m thick, with a sandstone roof and clay floor. The test pits and short drive were all full of water at the time of Twelvetrees' visit.

Two chip holes have been drilled in the coalfield in recent years as part of coal exploration programmes by two companies. The first hole (O-04) was drilled in 1982 by Capricorn Mining when the area was held under EL 29/79, and the second hole (JC-01) in 1984 when EL 20/82 covered the area around Mike Howes Marsh. One thin (0.12 m thick) coal seam was encountered in hole O-01 (Capricorn Mining, 1982). No coal was found in hole JC-01 (Summons, 1984).

POTENTIAL FUR FUTURE EXPLORATION

Because of the restricted lateral extent of the coalfield, and the thin nature of the seam exposed, the inferred reserves of this area are very small. The coalfield is of minimal interest for further exploration.

PART 8: THE AVOCA COALFIELD

The Mount Christie (Stanhope) Coalfield

SUMMARY

Coal has been mined from the Mount Christie (Stanhope) coalfield almost continuously since 1923. The seams occur in a sequence of dominantly lithic sandstone interbedded with minor mudstone, siltstone and coal of the Upper Parmeener Supergroup. These sediments overlie a sequence of dominantly quartzose sandstone which is devoid of coal. To the east, the coalfield is bounded by the Castle Carey Fault.

The coalfield is badly faulted, and meaningful correlation of coal seams, which are up to four metres thick and heavily banded with mudstone, is difficult on the available information. Coal has been mined from the Mount Christie, Stanhope, and New Stanhope mines and is still mined from the Fenhope mine. Production from the two largest mines, the Stanhope (1932–1957) and the New Stanhope (1957–1973) was about 175 000 tonnes and 220 000 tonnes respectively.

The inferred reserves are likely to be less than one million tonnes, classed as a very small *in situ* inferred reserve.

LOCATION AND ACCESS

The Mount Christie (Stanhope) coalfield is situated about eight kilometres north-west of Avoca in north-eastern Tasmania, and is reached by an unmade road off the sealed road from Avoca to Rossarden.

Bonneys Plains, on the south-western side of Mount Christie, is reached by a track from the Esk Highway at Hanleth, ten kilometres west of Avoca.

GENERAL GEOLOGY

The geology of the Stanhope area is discussed briefly by Twelvetrees (1906) and mentioned by Blissett (1959). Further regional details are given by Threader (1968), Western Mining Corporation (1977*a*, *b*), Ivett and Taylor (1978), Taylor (1979), Bornman (1981), and Bornman and Murphy (1981).

The basement rocks in the Stanhope area are the Siluro-Devonian Mathinna Beds, which are extensively folded micaceous quartzwacke turbidite sequences, with minor mudstone intervals. These rocks were extensively folded during the Tabberabberan Orogeny, and have been intruded by the Ben Lomond Granite of Devonian age. Late-stage hydrothermal fluids associated with the granite are responsible for areas of tin-tungsten mineralisation around Storys Creek and Rossarden, to the north-east of the coalfield.

The basement rocks are unconformably overlain by a dominantly marine sequence of the Lower Parmeener Supergroup. This sequence is recorded as being at least 150 m thick (Western Mining, 1977*a*; Taylor, 1979).

Good exposures of Lower Parmeener Supergroup sediments occur east of the Castle Carey fault, and have been subdivided and described by Blissett (1959). Sediments belonging to the Upper Parmeener Supergroup are confined to the upthrown block of country to the west of the Castle Carey Fault. These sediments paraconformably overlie the Lower Parmeener Supergroup sequences. The geology of the coalfield is shown in Figure 54.

Drilling by the Western Mining Corporation (Tas) Pty Ltd in 1977 and The Shell Company of Australia in 1980 intersected a sequence of lithic sandstone interbedded with minor mudstone, siltstone, and coal overlying a quartzose sandstone sequence. In the area of Bonneys and Buffalo Plains, Western Mining (1977*b*) found that quartzose sandstone intervals were occasionally interbedded with the lithic sandstone–siltstone–mudstone–coal sequence. South of Royal George, an adit was put in on a coal seam with a quartzose sandstone roof, and other, albeit rare examples of quartzose sandstone intervals occurring in or close to the lithic sandstone sequence, are also known.

Mapping in the Midlands area (Oatlands and Interlaken Quadrangles; Forsyth *et al.*, 1976; Forsyth, 1986) indicates that within the lower part (Middle Triassic) of the lithic sandstone sequence there are intervals of quartzose sandstone, sometimes associated with coal (Forsyth, 1984*a*).

Jurassic dolerite has extensively intruded the Parmeener Supergroup sediments and caps most of the higher ground to the west of the Castle Carey Fault. The dolerite sill capping the Ben Lomond Plateau to the north of the Stanhope area is at least 330 m thick (Blissett, 1959). The dolerite has intruded as a series of dykes and transgressive sheets, with minor faulting accompanying the intrusion.

Major faults developed during the Tertiary, with the largest fault being the NW-trending Castle Carey Fault, which may be traced for about sixteen kilometres (Blissett, 1959). These faults have caused the formation of a number of horst and graben structures, which form the basis of the present day topography (Blissett, 1959). To the south of the Stanhope–Mount Christie area the overall faulting pattern seems to consist of a series of step-faults to the south-east (Taylor, 1979).

Quaternary dolerite talus masks most of the higher hill slopes west of the Castle Carey Fault, and alluvium covers much of the lower-lying plain areas.

PREVIOUS MINING HISTORY

Coal was discovered on the slopes of Ben Lomond in 1864 by James Lamont. In 1882 a Mr R. Stevenson and party drove a tunnel into a coal seam on Storys Creek on the southern flank of Ben Lomond four kilometres from the Storys Creek tin mine [approximately EP594930]. Montgomery (1892) wrote of coal discoveries in the Avoca district and Waller (1901) mentioned coal outcrops in Gipps Creek and on the south-eastern flank of Ben Lomond. James Stevenson found coal near Mount Christie in 1904 and Twelvetrees (1906) reported at length on the Mount Christie and 'Buena Vista' seams. Twelvetrees found three tunnels (one partly collapsed) on the southern flank of Greenstone Hill. The uppermost tunnel had been driven in a north-west direction for 15 m on a 1.8–2.1 m thick seam of coal. A second (collapsed) tunnel was 33 m lower in elevation than the first and had intersected 3.6 m of coal. A third tunnel, a few metres west of the collapsed tunnel, had been driven 50 m on a bearing of 250°. The seam here was 3.6 m thick and dipped at 10° to the west. Twelvetrees (1906) and Hills *et al.* (1922) thought the exposed seam in both the upper and lower tunnels was the same, repositioned by faulting. These workings, together with many subsequent adits in the same area, became known as the Mount Christie mine. The locations of the various mines are shown in Figure 55.

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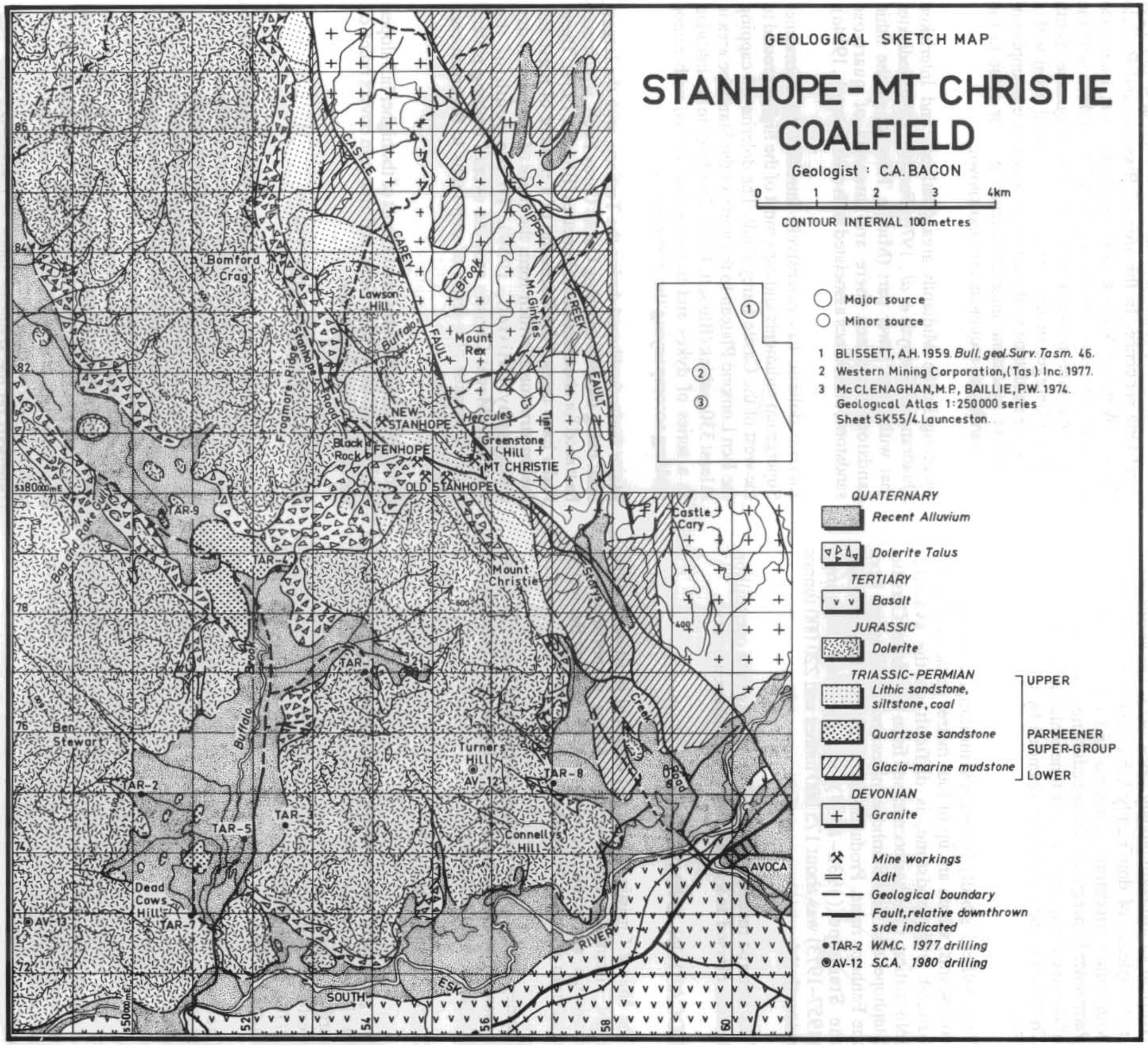

Figure 54.

'Buena Vista' Mine

In 1905 one shaft had been sunk on the area of flat ground between Mount Christie and Greenstone Hill (Twelvetrees, 1906). By 1922, five shafts had been dug on the flat, and three exploratory adits had been dug into the slopes of Mount Christie. These exploratory works, together with other prospecting adits, pits, and trenches to the south and west of Mount Christie, were collectively called the 'Buena Vista' mine by Hills *et al.* (1922), although no actual mining resulted from these preliminary activities. The workings on the slope of Mount Christie later became the site of the Stanhope mine.

Stanhope (Excelsior) Mine

Production from the early, largely prospecting workings known as the Excelsior mine was small (e.g. 7 tonnes in 1923 rising to 23 tonnes in 1928 and 63 tonnes in 1929). The seam worked was badly faulted and banded, with five distinct mudstone bands. The mine was renamed the Stanhope in 1931, and the workings moved eastwards. As the mine workers opened up adits to the east, the area of earlier activity became known as the 'old workings', and pillars were mined for a number of years (1931–1939) from these workings by open-cut methods.

Seam conditions were reported as 'troubled' for much of the mine life, because of extensive faulting and some seam thinning (Annual Reports of Director of Mines, 1931–1956).

A new drive east of a five metre fault, and a few hundred metres east of the old workings, was opened up in 1937. These are called the new workings at the (old) Stanhope; they are adjacent to, but not connected with the old workings at the (old) Stanhope, and 1.3 km south-east of the workings at the more recent New Stanhope. Coal was mined with a chain-type of coal cutter, largely by the bord and pillar method. In 1943 a shortwall face was opened up over a 3.0 m fault, and in 1944 the longwall system of mining was briefly adopted. Collapse of the longwall face resulted in a dramatic decrease in output, and management quickly reverted to the more suitable bord and pillar method of mining.

The large number of small faults in the area made mining conditions very difficult, often causing development work to be abandoned and pillars pulled. Drill holes were put down in the period 1953 to 1956 around the Stanhope and in the area where the New Stanhope was to open. The main drive of the New Stanhope was started in 1956, and operations finally ceased at the (old) Stanhope in June 1957. Total production from the Stanhope (new workings) from 1932 to 1957 was about 175 000 tonnes.

In the mid 1960s, a bushfire swept over the area of the (old) Stanhope mine and set fire to the seam, which is still burning. Parts of the ground surface over the mine workings have collapsed.

New Stanhope Mine

Situated 1.3 km north-west of the (old) Stanhope mine, production at the New Stanhope mine began in 1957. A washing plant was installed in 1959, working for the first time in 1960. In 1963 a new tunnel known as 'No. 2' was driven into the seam adjacent to the 'No. 1' or old tunnel. The seam was 2.1 m thick with a good roof and floor. Pillars in the No. 1 tunnel area were pulled in 1964 and developmental activities concentrated on the No. 2 tunnel area. By 1969 the geological structure of the No. 2 tunnel area was found to be more complex than anticipated, and pillars were extracted. Bad roof falls finally forced the closure of the No. 2 tunnel area, and the No. 1 tunnel area was reopened in 1971 and more pillars extracted. The mine finally closed in 1973 due to the exhaustion of extractable pillars. Total production from the New Stanhope from 1957 to 1973 was about 220 000 tonnes.

Mount Christie Mine

The workings scattered on the southern flank of Greenstone Hill are collectively known as the Mount Christie mine. Hills *et al.* (1922) noted that no further work other than the three adits described by Twelvetrees (1906) had been done in the area; this was due to the fact that cartage rates to deliver the coal to Avoca were prohibitive.

In 1927 a few tonnes of coal were produced from the old workings, which were again opened up briefly in 1940, producing 65 tonnes in that year.

A new tunnel was opened up in 1944, higher up on Greenstone Hill where some drilling had apparently been done (Annual Report of Director of Mines, 1944). The production from these workings was small, and faulted conditions hampered mine development and caused the mine to close in 1947. Minor prospecting works continued until 1958, when the old mine was again re-opened for a short time.

In 1959 a new tunnel was put in 50 m west of the previous tunnel, and was worked until 1965 by Messrs N. and D. Fenton, who produced 1700–1800 tonnes of coal per year from the mine. The seam in this tunnel was 2.4 m thick, with a 230 mm band of mudstone in the middle. The mudstone was separated from the marketable coal by first mining the top ply, then the dirt band, and then the lower ply. The workings closed in 1965 after some pillars had been extracted. Total production from this mine was about 13 000 tonnes.

Fenhope Mine

In 1981 a new mine was opened close to the old workings of the (old) Stanhope mine, and named the Fenhope. The mine is worked solely by the owner, Mr D. Fenton. The seam mined is 3.6 m thick, and has few dirt bands apart from a section 450 mm thick in the middle of the seam, this section consisting of many mudstone bands interbedded with thin plys of coal. The seam is mined in three stages; a top coaly section, the dirty middle section, then the lower coaly section. The 'dirty' middle section of coal is discarded. Total production from the Fenhope to date would be less than 1000 tonnes.

Mr Fenton has lined the main drive with timber and galleries sweep off from the main heading. Coal is wheeled by hand along a tramway, to an impressive raised gantry which leads to some large, hand-built, wooden bins. The gantry, bins and mine timbering have all been done with most enviable attention to detail.

COAL QUALITY

Analyses of coal from the various mines in this area are tabulated in Bacon (1983). Analyses of samples from the Fenhope and New Stanhope areas are given in Table 37.

RECENT EXPLORATION

From 1953 until 1972 the New Stanhope mine management diamond-drilled holes totalling some 1000 m of drilling in the vicinity of the Stanhope and New Stanhope workings. The drill log records of these holes are incomplete, and the location of holes approximate. A summary of the company

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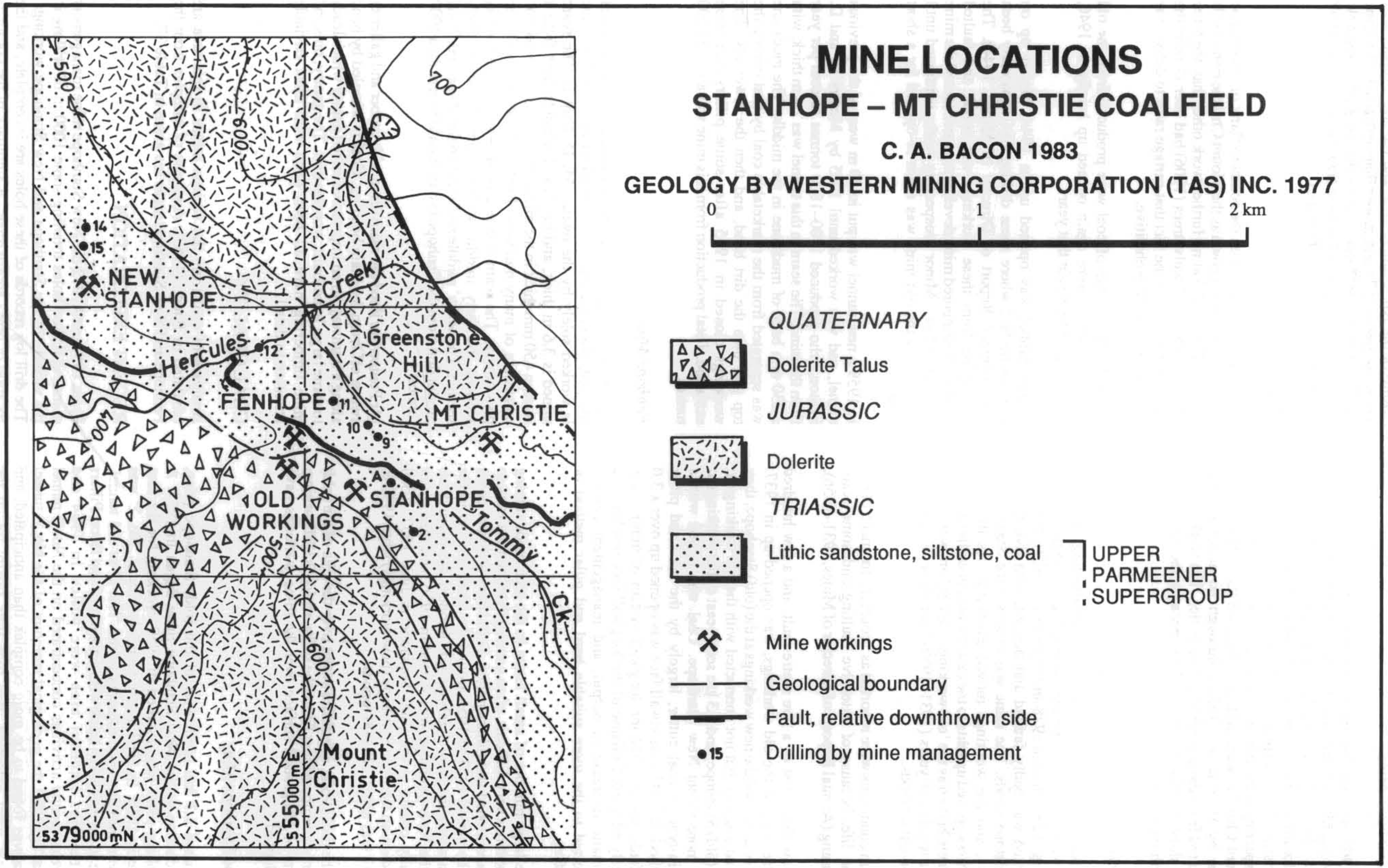


Figure 55.

Table 37. *Analyses of coal samples, Fenhope and New Stanhope areas.*

	1	2	3	4	5
Moisture (%)	3.1	3.8	1.94	3.03	2.1
Analysis basis (AD)					
Ash (%)	29.4	15.2	19.6	21.7	10.8
Volatile matter (%)	24.7	28.6	31.0	31.3	31.0
Fixed carbon (%)	42.8	52.4	47.5	44.0	51.6
Total sulphur (%)	0.40	0.39			
Specific energy (MJ/kg)	22.60	27.38	26.17	25.47	
Carbon (%)	54.78	67.22			
Hydrogen (%)	3.56	4.17			
Nitrogen (%)	1.03	1.23			
Carbon dioxide (%)	0.53	0.27			
Dry, ash-free basis					
Volatile matter (%)	36.6	35.3			
Specific energy (MJ/kg)	33.48	33.80			
Carbon (%)	81.16	82.99			
Hydrogen (%)	5.27	5.15			
Nitrogen (%)	1.53	1.52			
Ash fusion temperatures (reducing atmosphere) °C					
Deformation	1200	1310			
Spherical	1490	1470			
Hemisphere	1500+	1500			
Flow	1500+	1500+			
Trace elements					
Cu				20	
Pb			40	100	
Zn			10	10	
Seam thickness (m)	3.54	3.54	0.48	0.61	
Separation density		F1.70			
Yield (%)		71.1%			

1. Raw coal, channel sample of Fenton seam, 3.54 m thick, Fenhope Colliery (Bacon, 1986).
2. Washed coal, channel sample of Fenton seam as above, F1.70 (Bacon, 1986).
3. Coal ply 0.48 m thick (between bands 3 and 4) towards base of seam at New Stanhope Colliery, collected near Adit 2 (Bacon, 1986).
4. Coal ply 0.61 m thick (between bands 4 and 5) near base of seam at New Stanhope Colliery, collected near Adit 1 (Bacon, 1986).
5. Spot sample from dump at New Stanhope Colliery (Western Mining Corporation, 1977*a*).

drilling was made by V. M. Threader in 1972. The positions of these holes are shown on Figure 55.

In 1976 the Western Mining Corporation (Tasmania) Pty Limited drilled nine chip holes west of the Stanhope–Fenhope–Mount Christie mine areas on Bonneys and Buffalo Plains. The positions of these holes (TAR 1–9) are marked on Figure 54. The individual holes were no deeper than 85 m, and the total length drilled was 587.3 metres. The company was looking for shallow open-cut coal. Only three holes, TAR-2, TAR-3, and TAR-8 intersected minor coal seams, the remainder of the holes being barren. Further details of the exploration were reported by the Western Mining Corporation (Tasmania) Pty Limited (1977*a*, *b*).

The Shell Company of Australia drilled two holes west of the Stanhope area in 1980, one near Turners Hill (AV-12) and one 2 km west of Bonneys Plains (AV-13) (fig. 54). Hole AV-12 encountered 159 m of dolerite, followed by 267 m of interbedded lithic sandstone, siltstone, mudstone, and minor coal; then 64 m of quartzose sandstone overlying a dark grey marine mudstone. Hole AV-13 passed through 307 m of dolerite; the hole was terminated after a further 52 m of interbedded lithic sandstone and siltstone was drilled. Very few coal seams were found in AV-12, with the thickest seam being only 0.57 m thick.

Avoca Transport Pty Ltd took out Exploration Licence 2/82 over the area of the Stanhope coalfield in 1982. This lapsed and the area was included in EL 1/84. One cored hole (A75-56) was drilled close to the old workings at the New Stanhope Colliery, and intersected the New Stanhope seam (3.82 m thick) (Avoca Transport, 1987*a*). Eight shallow holes were drilled near the (old) Stanhope Colliery; most of these intersected the (old) Stanhope seam. Seam sections and hole locations are given in Avoca Transport (1987*a*). No significant deposits of open-cuttable coal were found close to the old workings, and the Exploration Licence was relinquished. The area of coal between the two worked-out areas of ground (at the Stanhope and New Stanhope Collieries) is held under Mining Lease 1008 P/M by Mr D. Fenton.

POTENTIAL FOR FUTURE EXPLORATION

The thickest seam development appears to be between Mount Christie and Mount Rex, in the area of the existing mines. The seams thin drastically to the west and north of Mount Christie, and seldom reach more than one metre in thickness in this area. The area around the Mount Christie and Stanhope mines is regarded as being worked out. A limited supply of coal remains around the area of the Fenhope mine.

The total *in situ* reserve is not likely to exceed one million tonnes, so the reserve is classed as a very small *in situ* inferred reserve.

The reserves in the area of Bonneys Plains are regarded as insignificant, as no seams of economic thickness (i.e. greater than one metre) are recorded from the area.

The Merrywood Coalfield

SUMMARY

The Merrywood coalfield is a southern extension of the Fingal–Mount Nicholas coalfield and once supported a small open cut and underground mine. The seam is four metres thick, but is interbedded with many mudstone bands. Operations ceased in 1963 due to loss of markets. The coal is of good quality, but the deposit is small.

LOCATION AND ACCESS

The Merrywood coalfield [EP795745] is located 19 km east of Avoca and 15 km south of Fingal. The mine area is 28 km by road from Avoca through the township of Royal George.

GENERAL GEOLOGY

The geology of the mine area (fig. 56) has been briefly discussed by Hughes (1949*b*, 1961). A summary of the geology of the district is given in Threader (1968) and Waters (1978).

The basement rocks in the area are the Siluro-Devonian Mathinna Beds, which are extensively folded micaceous quartzwacke turbidite sequences with minor mudstone intervals. These beds have been intruded by the Ben Lomond Granite of Devonian age.

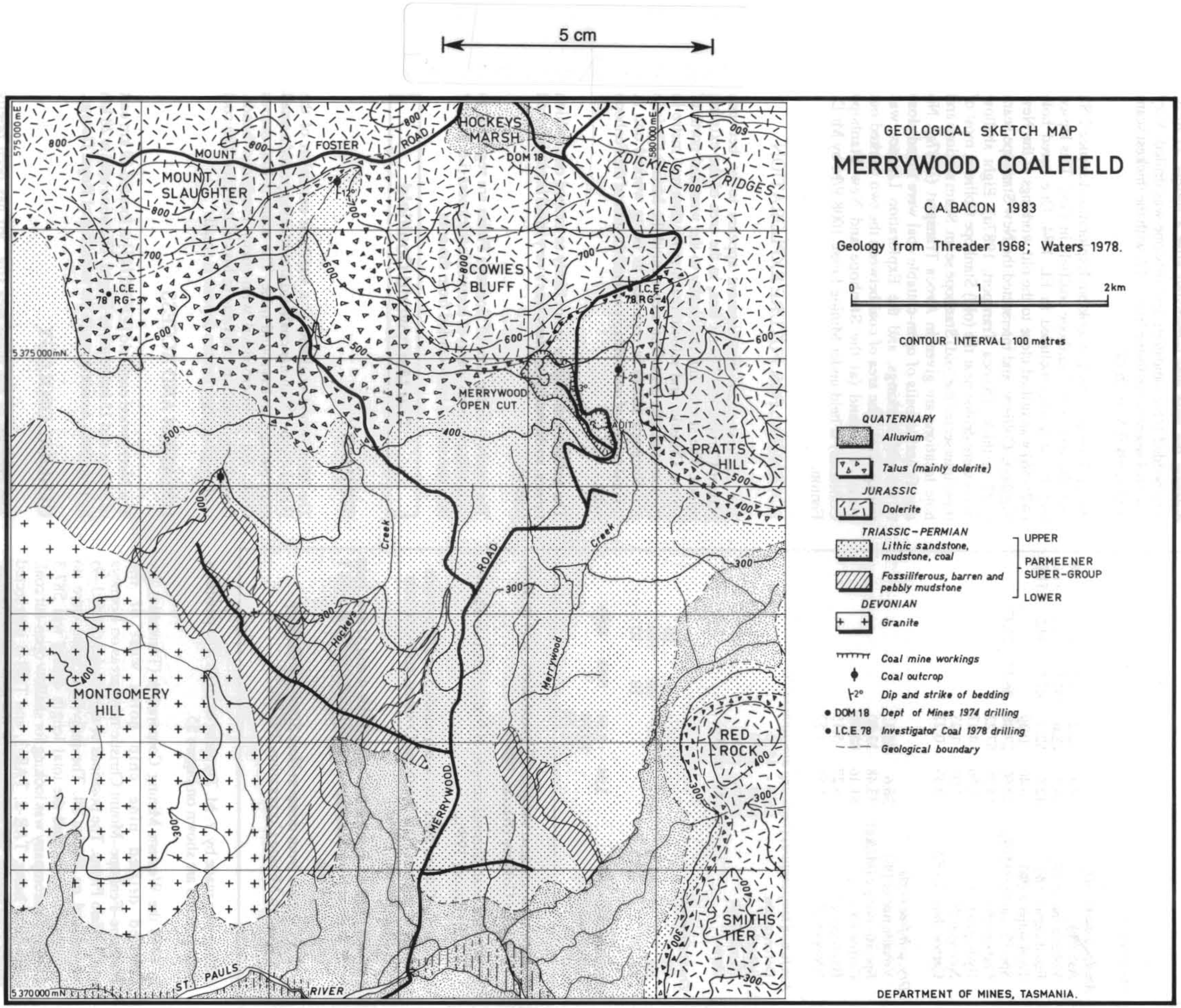

5 cm
GEOLOGICAL SKETCH MAP
MERRYWOOD COALFIELD
C.A. BACON 1983
Geology from Threader 1968; Waters 1978.
0 1 2km
CONTOUR INTERVAL 100 metres
QUATERNARY
Alluvium
Talus (mainly dolerite)
JURASSIC
Dolerite
TRIASSIC–PERMIAN
Lithic sandstone, mudstone, coal
Fossiliferous, barren and pebbly mudstone
UPPER
PARMEENER SUPER-GROUP
LOWER
DEVONIAN
Granite
Coal mine workings
Coal outcrop
Dip and strike of bedding
DOM 18 Dept of Mines 1974 drilling
I.C.E.78 Investigator Coal 1978 drilling
Geological boundary
DEPARTMENT OF MINES, TASMANIA.
575 000 mE
580 000 mE
5 375 000 mN
5 370 000 mN
MOUNT SLAUGHTER
MOUNT FOSTER ROAD
HOCKEYS MARSH
DOM 18
DICKIES RIDGES
COWIES BLUFF
I.C.E. 78 RG-3
I.C.E. 78 RG-4
MERRYWOOD OPEN CUT
ADIT
PRATTS HILL
MONTGOMERY HILL
Hockeys Creek
Merrywood Creek
MERRYWOOD ROAD
RED ROCK
SMITHS TIER
ST. PAULS RIVER

Figure 56.

Unconformably overlying the basement rocks are a series of dominantly marine sediments, belonging to the Lower Parmeener Supergroup. The unconformity is exposed in Tullochgorum Creek and in Iron Pot Gully, south-west of Fingal (Waters, 1978).

At the base of the Lower Parmeener Supergroup in the Merrywood area is a conglomerate (1–15 m thick). This is overlain by an interbedded, often fossiliferous mudstone–siltstone sequence (up to 40 m thick) which grades into a highly fossiliferous limestone (10–50 m thick). Massively bedded unfossiliferous mudstone (25–50 m thick) overlies the limestone sequence. The total thickness of the Lower Parmeener Supergroup near Merrywood would appear to be 150–200 m (Waters, 1978).

Paraconformably overlying the dominantly marine Lower Parmeener Supergroup is a massively-bedded quartzose sandstone sequence which grades up into lithic sandstone with subordinate interbedded mudstone, siltstone, claystone and coal. These rocks belong to the Upper Parmeener Supergroup. Most of the coal seams are restricted to the upper part of the lithic sandstone sequence, although rare coal is found in the quartzose sandstone. Sangster (1979) reported that Investigator Coal DDH 78RG-1 intersected a coal seam which had a quartzose sandstone roof. The sandstone sequence is about 300 m thick in the Merrywood area.

The Parmeener Supergroup sediments have a regional dip to the south-east of 3–5°, have been extensively intruded by Jurassic dolerite, and some parts of the coal-bearing sequence have been rafted upwards, eroded and lost. The dolerite forms a protective capping on much of the high plateau areas around Merrywood.

The dolerite has intruded as a series of transgressive sheets and dykes. Intrusion into the older Mathinna Beds is rare but has been recorded by Threader (1968). Faulting accompanying the dolerite intrusion and occurring later in the Tertiary has disrupted the continuity of the coal seams.

Dolerite to the north of the Merrywood open cut truncates the coal seam and has restricted the area of potential development to the north and east. In the underground workings at Merrywood, Hughes (1949*b*) recorded the strike of the seam as 30° E of N, with a dip to the south-east of 5°. Two minor faults with throws of 1–2 m in the underground workings were noted by Hughes (1949*b*).

In the area of the open cut the dolerite cover has been eroded, leaving a thin sandstone overburden on the near-surface coal. Some dolerite talus covered the sandstone. The cover was relatively easily removed by bulldozer, with no blasting required.

From drilling by the Department of Mines and the Shell Company of Australia Pty Ltd, eight seams have been recognised in the Fingal area and most of these have now been correlated with sequences to the east of Fingal, near Dalmayne, and further south near the Douglas River. Drill hole data is more sparse west of Fingal, but a tentative correlation has been made between the 'C' coal interval on Fingal Tier and the Merrywood seam.

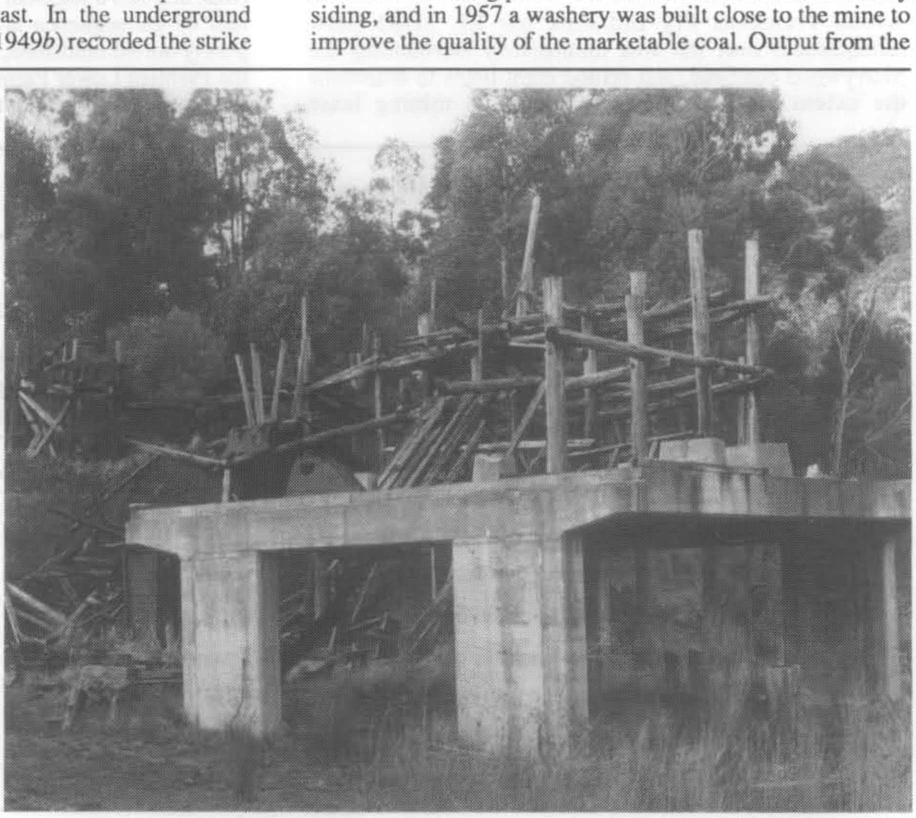
PREVIOUS MINING HISTORY

In 1862 Zephaniah Williams found coal at the Red Rock (near Merrywood) and sunk a shaft to intersect the seam, which was 3.15 m thick. The coal was 'much perished' (Senate Select Committee on Coalfields, 1864) and no further work was done until 1907, when the coal near Merrywood was rediscovered.

Hills *et al.* (1922) noted that exploratory works at Merrywood consisted of one adit 40 m long and two shafts. Large scale mining began in 1945. The seam was reported as being 5.2 m thick of which 2.1 m was mined by the bord and pillar method (Annual Report of the Director of Mines for 1945, p. 50).

In 1947 tests were made by bulldozer to ascertain the viability of open-cut operations, which eventually commenced in 1948. Coal was produced from both underground workings and the open cut until the mine closed, except for an interval in 1949 when open-cut operations were briefly suspended until demand increased.

In 1953 a crushing plant was installed at the Avoca railway siding, and in 1957 a washery was built close to the mine to improve the quality of the marketable coal. Output from the



Ruins of old washery building at Merrywood.

[Carol Bacon]

mine was the highest in the State in terms of tonnes/man/year for much of the mine life, although the transport of the coal to Avoca was always a problem for the mine owners. The road was in poor condition, subject to frequent flooding, and the transport trucks suffered many mechanical difficulties. Both underground and open-cut operations ceased in 1963 due to a loss of markets.

COAL QUALITY

Analyses of coal samples from the Merrywood area are given in Tables 38 and 39.

RECENT EXPLORATION

In 1974 the Department of Mines drilled two holes near the Merrywood open cut as stratigraphic control holes for a gravity survey. In DOM DDH 18, dolerite had intruded to RL 293 m, below the level of the Merrywood seam. However in DOM DDH 22, drilled near Royal George, six thin coaly intervals were intersected and sampled. The coal seam at the mouth of the Merrywood adit was sampled in 1970 by V. M. Threader.

Another channel sample was taken at the open cut in 1984. The results of this sampling, and petrographic analyses of the seam, are given in Bacon and Threader (1984).

In 1978 Investigator Coal Exploration Pty Ltd drilled four holes in the area, two of which were in the vicinity of the old Merrywood mine. The holes intersected a total of 29 coaly intervals, from 0.3 m to 2.2 m thick. Coal sections greater than 0.5 m thick were sampled and analysed. The analysis results and details of exploration are given in full in Waters (1978) and Sangster (1979).

Three holes were drilled on the lower northern slopes of Mt Foster by the Cornwall Coal Company in 1983 (in EL 22/82). These holes intersected dolerite scree and Permian sediments. Another hole drilled on Coachies Marsh, also to the north of Merrywood, was terminated in dolerite (Bryan, 1984).

Avoca Transport Pty Ltd took out EL 21/82 (now relinquished) over the area immediately surrounding the Merrywood coalfield, and drilled eight holes to determine the extent of the Merrywood seam. A mining lease (103M/84; 132 ha) was taken out covering the old open cut and the area immediately adjacent. Six holes were drilled in 1986 close to the old workings, a further two shallow holes were put down near Hockeys Creek to the west of the Merrywood open cut, and later two more shallow holes were drilled near Pratts Hill, east of Merrywood. Seam sections are given in Avoca Transport (1987*b*, *c*).

Since 1984, when Mining Lease 103M/84 was taken out, the Merrywood Coal Company NL have stripped the overburden from most of the old underground workings at Merrywood. The remaining pillars were mined intermittently (33 000 tonnes of coal being mined in 1986–87) and sold to the Cornwall Coal Company at Fingal. Sales of screened coal to industry commenced in 1989/90, and there are plans for this operation to continue.

POTENTIAL FOR FUTURE EXPLORATION

The coal seam exposed in the Merrywood open cut is thick (≅ 4 m), of which 2.0 m is relatively free of dirt bands. The mine area is free of major faults. The reserve remaining in the Merrywood area is not likely to exceed one million tonnes, thus the deposit is classed as a very small inferred reserve. Of this, 0.5 million tonnes may be regarded as an indicated *in situ* reserve.

Minor coal areas

TOWER HILL AREA

Tower Hill, located 28 km north-east of Avoca, is a dolerite-capped outlier of flat-bedded Parmeener Supergroup rocks resting unconformably on Mathinna Beds. The topmost part of the Parmeener sequence is prospective for coal, being a correlate of the coal measures presently mined at Fingal and Mt Nicholas. Recent mapping by Calver *et al.* (1988) has shown the extent and geological setting of this minor coalfield.

The Parmeener Supergroup at Tower Hill is about 400 m thick and has a regional dip of 1–2° to the ESE. The lower half of the sequence is composed of dominantly marine, poorly-sorted mudstone, pebbly sandstone and limestone of the Permian Lower Parmeener Supergroup. This part of the sequence is subdivided in detail by Calver *et al.* (1988).

Table 38. *Analyses of coal samples, Merrywood coalfield.*

	1	2	3	4	5	6	7
Total moisture (%)	2.66	2.40	2.19	-	3.5	3.5	3.3
Moisture (%)	-	-	-	4.4			
Ash (%)	18.36	20.00	18.82	25.3	36.7	27.7	22.6
Volatile matter (%)	25.10	26.66	27.74	26.1	26.0	22.2	23.1
Fixed carbon (%)	53.88	50.94	51.24	44.2	33.8	46.6	51.0
Total sulphur (%)	0.40	0.35	0.35	-	0.77	0.34	0.40
Specific energy (MJ/kg)	25.27	25.28	26.47	-	19.42	22.38	24.74

1. Outcrop in Merrywood Creek (Hills *et al.*, 1922, sample 693).
2. Top 1.22 m of seam in open cut (Hughes, 1949*b*).
3. Whole seam (2.03 m thick) in open cut (Hughes, 1949*b*).
4. Whole seam (3.62 m thick) in open cut (Bacon and Threader, 1984).
5. Whole seam composite, 3.83 m thick, DDH A75 (Avoca Transport, 1987*b*).
6. Middle portion of seam, 1.94 m thick, DDH A75 (Avoca Transport, 1987*b*).
7. Lower portion of seam 1.07 m thick DDH A75 (Avoca Transport, 1987*b*).

Table 39. *Analyses of coal samples, Merrywood mine.*

	1	2	3
Moisture (%)	4.9	2.8	3.3
Analysis basis (AD)			
Ash (%)	23.2	22.7	29.4
Volatile matter (%)	28.8	27.1	25.0
Fixed carbon (%)	48.0	47.4	42.3
Total sulphur (%)	0.43	0.36	0.31
Specific energy (MJ/kg)	25.66	25.54	22.58
Carbon dioxide (%)	-	-	0.09
Chlorine	0.01	-	-
Dry, ash-free basis			
Volatile matter (%)	-	-	-
Specific energy (MJ/kg)	33.42	-	-
Carbon (%)	82.2	-	-
Hydrogen (%)	4.97	-	-
Nitrogen (%)	1.40	-	-
Sulphur (%)	0.56	-	-
Oxygn (%)	10.2	-	
Ash fusion temperatures (reducing atmosphere) °C			
Deformation	1550	1260	1320
Spherical	1550+	1560+	1560+
Hemisphere	1550+	1560+	1560+
Flow	1550+	1560+	1560+
Ash Analysis (%)			
SiO_2	60.9	63.3	60.6
Al_2O_3	32.6	27.6	28.5
Fe_2O_3	3.14	3.77	2.70
Mn_3O_4	0.05	0.02	0.07
P_2O_5	0.12	0.04	0.04
TiO_2	1.32		
CaO	0.99	1.13	2.63
MgO	0.72	1.07	0.96
K_2O	0.89	0.85	1.25
Na_2O	0.11	0.20	0.10
SO_3	0.31	0.16	1.32
BaO		0.04	0.02
SrO		0.01	0.02
ZnO		0.01	0.06

1. Sample of run of mine coal sent to NSW Joint Coal Board in December 1988 by Avoca Transport.
2. Crushed oversize coal (+37 mm) sent to SGS in July 1989 by Avoca Transport.
3. Product coal (-37 mm) without oversize fraction sent to SGS in July 1989 by Avoca Transport.

The uppermost unit of the Lower Parmeener Supergroup, a marine, unfossiliferous, poorly-sorted grey mudstone, is abruptly overlain by the wholly freshwater sequence of the Upper Parmeener Supergroup, in which four units are recognised. The oldest is an impersistent unit of medium to fine-grained, tough, slightly feldspathic quartz arenite and micaceous shale up to 10 m thick. This unit, which is best exposed in cuttings on O'Tooles Road at EP711986, is Late Permian in age, and is a probable correlate of the Cygnet Coal Measures (S. M. Forsyth, pers. comm.). An abrupt and probably erosional interface delineates the base of the second unit, which almost wholly consists of cross-bedded, medium-grained quartz arenite, about 30–50 m thick. This unit tends to crop out prominently, often as cliffs. Slumping (resulting in overturning of the upper parts of beds) is common. Correlation on lithologic grounds with the Early Triassic quartz sandstones of the Midlands (see Forsyth, 1984*a*) is suggested.

The third unit, not well exposed except in road cuttings, consists of quartz-rich lithic arenite and quartz arenite interbedded with mudstone and carbonaceous mudstone, and is about 20 m thick. This passes up, possibly gradationally, into the fourth unit, an interbedded lithic arenite–mudstone–coal sequence. Outcrop is severely limited by the widespread dolerite talus cover. A maximum of 150–200 m of coal measures may be inferred under East Tower. The sequence is capped by dolerite which crops out at the summit as a prominent arête, and is the remnant of a once widely-distributed, sheet-like intrusion. Small areas of fine-grained dolerite cropping out at lower elevations (at EQ716004 and as narrow dykes at EQ716016 and EQ729014) are probably feeders continuing at depth.

The coal-bearing sequence on West Tower is probably much thinner and also more areally restricted, due in part to the dolerite intruding at a lower elevation. The coal measures do not crop out at all on West Tower because of the continuous coverage of dolerite talus.

Minor faulting, probably of Tertiary age, disrupts the sequence in the south-eastern and far western parts of the area.

Coal has been intersected in drill holes on East Tower. One hole was drilled in 1979 and three in 1984 by the Cornwall Coal Company, which currently holds Retention Licence 8814 over the area.

The 1979 hole intersected one seam 1.86 m thick from which the following analysis was made:

Moisture (%)	3.9
Ash (%)	37.6
Volatile matter (%)	21.8
Fixed carbon (%)	36.7

No mining of coal has occurred in this area. The *in situ* reserves are not likely to exceed one million tonnes, and the inferred reserves are classed as 'very small'.

LEWIS HILL AREA

In 1862 Williams sunk a shaft through coal on Lewis Hill, south of Royal George. The seam intersected was 3.0 m thick and was very banded. No mining activity commenced at this time, although small-scale mining occurred on Lewis Hill from 1910 to 1920. Coal was mined from an adit named the 'Prospect tunnel' (located in a tributary of Rockhouse Creek at EP772662) and from an adit in Stable Creek [EP735638] (Waters, 1978). Both these small mines had ceased production by 1922.

BEN LOMOND AREA

Coalmine Crag (Rafferty Creek)

Two small coal outcrops occur in Rafferty Creek at an altitude of about 1280 m [EP541997], where they were formerly worked on a small scale and burnt in skier's huts. The best outcrop is on the left bank in a bend in the creek, where a seam about 0.5 m thick is interbedded with off-white to dark grey, finely laminated, generally flat-lying but cross-bedded siltstone and mudstone. The upper contact is sharp, but the lower is gradational. Weathered and fragmented sandstone is exposed in the creek both upstream and downstream of the coal outcrops. Dolerite occurs a few hundred metres away to the south at a rocky knoll in Rodway Valley; to the north-east at the base of the Giblin Fells; to the north-west at the base of Coalmine Crag; and 700 m to the south-west, downstream in Rafferty Creek. From the local topography and texture of the surrounding dolerite, it is clear that the Triassic coal measures occur below the dolerite sill, which is markedly transgressive, the base probably locally dipping to the south-west (J. L. Everard, pers. comm.)

Carbonaceous siltstone immediately above the first coal outcrop yielded a well-preserved microflora, including *Annulispora microannulata*, *Circulisporites panius*, *Semiretisporis denmeadi*, and *Aratrisporites parvispinosus*. These belong to the *Craterisporites rotundus* Zone (as locally applied) and indicate a Karnian age (S. M. Forsyth, pers. comm.).

A Reward Lease (7342/M) of 80 acres (32 ha) was given to Joseph Box Dean and Francis Richard Davis near Coalmine Crag in 1917, but this expired in 1923 with no work having been done. Dean and Davis took out a lease of 320 acres (130 ha) (7343/M) adjacent to the Reward Lease in 1917, but this was cancelled on 8 October 1918.

On the Lease Plan, Rafferty Creek is shown as Rodway Creek above the junction of Talus Creek and as Borrowdale Creek below the junction. This area is on the Ben Lomond plateau and is now contained within the Ben Lomond National Park and so is exempt from the provisions of the Mining Act, 1929.

Rabbit Marsh

Much of the area around Rabbit Marsh [EP972485] and the Nile River is underlain by Triassic rocks, including both quartz sandstone and lithic sandstone and mudstone (coal measures). However except in a few river and stream exposures, bedrock is obscured by dolerite talus. A series of NNW-trending faults cross the area and probably throw the Triassic rocks against dolerite bedrock in several areas. In creek outcrop between EP499947 and EP486979 near Rabbit Marsh, there is a probably unfaulted, patchily exposed succession from Triassic quartz sandstone, through a transitional lithology to lithic sandstone, siltstone and carbonaceous mudstone. The latter contains discontinuous lenses and seams up to 500 mm thick of coal (J. L. Everard, pers. comm.).

A coal sample (BU245) from EP489965 was associated with spores of *Semiretisporis denmeadi*, indicating an age not younger than the *Craterisporites rotundus* Zone but younger than the Triassic basalt near St Marys and the Tiers Formation (S. M. Forsyth, pers. comm.).

A sample of this coal was analysed (air-dried basis) as follows:

Moisture (%)	4.4
Ash (%)	19.1
Volatile matter (%)	29.2
Fixed carbon (%)	47.3
Specific energy (MJ/kg)	25.58

Storys Creek (Coal Falls)

Strzelecki (1845) mentioned a seam of coal on the southern side of Ben Lomond, uplifted 2100 feet (700 m) "above the actual coal beds". This is most probably the outcrop in Storys Creek at Coal Falls [EP594930]. Milligan (1849) also wrote of coal on the southern side of Ben Lomond, probably a rediscovery of the Coal Falls outcrop. A lease (ML 898/M; 320 acres) was taken out by James Lamont in 1864, but this was allowed to lapse.

An adit [at EP594930] was dug into the three metre thick seam in 1887 by a party including a Mr Robert Stevenson of Evandale. Coal was transported by pack horse to Avoca, but the distance from the railway and difficulty of transporting the coal prevented mining activity of any consequence from continuing.

MANGANA

Coal of Permian age occurs near Mangana, and a shaft sunk to intersect the 380 mm thick seam was visited by T. Stevens in 1863 (*Pap. Proc. R. Soc. Tasm.*, April 1863). From Stevens' description of the geology passed *en route* to the shaft, located above the Mangana township, the position of the old shaft has been ascertained from recent mapping (Calver *et al.*, 1988). The shaft must have been on a slight ridge running down from East Tower, between Calders and Breakneck gullies, and sunk in Permian sediments around EP710970. The coal is contained in a rock sequence known as the Aberfoyle Formation, which is a sandstone–shale–sconglomerate sequence with very rare lenses of coal, and is equivalent in age to the Mersey and Preolenna Coal Measures. Stevens noted that the shaft had been sunk in a (vain) search for gold.

PART 9: NORTHERN TASMANIAN COALFIELDS

The Longford Coalfield

SUMMARY

Coal was mined at two small mines, the Norwich and Pateena Collieries, intermittently from 1886 to 1919. The collieries were located close to each other near the township of Pateena, six kilometres north of Longford. The coalfield is of small areal extent and reserves are negligible. The coal is of Late Triassic age and forms a minor component of a dominantly lithic sandstone sequence with minor interbedded shale, mudstone and siltstone, from the top of the Upper Parmeener Supergroup. The coalfield is of no further economic interest, due to the limited areal extent and the thin nature of the coal seams.

LOCATION AND ACCESS

The Longford coalfield lies six kilometres north of Longford and two kilometres south of Mt Arnon [EQ091035] in northern Tasmania. Jordans Creek runs through the coalfield. Access is provided by Pateena Road and various secondary tracks.

GENERAL GEOLOGY

The Longford coalfield has been examined by Johnston (1888) and Reid (*in* Hills *et al.*, 1922). Johnston (1888) collected a variety of Triassic plant fossils from shale exposed on the property 'Norwich', north of Longford.

The coalfield was mapped by Blake (1959) as part of the Longford Quadrangle. The dominantly lithic sandstone sequence in which the coal seams occur forms the youngest part of the Upper Parmeener Supergroup, and is of Late Triassic age.

The sequence is of small areal extent and is faulted to the east against a dolerite sheet (along the Pateena Fault). The block of coal-bearing lithic sandstone is considered by Longman and Leaman (1971) to overlie a dolerite sheet which has intruded at the base of the Upper Parmeener Supergroup sediments in the Longford area.

An outcrop of coal in Jordans Creek, close to Pateena Road, is described by Johnston (1888) and Reid (*in* Hills *et al.*, 1922).

PREVIOUS MINING HISTORY

In 1886 two diamond-drill holes were sunk on the property 'Belmont' south of Longford, but coal-bearing sediments were not intersected in either hole.

The Pateena Coal Company was mining coal from a 0.6 m thick seam on land belonging to J. Wise (near Pateena) in 1886. The seam was intersected in the shaft at a depth of 80 metres. A new shaft, 1.8 × 1.8 m, was sunk in 1896 close to the older workings. Several additional shafts are shown on the 1896 mine plan (Department of Mines underground plan 252). A 1918 plan of the Pateena Colliery shows an adit and pump shaft with some underground workings. Hills *et al.* (1922) recorded that from 1916 to 1919 some 800 tonnes of coal were raised by two men operating the Pateena mine, which consisted primarily of a dip-tunnel in the bank of Jordans Creek.

Johnston (1888) noted that four shafts had been sunk for coal at Norwich. These were all between 6 m and 21 m deep, and the coal seam mined was 1.8–2.1 m thick. In 1890 the Norwich Colliery consisted of three shafts, one already filled in, and two adits (DOM underground plan 254). Reid (*in* Hills *et al.*, 1922) recorded that a small quantity of coal had been raised from prospecting shafts sunk into the coal at Norwich.

COAL QUALITY

The following analysis is from coal mined from the Norwich Colliery (Johnston, 1888):

Moisture (%)	13.00
Ash (%)	12.60
Volatile matter (%)	27.30
Fixed carbon (%)	47.10
Sulphur (%)	0.55

RECENT EXPLORATION

Two exploration drill holes were drilled by the CSR Coal Division in 1982 in the vicinity of the old mine workings (Carr, 1984). Three thin coal seams were recorded in one of the drill holes.

POTENTIAL FOR FUTURE EXPLORATION

The potential for future development of the Longford coalfield is minimal.

The George Town Coalfield

SUMMARY

The George Town coalfield is located on the south-eastern slopes of Mt George [DQ892491] where thin seams of coal were found in the Clog Tom Sandstone late last century. A few shafts were sunk for prospecting purposes but no mining activity eventuated. The seams are all thin and of limited areal extent. The coal is of Late Permian age.

LOCATION AND ACCESS

The George Town coalfield is situated on the south-eastern slopes of Mt George, 3 km east of George Town and 3 km north of Bell Bay, at the mouth of the Tamar Estuary in northern Tasmania. Access is provided by a network of sealed and secondary roads.

GENERAL GEOLOGY

The George Town coalfield has been examined by Twelvetrees (1904), Hills (1920), Hills *et al.* (1922), Blake (1936*c*), Hughes (1949*c*), and is included on the Beaconsfield Sheet of the Geological Atlas 1:63 360 Series (Gee and Legge, 1971).

Twelvetrees (1904) regarded the coal as being of Tertiary age, describing the sediments examined as follows:

> "the looseness of the sandstones, the character of the clay combine in indicating that the coal and enclosing strata belong to the Tamar series of Tertiary deposits. The character of the coal confirms this conclusion. It is a light coal retaining a slightly woody structure, brown to black in hue, moist when freshly broken not at all sulphurous ....".

Hills (1920) was of the opinion that the rocks hosting the coal were of the "Trias-Jura" series (i.e. Triassic), while Hughes (1949*c*) described the host rocks as being typical of the "Permian mudstone and coarse iron-stained sandstone or grits which bear little likeness to the typical feldspathic sandstone, the coal bearer of the Triassic".

The mapping of Gee and Legge (1971) shows a small fault block of Triassic (Upper Parmeener Supergroup) micaceous quartz sandstone faulted against Permian (Lower Parmeener Supergroup) sediments in the coalfield area. Careful plotting of the old shafts and bores has shown that these were all sunk in the Clog Tom Sandstone, a correlate of the Cygnet Coal Measures of Late Permian age.

The stratigraphy (Gee and Legge, 1971) in the George Town area is:

Upper Parmeener Supergroup

Thickly-bedded and cross-bedded to medium-grained ferruginous quartz sandstone.

Lower Parmeener Supergroup

Clog Tom Sandstone: carbonaceous and micaceous quartz sandstone.

Middle Arm Group: Interbedded, unfossiliferous, worm-cast argillaceous sandstone and dark mottled siltstone.

Liffey Sandstone: Well-sorted cross-bedded carbonaceous sandstone.

Masseys Creek Group: Calcareous siltstone, sandstone, limestone and mudstone, commonly fossiliferous and pebbly in places.

PREVIOUS MINING HISTORY

Coal was discovered on the Musk Vale Estate, near George Town, in 1888 by a Mr Hackett, who was granted a Reward Lease in 1889. The field was visited by Twelvetrees (1904) who described two old shafts (Hackett's and Grubb's) sunk to a depth of 3.6 m and 9.75 m respectively, and a 'new' shaft, 13.4 m deep. The seams encountered in all of these shafts were from 50–300 mm thick.

Hills (1920) inspected the field to determine whether the coals were Tertiary lignite or older (i.e. Triassic). On deciding that the coals were Triassic, Hills marked out the position of eight drill holes to determine the extent of the field. A shaft 13.7 m deep had recently been dug near Hackett's old shaft prior to Hills' visit. Two thin seams of coal, 200 mm and 150 mm thick respectively, were intersected in the shaft.

Six holes were drilled in 1935–36, several being in positions suggested by Hills (1920). The logs are given by Blake (1936*c*). No coal was intersected in these holes, and Hughes (1949*c*) commented that the holes were sited below the level of the two seams inspected in the shaft by Hills (1920).

COAL QUALITY

Few analyses of coal are available from the George Town coalfield. The analyses in Table 40 are from Twelvetrees (1904).

Table 40. *Analyses of coal samples, George Town coalfield.*

Moisture (%)	10.06	6.60	14.50	15.00	15.83
Ash (%)	4.12	8.00	4.65	8.40	15.57
Volatile matter (%)	33.42	35.50	26.80	36.90	33.09
Fixed carbon (%)	52.40	49.00	54.05	39.70	35.49
Sulphur (%)	-	0.90	0.00	0.00	0.02

The samples would be hand-picked pieces and not whole-seam samples.

RECENT EXPLORATION

A number of auger holes and costeans were put down in the George Town area by Avoca Transport Pty Ltd in 1981, when the area was held under EL 16/79. The programme was unsuccessful in locating any significant coal seams (Miedecke, 1983).

POTENTIAL FOR FUTURE EXPLORATION

The potential for future exploration in the George Town coalfield is extremely small. The known seams are very thin (<0.30 m thick) and of limited lateral extent.

PART 10: NORTH-WEST TASMANIAN COALFIELDS

The Mersey–Don Coalfield

SUMMARY

Following the discovery of coal in the Mersey–Don area in 1850, mining of coal continued intermittently until 1961. The coal is of Early Permian age and occurs in thin, faulted seams from 450–600 mm thick. Mining was by hand, using both bord and pillar and longwall methods of extraction. While low in ash content, the coal contains up to 5% sulphur. The thin and faulted nature of the coal seams, and the limited lateral extent of the coalfield, suggest that the area is of minimal interest for future exploration.

LOCATION AND ACCESS

This coalfield occupies an area between the Mersey and Don Rivers south of Devonport on the North West Coast (fig. 57). The area of interest extends from Spreyton [DQ450360], five kilometres south of Devonport, in a southerly direction towards Railton [DQ520230]. Within this larger area, Burns (1965) has identified ten smaller centres of interest, these being the focal points of previous mining activity. These areas are: Tugrah (on the banks of the Don River) [DQ415338]; Denny Gorge [DQ425335]; Bott Gorge [DQ430310]; West Spreyton [445340]; East Spreyton [DQ455343]; Tarleton [DQ480342]; Sherwood [DQ492338]; near Nook [DQ450280]; Dulverton [DQ500240]; and at the mouth of Caroline Creek [DQ508320].

A number of sealed and unsealed roads provide adequate access to the various parts of the coalfield.

GENERAL GEOLOGY

The area has been examined by Milligan (1852), Selwyn (1855), Gould (1861*a*), Stephens (1870), Thureau (1883*e*, 1885), Twelvetrees (1911) and Reid (*in* Hills *et al.*, 1922).

The geology of the area is shown in Figure 58 and is discussed in detail in Burns (1965), who gave the stratigraphy of the Mersey Coalfield as:-

Kelcey Tier Beds	180 m thick
Mersey Coal Measures	19–29 m+ thick
Spreyton Beds	48–176 m+ thick
Basal conglomerate	0–55 m+ thick

These four units belong to the Lower Division of the Parmeener Supergroup and are Permian in age.

The basal conglomerate is composed of sub-angular pebbles (ranging up to 50 mm in diameter) of white quartzite, schist and conglomerate. The matrix is feldspathic sandstone. The conglomerate is overlain by the Spreyton Beds which consist of interbedded siltstone, mudstone and pebbly sandstone. Horizons rich in shells are common. The Mersey Coal Measures overlie the Spreyton Beds and consist of (lithic) sandstone with minor mudstone and thin coal seams. The overlying Kelcey Tier Beds is composed of interbedded mudstone, pebbly mudstone, siltstone and sandstone (Burns, 1965).

Jurassic dolerite has intruded the sedimentary sequence and now caps much of the higher ground in the coalfield. The coal seams, which are on average 450–600 mm thick, have been disrupted by faulting of probable Tertiary age.

The Mersey Coal Measures are of Early Permian (late Sakmarian–early Artinskian) age and pre-date the Artinskian Greta Coal Measures of NSW (Noldart, 1975). An examination of microflora from samples collected in the vicinity of Tarleton (presumably near the Tarleton Colliery) and Illamatha (presumably near the Illamatha Colliery) was made by Truswell (1978), who concluded that the microfloral assemblages were probably as young as substage 3B (i.e. Bernacchian) in age (M. J. Clarke, pers. comm.).

The Tasmanite Oil Shale is not a lateral equivalent of the Mersey Coal Measures, occurring at a much lower horizon within the Parmeener Supergroup (Noldart, 1975) and is, in fact, Late Carboniferous (Tamarian) in age (M. J. Clarke, pers. comm.).

PREVIOUS MINING HISTORY

Bott Gorge

In 1851 Messrs Dean and Cocker were *en route* from the River Leven to Launceston when they were benighted on a tier near the Don River and forced to spend one night as the guests of two burly timber splitters, Powell and Ayres. Dean noticed that the hut fire was fuelled with coal, and on the offer of five sovereigns, the timber splitters showed the two visitors where the coal could be found. On reaching Launceston, Dean quickly formed a syndicate to work this find of coal. The Launceston Syndicate lost no time in purchasing some 690 ha of land from George Augustus Robinson and started prospecting work (Ramsay, 1958). This area, at the mouth of the Bott Gorge, was inspected by Milligan (1852), who records seeing fragments of bituminous coal in the channel of a tributary of the Don River, and three beds of coal from 250–400 mm thick in the channel of the Don River.

A shipment of 12 t of this coal was sent to Launceston in February 1853 on the cutter *Mountaineer* and samples were exhibited. The Mersey Coal Company was formed by the Launceston Syndicate, raising £25,000 ($50,000) as working capital from the sale of 1000 shares at £25 each. William Dawson was engaged as a surveyor and manager of the planned mines, the company sent to England for experienced miners, and the construction of a tramway and installation of mining machinery started (Ramsay, 1958).

The mining operations were visited by the Governor, Sir William Denison, in February 1853. Dean had disagreed with the extravagant and wasteful nature of the initial operations, and had since left the syndicate to go prospecting on his own.

The shaft, which was sunk to a depth of 100 m, was noted by Selwyn (1855) to be situated in fossiliferous limestone and shale, in which no coal would be found. Selwyn (1855) was of the opinion that all but 0.4–0.8 ha of the land held by the company was unprospective. The company dug an adit into an outcrop of coal, but the seam was cut off by a fault.

After spending nearly £20,000 pounds in fruitless endeavour, the company was wound up and the miners were paid off in 1857. No further work has been done in this area.

Denny Gorge

DENNY COLLIERY (1853–1854)

Dean formed a new company in late 1853 to work coal discovered on Mr J. Denny's land. The company rented the ground for £500 per year, but after working for only one year and raising 3000 t of coal, difficult mining conditions caused by excessive faulting resulted in the cessation of the operation. Denny was awarded £1000 compensation for non-fulfilment of the lease (Ramsay, 1958). The mine was known as the Denny Colliery, and was situated on the east bank of the Don River near the mouth of Denny Gorge. Four shafts were sunk, although most of the production came from only one. The workings are described by Selwyn (1855), Gould (1861*a*) and Burns (1957*b*). Selwyn (1855) recorded that the coal seam was 600–710 mm thick.

NOVELTY COLLIERY (1938–1939)

A new mine was opened close to the old main shaft of the Denny Colliery in 1938. These workings were known as the Novelty Colliery and produced coal for only two years (1938–1939).

Tarleton

An experienced Welsh miner, Zephaniah Williams, was arrested on a charge of high treason in connection with the Chartist riots in Britain in 1848. Williams was transported to Van Diemens Land, but was later pardoned on the condition that he did not return to the United Kingdom.

Williams was introduced to the Mersey coalfield by Dean, who suggested he be appointed as manager of the Launceston Syndicate's initial operations near the Don River (at the mouth of Bott Gorge). However other syndicate members rejected Williams.

At the time (1851) Williams was engaged in mining coal at New Town. After his inspection of the Mersey coalfield he promptly sold his New Town mine and formed his own company, in which he assumed the position of manager, and returned to prospect in the Mersey coalfield. Members of Williams' company purchased some 800 ha of land between the Mersey and Don Rivers. Prospecting work commenced by sinking a shaft south-west of the township of Tarleton. By late 1853 Williams had located various outcrops of coal and extravagantly sent to England and Wales for experienced miners, as well as ordering the building of forty brick cottages for them and a cottage for himself (Ramsay, 1958).

The shaft, which was dug to a depth of 80 m, was barren of coal. Selwyn (1855) inspected the work and declared that the shaft was sunk in fossiliferous strata stratigraphically below the coal-bearing horizons, stating further that Mr Williams had no prospect "... of finding coal were he to sink for another thousand yards; he (Williams), however is firmly persuaded to the contrary" (Selwyn, 1855).

Williams' company opened up the Denison Colliery on one of the outcrops of coal. The coal was worked from a number of short adits. The ground was very faulted, with the faults generally running in a NW-SE direction (Gould, 1861*a*). Operations had ceased by 1861.

A number of other shafts were sunk in the Tarleton area by Williams. These are described in Burns (1965). The coal-bearing area at the Denison Colliery is confined to a very small fault block (Twelvetrees, 1911).

DENISON COLLIERY (1855–1859)

The Denison Colliery was worked from 1855 to 1859 by Williams and a syndicate partner, A. Nicholls. The Government provided an access road to the mine (Booth, 1962), and Williams constructed a jetty at which boats could load coal. Williams and Nicholls' partnership dissolved in 1859, with the two disputing ownership of their assets. Their affairs were eventually settled by arbitration, and Williams left the coal mining industry to become a publican at Ballahoo and Tarleton (Booth, 1962).

RILEY'S MINES (1881–1900)

Areas south-west of the Tarleton township were worked by Riley. The initial workings (Riley No. 1) operated between 1881 and 1891. The later Spreyton No. 4 (1909) workings were adjacent to the earlier ones. A plan of the workings was made by Thureau (1883*e*). From about 1883 until 1900 new workings south of the first were opened and named Riley No. 2. These are described by Burns (1965).

SPREYTON No. 4 (1909–1916)
SPREYTON No. 5 (1917–1923)

The Spreyton No. 4, close to Rileys first set of workings, was also known as the Spreyton, Allisons or the Mersey Colliery. Extraction in this mine was by longwall methods (Hills *et al.*, 1922).

The Spreyton No. 5 was located a few hundred metres to the north of the No. 4 workings, and was worked by the same owners, the Allisons (Burns, 1965).

SOUTHERN STAR (1931–1936)

Coal was extracted from three adits, and the workings adjoined the old Denison Colliery to the west. The coal produced was sold to the Goliath Portland Cement Company at Railton (Burns, 1965).

COVENTRY No. 1 (1931–1939)
COVENTRY No. 2 (1939–1946)

The Coventry No. 1 mine consisted of a single adit, and was also known as the Tarleton Coal Mine or Tarleton No. 1 pit. The Coventry No. 2 mine was situated east of the Coventry No. 1. The Government provided assistance to both operations by building tramways to each mine (Burns, 1965).

East Spreyton

RUSSELL COLLIERY (1867?–1899)

Coal was discovered in this area by Williams in 1855, but production did not start until some time between 1867 and 1869. The mine was worked from a number of adits driven under the eastern face of the hill. A large number of small NW-trending faults were encountered in the workings. The mine was owned by T. Hainsworth (Burns, 1965).

SPREYTON No. 1 (1902–1903)
SPREYTON No. 3 (1904–1908)

Spreyton No. 1 mine worked land adjoining the Russell Colliery on the south-west side and was also known as Allison's Coal Mine or the Spreyton Coal Mine. Coal was extracted from an adit. The Spreyton No. 3 was also operated by Allison. A small area was worked from a low tunnel with a short tramway to the main road (Burns, 1965).

West Spreyton

DON COLLIERY (1855–1883)

Following the failure of the Denny Colliery in 1854, W. Dean found coal on his own land (between the Don River and Deans Point) by sinking a shaft (Fenton, 1891), and promptly opened the Don Colliery. Coal was sent to Swan Bay (now Flour Mill Bay) using a tramway built for Dean's sawmill (Booth, 1962). After raising a small quantity of coal, Dean leased the mine to Williams. In 1857 three bore holes were put down to determine the extent of the coal and coal was proved over a small area (Gould, 1861*a*; Burns, 1965). Williams then sank the main shaft of the colliery but two faults were encountered in the workings.

SPREYTON No. 2 (1903–1904)

Spreyton No. 2 was located west of Figure of Eight Creek at Spreyton, adjacent to the Aberdeen Colliery. The mine was opened by Allison in 1902 and was also known as Allison's or the Spreyton Colliery. Coal was extracted from a single adit. This mine experienced difficulties with faulting and an influx of water (Burns, 1965).

ABERDEEN COLLIERY (1931–1950)

Prospecting was done in this area by Teasdale in 1900 but no production followed this initial activity. The Aberdeen Colliery, situated at Spreyton, opened in 1921. Mining was from a single adit (Burns, 1965).

ILLAMATHA No. 1 (1903–1942)
ILLAMATHA No. 2 (1943–1961)

The Illamatha No. 1 opened in 1903 and produced on a small scale until 1922. Production resumed in 1924. Extraction was by hand using the step longwall method of mining. The Illamatha No. 2 was situated north of the No. 1 workings and was operated by the same lessees, the brothers R., J. R. and C. A. Bound. Coal was extracted by bord and pillar methods from a shaft 25 m deep (Burns, 1965).

Sherwood

ALFRED COLLIERY (1855–1883?)

In 1855 Thomas Johnson of Frogmore opened the 'Alfred Colliery' on his land, 1.6 km east of Tarleton. The seam was about 600 mm thick (Ramsay, 1958) and was worked by two adits driven into the eastern face of a hill (Gould, 1861*a*).

The first loads of coal were raised on 30 May 1856. A celebration party was thrown at Frogmore House by Mr Johnson to mark the occasion:

> "... on which occasion the whole of his men together with a number of others .... were regaled with bread, cheese and ale. .... The coals were drawn by two teams of bullocks, sixteen in number, all tastefully decorated with ribbons, as well as the drivers and a flag was hoisted on each dray ...." (*Launceston Examiner*, 6 June 1856).

The colliery was inspected by Gould (1861*a*) and a section of a shaft at the Alfred Colliery was drawn by Thureau (1883*e*). Descriptions of the workings and various bore holes sunk around this mine are given by Burns (1965).

MERSEY COLLIERY (1861–1890?)

These workings were situated a few hundred metres north of the Alfred Colliery, on a bluff overlooking the Mersey River flood plain. The mine consisted of a number of adits driven into the cliff from the bank of Ballahoo Creek (Gould, 1861*a*; Thureau, 1883*e*, Hills *et al*., 1922; Burns, 1965). The colliery workings were confined to a small fault block (Burns, 1965). The mine was probably opened in 1861 by Bennett, the lessee of the Alfred Colliery, before being taken over by the Mersey Coal Company. The mine closed about 1890 (Burns, 1957*b*).

Tugrah

In 1862 coal was discovered on the east bank of the Don River near Barrington. The land was quickly acquired by Messrs Cummings and Raymond, who commenced coal mining operations and sent "considerable quantities to the Launceston market" (Fenton, 1891). Mining was from adits driven into a hill on the western side of the Don River between Tugrah settlement and Tugrah siding. Thureau (1883*e*) states that the Don Coal Mining Company (which was formed by Messrs Cummings and Raymond) had raised some 25 000 t of coal during the 18 years from 1865 to 1883. Evidence of the mining activity was inspected by Burns (1965).

Mouth of Caroline Creek

SHERWOOD COLLIERY (?–1861?)

This colliery, close to the mouth of Caroline Creek, was operated by W. Dawson. A tramway was completed over a distance of five kilometres, linking the mine with a shipping place.

At the time of Gould's (1861*a*) visit the mine had closed in consequence of a disputed right of road. Gould recorded that "brilliant crystals of mispickel or arsenical iron pyrites are frequently found in coal in this colliery".

Nook area (1855, 1931, 1938–1942)

Coal was found in 1855 by Richard Crompton on land owned by Alfred Nicholls, one of Williams' syndicate members. Nicholls asked the Government to spend £200 on deepening Ballahoo Creek, then opened the Nook Colliery, which produced for only a short time (Booth, 1962).

A number of small collieries were opened in the Nook area in the 1930's. These were the Lucky Nook (1931), Botts (1939–1942), Bott's No. 2, (1938), G. Jeffrey (1938), H. Bott and Jeffrey Bros (1938–1939) and J. Bott (1939). Locations (where known) are shown in Figure 57.

Dulverton

Two leases in this area were surveyed in late 1882. Thureau (1883*e*) collected samples from the Dulverton Coal Mining Company's workings in 1883 for testing, and drew a diagrammatic sketch of the mine.

A large number of small mines have operated in the Dulverton coalfield. The locations (where known) are given in Figure 57. The mines were: Dulverton (1931–1939); Lucky Hit (1931–1938); Hard-to-Get (1931–1937); Esk Bank (1931–1938); Black Beauty (1933–1944); Last Chance (1931–1933); Star (1934–1937); Dulverton Tribute (1933–1934); Brickyard (1935–1936); and Shepheard and Party (1938) (Dix, 1979).

A pit was opened near Dawsons Siding by J. Allison in 1923. This was sold to the Mersey Valley Oil Company in 1924 but closed in 1925. Three small mines have operated near Dawsons Siding since that time. They are the Star (1931–32); McCreghan and Sons (1937–38) and Sheehans (1938).

COAL QUALITY

Analyses of coal samples from the coalfield are given in Table 41.

Coal from the early workings was used primarily as a domestic fuel, sold locally, and shipped to Launceston. The coal produced from the 1930's mining activity was almost

Table 41. *Analyses of coal samples, Mersey–Don coalfield.*

	1	2	3	4	5	6
Moisture (%)	8.12	10.42	6.38	8.6	13.58	13.42
Ash (%)	5.28	4.00	5.50	7.08	4.84	4.64
Volatile matter (%)	42.56	43.02	43.18	42.92	36.28	35.06
Fixed carbon (%)	44.04	42.56	44.94	41.40	45.30	46.88
Sulphur (%)	4.56	3.48	3.52	4.81	4.39	4.04
Spec. energy (MJ/kg)	29.0	28.7	30.0	28.7	25.6	24.8

1. Whole seam sample from Aberdeen Colliery, October 1943 (Department of Mines correspondence files).
2. Whole seam sample from Coventry Colliery, October 1943 (Department of Mines correspondence files).
3. Whole seam samples from Black Beauty Colliery, October 1943 (Department of Mines correspondence files).
4. Whole seam sample from Illamatha (No. 1) Colliery, October 1943 (Department of Mines correspondence files).
5. Run of mine coal from Illamatha (No. 1) Colliery, 1922 (Hills *et al.*, 1922).
6. Run of mine coal from Spreyton (No. 1) Colliery, 1922 (Hills *et al.*, 1922).

exclusively used by the cement works at Railton. Local industry, such as the Ovaltine factory and various brickworks, consumed the remainder of the production.

RECENT EXPLORATION

Since the last colliery to work in the field closed in 1961, the area has been examined briefly by various companies, with some interest being shown in the oil shale potential of the area.

POTENTIAL FOR FUTURE EXPLORATION

Whilst the quality of the coal is quite good, the sulphur content is very high and the seams extremely thin. Faulting caused problems in most of the collieries. The area is of limited interest for further exploration.

The Preolenna Coalfield

SUMMARY

The Preolenna Coalfield, located 20 km south-west of Wynyard, is of minor economic importance. The Preolenna Coal Measures are of Early Permian age and are correlated with the Mersey Coal Measures further east. The seams are thin, from 220–600 mm thick, discontinuous, dislocated by faulting, and dip steeply at 14–25°. The inferred reserves of coal are very small and the potential for further exploration is limited.

LOCATION AND ACCESS

The Preolenna Coalfield is located 20 km south-west of Wynyard in north-western Tasmania. Access to part of the field is gained by unsealed roads and rough bush tracks, although much of the area is accessible only on foot. A railway from Flowerdale to Preolenna was opened in 1917 and extended a further 7.6 km to Maweena in 1924 to provide transport for coal and timber products. The railway was closed in November 1931 and dismantled.

GENERAL GEOLOGY

The oldest rocks exposed in the Preolenna Coalfield are mudstone and diamictite of the Wynyard Tillite. As the base of this unit is not exposed at Preolenna the thickness is not known. Overlying the Wynyard Tillite is a 135 m thick sequence called the Inglis Siltstone, which is in turn overlain by the Preolenna Coal Measures. In the Jessie Gorge area, the coal measures are overlain by the Flowerdale Sandstone.

Dolerite has intruded and dislocated the Permian sequence. Areas of higher ground, such as Diabase Hill, are now capped with dolerite. Tertiary basalt flows cover extensive tracts of land south of Preloenna (Bravo *in* Gee, 1977).

The Wynyard Tillite is composed dominantly of a conglomeratic bouldery mudstone or diamictite, with rhythmite deposits being recorded at several horizons. The transition from the tillite to the Inglis Siltstone is rapid. Lenticular beds of *Tasmanites*-bearing oil shale up to 0.6 m thick occur towards the base of this unit. The Inglis Siltstone becomes more fossiliferous towards the top with a variety of molluscs, brachiopods, bryozoans and crinoid debris occurring in fossiliferous pyritic siltstone beds towards the top of the unit.

The Preolenna Coal Measures, which overlies the Inglis Siltstone, consists of interbedded white, clean, quartzose sandstone, micaceous sandstone, shale and thin laminations of carbonaceous material. The sandstone is fine to medium-grained, well sorted, and usually massively bedded. *Glossopteris* leaves are occasionally found.

Four seams of coal crop out on the north-western bank of the Jessie Gorge near Preolenna (Bravo *in* Gee, 1977). Seams also crop out in the Flowerdale River valley south of Preolenna over a distance of three kilometres (Threader *in* Gee, 1977). The seams in both areas vary in thickness from 0.2–0.6 metres. Mining activity has taken place in both the Jessie Gorge (Preolenna Coal Mine) and in the Flowerdale River valley (Torbanhill or Meunna Coal Mine). Coal outcrops are also recorded from near Relapse Creek, south-west of Preolenna, and west of West Takone (Hughes, 1962). The coal seams exposed near Preolenna dip at 14–25° to the west (Hills *et al.*, 1922), although Bravo (*in* Gee, 1977) recorded one outcrop of coal dipping at 40°.

Bands of 'cannel coal' or torbanite exist within the thin seams of black coal. These are caused by concentrations of the alga *Reinschia*. These bands are very rich in volatiles, and have been called 'oil shale' by some authors. Selective sampling of these torbanite bands accounts for some of the very volatile-rich analyses from the Preolenna area.

The seams, which are part of the Preolenna Coal Measures, may be correlated with the Mersey Coal Measures of Latrobe and so are Sakmarian / Artinskian in age. Previously these seams have been correlated with the Great Coal Measures in New South Wales, which are Artinskian in age, and so in fact are younger than the Preolenna and Mersey Coal Measures (Clarke and Banks, 1975).

The Preolenna Coal Measures are overlain by the Flowerdale Sandstone, a 215 m thick unit which has been subdivided into four lithologies. The basal part of this unit is composed of pebbly sandstone with a fossiliferous horizon, which is overlain by a dirty 'greywacke' sandstone. The third lithology is an interbedded sequence of fine-grained sandstone and siltstone which grades upwards into a white, argillaceous, coarse quartz sandstone (Bravo *in* Gee, 1977).

The geology of the area is shown in Figure 59.

PREVIOUS MINING HISTORY

In 1869 a Mr T. Stephens exhibited to the Royal Society of Tasmania a pebble of "kerosene shale" found near the mouth of the Inglis River. Stephens stated that further pieces had been found at the junction of the Inglis and Calder Rivers.

Montgomery (1896) noted that pebbles of coal had been found on beaches near Wynyard, and "high up in the Inglis River and Seabrook Creek", although no seams had been located in outcrop.

Outcrops of coal were discovered by Messrs Lowrie and Harris whilst cutting a track from the Calder Road to the Arthur River (Twelvetrees, 1903*b*).

Waller (1902) inspected the newly discovered outcrops, some 22–24 km from the coast. Three outcrops were inspected, with the upper seam being the only one Waller considered to be of economic importance, being 500–560 mm thick. The coal was described as being brownish-black to black in colour, with a resinous to dull lustre and a conchoidal fracture. Shortly after this inspection was made, the North West Coal and Shale Company was formed and took out mining leases in the area between the Flowerdale and Jessie Rivers.

Outcrops on these leases were examined and sampled by Twelvetrees (1903*b*) and Hills (1913). Twelvetrees inspected one adit driven for four metres on a seam of coal 500 mm thick. The adit was driven in a south-westerly direction at a dip of 10°, and was called the "Shale Tunnel". This adit, on an outcrop of coal in the south fork of Fenestella Creek, was also inspected by Hills (1913), although no further work had been done since Twelvetrees' visit. A second adit, named the "Cliff Tunnel", was described by Hills (1913). This adit was six metres long and was driven in on a seam cropping out on the spur between Spirifer and Fenestella Creeks. The seam was 600 mm thick and dipped to the west at 25°. In total the North West Coast and Shale Company drove three short tunnels from 4.8–6.0 m in length on outcrops of coal before abandoning the field.

By 1913 the new lease holders, Weston and Graue, had dug a tunnel 1.8 × 1.4 m for a distance of 62 m on an outcrop in Preolenna Creek. A 1.8 × 1.3 m shaft was sunk to intersect the tunnel. Four seams were intersected in the tunnel and two in the shaft. None of the seams were more than 600 mm thick. Coal bins were erected at the tunnel mouth and a wooden tramway laid to the end of the road. Coal was mined from two of the seams, then hauled by horse-drawn tram some 120 m up a grade of 1 in 4, then transported 30 km by bullock wagon to Wynyard. The mining operation was not a success. Production statistics indicate that mining in this area lasted from 1918 to 1924.

By 1921, the leases covering the Preolenna coalfield had been taken over by the Preolenna Coal Company. The adit dug previously in Preolenna Creek by Weston and Graue was extended to 67 m, and another adit 2.1 × 1.7 m was driven in for 120 m close to the first adit. Further south, a tunnel 3.0 × 1.7 m, carrying a double tramline, had been driven for 180 m (Hills *et al*., 1922). A number of seams were cut in each of these tunnels, although none of the seams was more than 600 mm thick.

In 1925 the Meunna Coal Mining Syndicate was formed and took out mining leases in the Flowerdale River valley, three kilometres north-west of the Preolenna coalfield leases. This was probably the same occurrence of coal found "two miles from the Preolenna terminus" in 1919 and called "The Great Fitzroy Coal Mine". The syndicate undertook some initial exploration work, discovering three seams by means of trenching, and dug a dip adit for 18 m before asking the Government for financial assistance to continue with their exploration. In response to this request, an inspection of the area was made. Reid (1925*a, b*) records that three seams, 450–600 mm thick, were exposed on the eastern bank of the Flowerdale River and could be traced for 800 metres. The dip adit had advanced to 36 metres. A further inspection was made of the Meunna Coal Mine in 1926 when up to 100 t of coal was being produced per week (Reid, 1926). In 1928 a dip tunnel advanced to 25 m was inspected, but mining had ceased (Scott, 1928). Production statistics indicate that mining started in 1926 (10 t) with 53 t being produced in 1928 (the year of Scott's visit). Mining ceased in 1931 although small tonnages were won in 1935 and 1936 (two and six tonnes respectively).

COAL QUALITY

Analyses available for coal from the Preolenna Coalfield are largely of an historical nature. Twelvetrees (1903*b*) and Hills (1913) collected samples from all available outcrops and had analyses made. A selection of these results are given in Table 42.

Table 42. *Analyses of coal samples, Preolenna coalfield.*

	1	2	3	4	5	6	7	8
Moisture (%)	0.5	1.1	0.7	0.7	0.5	1.17	0.5	1.27
Ash (%)	2.3	4.1	6.5	6.6	2.0	7.58	6.0	4.82
Volatile matter (%)	76.2	71.6	45.9	48.3	75.5	40.46	47.3	42.45
Fixed carbon (%)	21.0	23.2	46.9	44.4	21.0	50.79	46.2	51.46
Sulphur					1.0		4.4	2.26

1. Sample from Tunnel seam (Twelvetrees, 1903*b*) in Fenestella Creek.
2. Sample from outcrop in cliff 60 m from Tunnel seam (Twelvetrees, 1903*b*).
3. Sample from 500 mm thick seam in Fenestella Creek (Twelvetrees, 1903*b*).
4. Sample from 450 mm thick seam in Camp Creek (Twelvetrees, 1903*b*).
5. Richest kerosene shale, Preolenna from Tunnel seam in Fenestella Creek (Hills, 1913).
6. Average of eleven samples of black cannel coal, Preolenna (Hills, 1913).
7. Bright coal from seam in adit in Preolenna Creek (Hills, 1913).
8. Bright coal from Tunnel seam in Fenestella Creek (Hills, 1913).

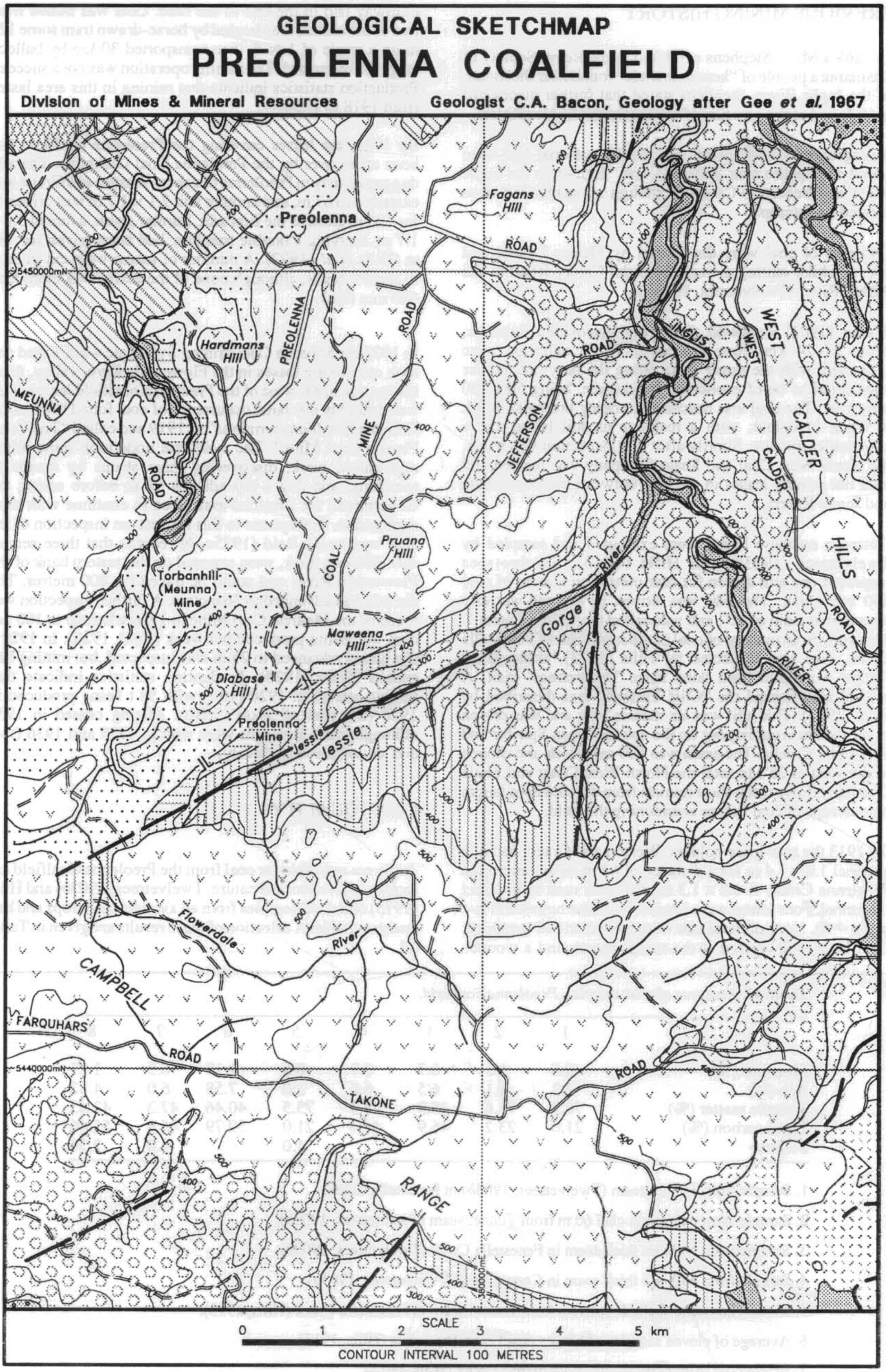
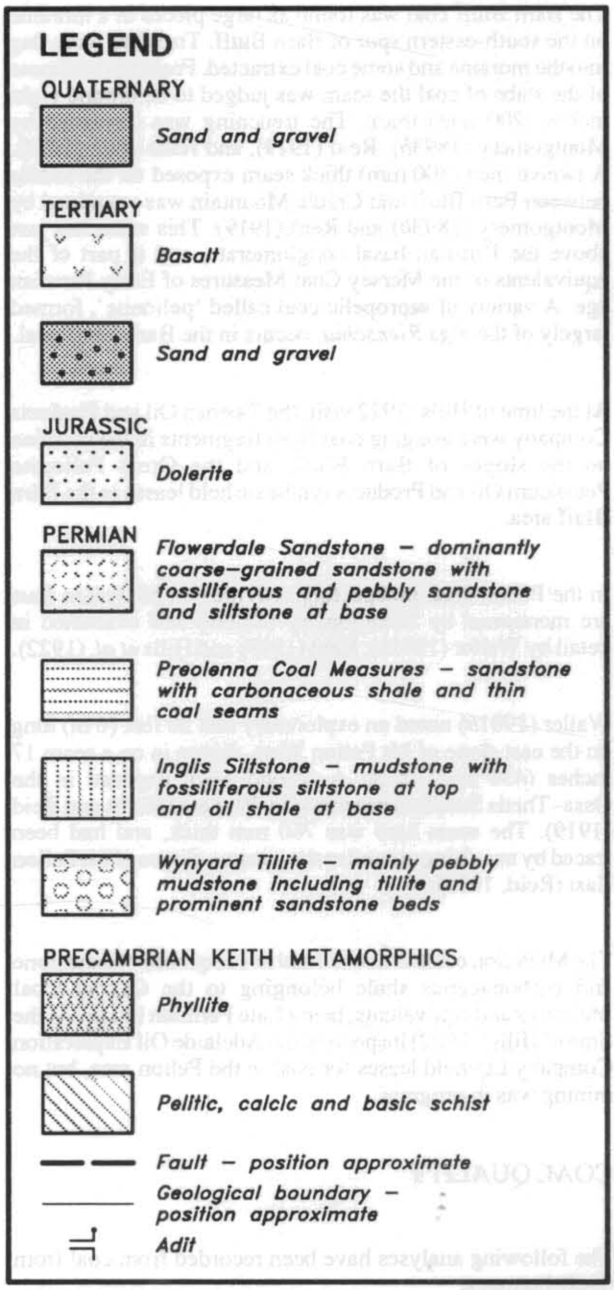

GEOLOGICAL SKETCHMAP
PREOLENNA COALFIELD
Division of Mines & Mineral Resources
Geologist C.A. Bacon, Geology after Gee et al. 1967
Preolenna
Fagans Hill
ROAD
Hardmans Hill
PREOLENNA
ROAD
MEUNNA
ROAD
MINE
COAL
INGLIS
JEFFERSON
WEST
WEST
CALDER
CALDER
HILLS
ROAD
RIVER
River
Gorge
Pruana Hill
Torbanhill (Meunna) Mine
Maweena Hill
Diabase Hill
Preolenna Mine
Jessie
Jessie
Flowerdale
River
CAMPBELL
FARQUHARS
ROAD
TAKONE
ROAD
RANGE
5450000mN
5440000mN
380000mE
SCALE
0 1 2 3 4 5 km
CONTOUR INTERVAL 100 METRES
5 cm

Figure 59.



Interest was shown at one stage in determining the oil yield from the cannel coal, but the venture was deemed to be an uneconomic proposition (Rogers, 1934).

In 1951 a 22 kg sample of coal was collected from one of the seams in one of the adits in Preolenna Creek (Hughes, 1951). However the results of analyses of this coal are not available.

A coal seam 300 mm thick cropping out in a tributary of Relapse Creek south-west of the main Preolenna coalfield was sampled by Hughes (1962). The seam dipped to the north (340–360°) at 11°. This and another nearby (300 mm thick) outcrop in Lowrie Creek were sampled in 1971 (Nye, 1971*a*, *b*). Part of the sample collected in Relapse Creek was tested for coking purposes but was reported as having no useful coking properties (Nye, 1971*b*).

A one kilogram spot sample was collected from the entrance of one of the three main adits in Preolenna Creek in 1970 (Smith, 1971). The analyses of these samples are given in Table 43.

RECENT EXPLORATION

Two holes were drilled in late 1929–early 1930 in the vicinity of the Meunna (Torbanhill) Mine (Department of Mines Annual Reports; 1929, 1930).

A study of the possibility of distilling various fuels and oils from the coal was made by Rogers (1934).

A one kilogram sample was collected in 1971 by Mining Systems Ltd, from the portal of an old adit (presumably the adit in Jessie Gorge). A 40 kilogram sample was collected for 'washability tests' but no results from this are available (Smith, 1971).

A sample of coal from an outcrop in a tributary of Relapse Creek was also taken in 1971, the seam being 12–14 inches (0.3 m) thick. Additional outcrops were found in Lowrie Creek (Nye, 1971*a*, *b*).

In 1982 four shallow holes were drilled along Coal Mine Road and three very shallow holes at Meunna, by a Tasman Shale and Coal Company Pty Ltd and Mineral Holdings of Australia Pty Ltd joint venture (EL 43/70). The Meunna holes (all less than 19 m deep) all terminated in basalt, and

Table 43. *Analyses of samples from Preolenna Creek, Lowrie Creek and Relapse Creek, Preolenna coalfield.*

	1	2	3	4	5	6	7
Moisture (%)	0.9§	0.9	4.3‡	9.3	8.3	11.1	0.36
Ash (%)	5.0	8.4	7.3	20.4	14.8	13.7	5.00
Volatile matter (%)	45.4	40.8	35.8	22.3	28.8	39.4	40.00
Fixed carbon (%)	48.7	50.8	52.6	48.0	48.1	35.8	54.64
Total sulphur (%)	1.74	4.06	1.5	0.14	0.43	0.40	3.30
Crucible swelling number	5.5						
Specific energy (MJ/kg)	33.8	32.5	29.1	19.7	23.1	20.9	
Specific gravity (g/cm^3)	-	1.25	-				

§ air dried moisture ‡ internal moisture

1. Spot sample from entrance of one of the adits in Preolenna Creek (Smith, 1971).
2. Sample taken from outcrop of seam 300 mm thick west of West Takone, in tributary of Relapse Creek (Hughes, 1962).
3. Sample taken from same outcrop (Nye, 1971*a*).

4,5,6. Sample taken from outcrop 300 mm thick in or near Lowrie Creek (Nye, 1971*b*).

7. Sample from seam 1.0 m thick from hole drilled near Meunna Mine in 1929.

the four Coal Mine Road holes (all less than 50 m deep) terminated in the Flowerdale Sandstone.

POTENTIAL FOR FUTURE EXPLORATION

Because of the thin, lenticular nature of the seams, which dip steeply at 14–25°, and are dislocated by faulting, the potential of this coalfield for further exploration is limited. The inferred *in situ* reserves of black coal are very small.

The Barn Bluff–Mt Pelion Coalfield

SUMMARY

Two small areas, around Barn Bluff and near Mt Pelion, have been of interest to prospectors. Very small quantities of coal were mined from trenches at Barn Bluff and adits at Mt Pelion in the late 1890s. The two areas do not contain sufficient coal to be of any economic importance. The area of the prospecting activity is scenically beautiful and quite remote, and now falls within the Cradle Mountain–Lake St Clair National Park, and so is exempt from the provisions of the Mining Act, 1929.

LOCATION AND ACCESS

The areas in which coal has been found are: on the lower slopes of Barn Bluff; on the spur connecting Barn Bluff with Cradle Mountain; and on the slopes of the Pelion group of mountains to the south of Barn Bluff. Access to all of these places was formerly by pack-horse, but now is by foot only.

GENERAL GEOLOGY

Geological descriptions of the Barn Bluff–Mt Pelion area may be found in Montgomery (1893*b*), Waller (1901*b*), Reid (1919), Hills *et al.* (1922) and briefly in MacLeod *et al.* (1961).

The coal at Barn Bluff belongs to the Early Permian Mersey Coal Measures and equivalents. Parts of the coal are formed from concentrations of the alga *Rienschia*, so this coal is classified as a torbanite or sapropelic coal.

In the Pelion area, the Cygnet Coal Measures crop out across the northern slope of the Pelion Range, between Mt Pelion West, Mt Thetis and Mt Pelion East. The coal seams prospected in this area are Late Permian in age.

PREVIOUS MINING HISTORY

The coal discoveries at Barn Bluff and Mt Pelion were examined by Montgomery (1893*b*), who noted that the coal had been found by members of the Mole Creek and Zeehan Mineral Prospecting and Exploration Company. The discovery of coal at Barn Bluff is credited by Reid (1919) to F. Holmes and W. Hart, who received Reward Claims of 320 acres (130 ha) each for their finds. Hills *et al.* (1922) credit I. Will with finding the Barn Bluff coal in 1892. Will was engaged in prospecting activity in the Barn Bluff and Pelion areas in 1893, and while in the Barn Bluff area he did find some copper-bearing lodes on the western bank of Lake Windermere (Reid, 1919).

The Barn Bluff coal was found as large pieces in a moraine on the south-eastern spur of Barn Bluff. Trenches were dug into the moraine and some coal extracted. From the thickness of the slabs of coal the seam was judged to be around eight inches (200 mm) thick. The trenching was inspected by Montgomery (1893*b*), Reid (1919), and Hills *et al.* (1922). A twelve inch (300 mm) thick seam exposed on the saddle between Barn Bluff and Cradle Mountain was examined by Montgomery (1893*b*) and Reid (1919). This seam lies just above the Permian basal conglomerate, and is part of the equivalents of the Mersey Coal Measures of Early Permian age. A variety of sapropelic coal called 'pelionite', formed largely of the alga *Rienschia*, occurs in the Barn Bluff coal.

At the time of Hills' 1922 visit, the Tasman Oil and Products Company were gouging coal from fragments in the moraine on the slopes of Barn Bluff, and the Great Pelionite Petroleum Oil and Products syndicate held leases in the Barn Bluff area.

In the Pelion area, prospecting activities on Mt Pelion East are mentioned by Montgomery (1893*b*) and examined in detail by Waller (1901*b*), Reid (1919) and Hills *et al.* (1922).

Waller (1901*b*) noted an exploratory adit 20 feet (6 m) long on the east slope of Mt Pelion West, driven in on a seam 17 inches (430 mm) thick. A second seam exposed in the Ossa–Thetis Saddle is described by Waller (1901*b*) and Reid (1919). The seam here was 760 mm thick, and had been traced by trenching around to the western slopes of Mt Pelion East (Reid, 1919).

The Mt Pelion coals are contained in a sequence of sandstone and carbonaceous shale belonging to the Cygnet Coal Measures and equivalents, being Late Permian in age. At the time of Hills' (1922) inspection the Adelaide Oil Exploration Company Ltd held leases for coal in the Pelion area, but no mining was in progress.

COAL QUALITY

The following analyses have been recorded from coal from the Pelion area:

	1	2
Moisture (%)	0.8	2.1
Ash (%)	17.1	20.2
Fixed carbon (%)	52.0	54.6
Volatile matter (%)	19.6	22.5
Sulphur (%)	10.5	0.6

1. Seam exposed in trenches on eastern slopes of Mt Pelion West, seam being 17 inches (430 mm) thick (Waller, 1901*b*).

2. Seam exposed in trenches on northern slopes of Mt Pelion (Waller, 1901*b*).

POTENTIAL FOR FUTURE EXPLORATION

The small quantity of coal available, the thin nature of the seams, and the very poor quality of the coal indicate that the coalfield is of no economic significance and has no potential for future exploration.

BROWN COAL IN TASMANIA

SUMMARY

Occurrences of brown coal or lignite in unconsolidated Tertiary sediments are widespread across Tasmania. Most of these occurrences are extremely small and localised features, and are of no economic importance.

INTRODUCTION

The first discovery of brown coal in Tasmania was made on the shores of Macquarie Harbour in 1815 by Captain James Kelly. The first mining venture in Tasmania was an attempt by the Colonial Government to exploit the brown coal at Coal Head on Macquarie Harbour, using convict labour. The exercise was brief and unsuccessful.

Brown coal was subsequently found in many places in Tasmania (fig. 60). The largest deposit is at Rosevale, near Westbury. This area has been recently evaluated as a potential source of fuel for a coal-fired power station.

BROWN COAL OCCURRENCES

Rosevale (Westbury)

A shaft was sunk near Hagley in 1919 by a Mr Gatenby and brown coal was mined on a small scale from this shaft for two years. An adit was driven to intersect the shaft in 1920. The brown coal was calcined (burnt to ashes) and used as a crop fertiliser. Extraction of the coal ceased in 1921.

In 1981–82 an exploration programme was conducted in the Rosevale (Westbury) area by AAR Limited in partnership with CSR to delineate the occurrence of brown coal in the area. As a result of this and subsequent exploration, CSR have defined three discrete deposits of lignite near Rosevale with combined (measured and indicated) reserves of 118 million tonnes.

North-West Coast

Brown coal deposits have been recorded from Myrtle Hill near Irishtown, 8 km south of Smithton, from where Blake (1940) briefly described a seam one metre thick overlain by basalt 30 m thick. At Edith Creek (also in the Irishtown area) two seams 0.6–1.0 m thick separated by 3.3 m of conglomerate are overlain by 30–40 m of basalt.

Various other isolated small outcrops of brown coal are known from the north-western part of Tasmania.

Macquarie Harbour

Brown coal was noted on the northern shore of Macquarie Harbour in 1815 by Captain James Kelly; these deposits were visited by D. McCarthy in 1816 (*Hobart Town Gazette*, 15 June 1816). Subsequently thin seams of brown coal were found exposed along the greater parts of the northern and eastern shores of Macquarie Harbour from Lettes Bay to Farm Cove and for several kilometres south of Birchs Inlet.

A report by Deputy Surveyor G. W. Evans to Lt Governor Sorell, dated 9 February 1822, stated "coals can be procured at a place called Coal Head and along the shore some distance south-east of it" (*Hobart Town Gazette*, 9 February 1822).

Confessions of the convict Alexander Pearce (Sprod, 1977), who escaped from Macquarie Harbour on 20 September 1822, contain references to coal mining at Coal Head.

In tracing the route taken by Pearce and his colleagues, Sprod (1977) writes:

> "The party which included Pearce, met no difficulties in making their initial break by seizing a boat .... from Logan's work gang at Kelly's Basin at the eastern end of Macquarie Harbour. From the basin they rowed along the northern shore to the coal mines at Coal Head, midway between their starting point and the open sea".

The initial mining attempts were apparently short lived. A despatch from Colonel Sorell to Under Secretary Horton, dated 29 November 1824, reads in part:

> "At the penal settlement of Macquarie Harbour, where the indications of coal were so strong as to induce the Deputy Surveyor General [Evans] to report its existence there, the want of professional research had deprived the local Government of the means of working it" (*Historical Records of Australia*, 3(4):583).

The brown coal occurs in thin beds, 125–140 mm thick, in Tertiary sediments comprising lightly consolidated sand, clay, shale and mud. The coaly bands are comprised of brown coal and carbonaceous shale with occasional black lignitised wood lenses. On the coast, the coal is commonly overlain by 15–30 m of sediments, and the thickness of overburden increases inland (Blake, 1939*b*).

Leases were held in the area of Farm Cove from 1891 to 1903 by a number of individuals and syndicates, although no serious mining eventuated. Leases were also held at Coal Head (1888–92) and near Eden (1902). The Government drilled two holes for the Eden Coal Company in 1902–03 (Twelvetrees, 1902*g*, 1902*h*, 1903*c*) to examine an outcrop of brown coal discovered near Eden by woodcutters, while dragging piles for the Strahan wharf to the railway (Twelvetrees, 1901). A third government bore was put down at Farm Cove (Twelvetrees, 1903*d*).

In 1981 CRA Exploration Pty Ltd drilled five chip holes in the Strahan area, and concluded that the potential for discovery of a major lignite horizon in the area was minimal (Clementson, 1981).

King Island

Brown coal was reported on King Island in 1930 by Mr R. Hooper who struck a thin seam while sinking a well on his property in the Sea Elephant River district. Carey (1946) documents a number of brown coal and peat deposits on King Island, listing the occurrence of:

(a) thin seams of brown coal of Miocene age;

(b) immature lignite of Quaternary age under sand dunes;

(c) peat swamps belonging to the present cycle of sedimentation.

Longford Basin

One of the striking features of the Tertiary sediments in the Longford Basin is the presence of lignite fragments throughout (Matthews, 1983).

Thin seams of lignite were intersected in drilling for black coal at Belmont, near Longford, and at Carr Villa late last century. The thickest seam intersected was 1.2 m at 244 m

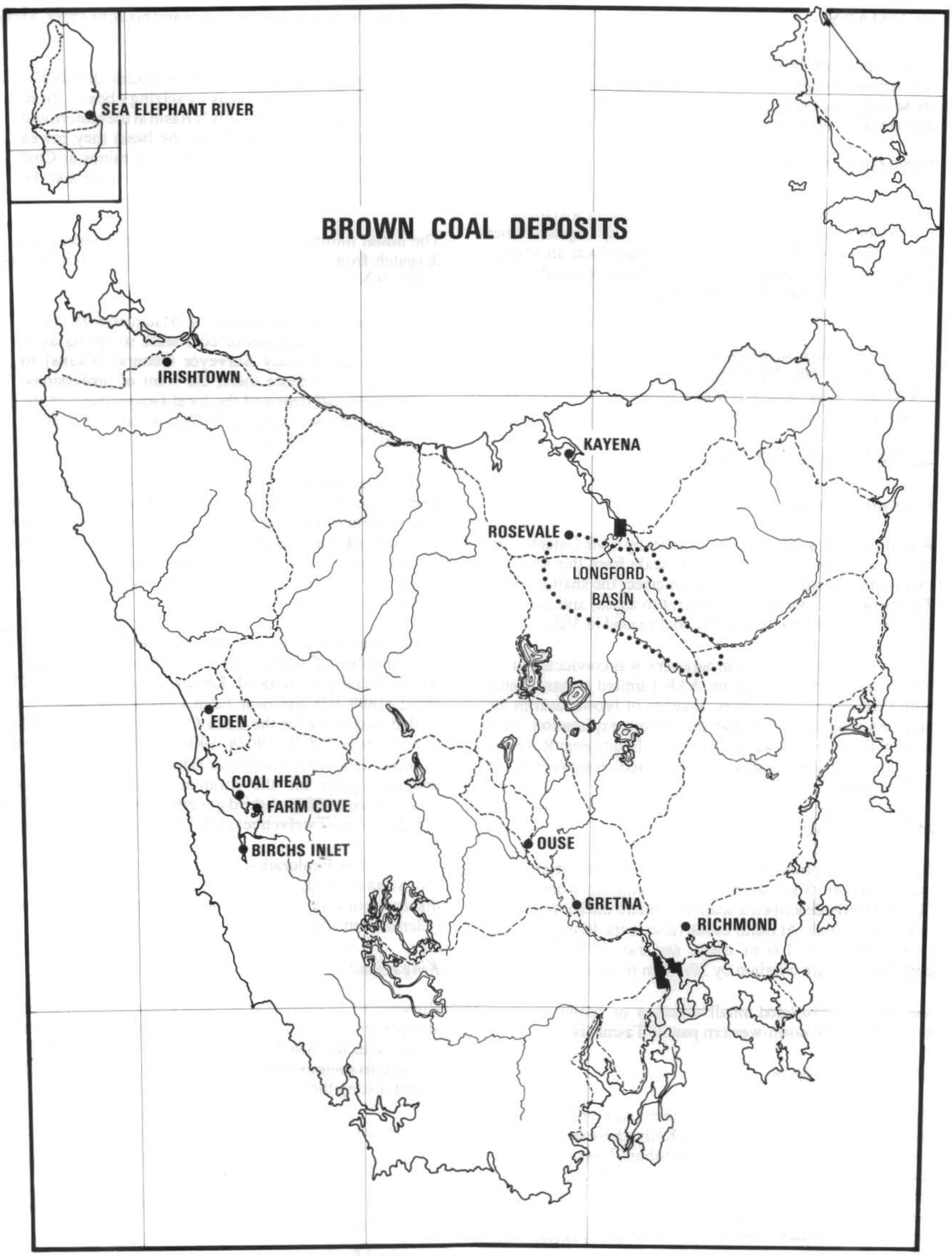


Figure 60.

5 cm

Table 44. *Analyses of brown coal samples.*

	1	2	3	4	5	6	7
Moisture (%)	20.8	5.84	4.26	7.5	9.9	22.8	13.0
Ash (%)	12.25	35.70	57.94	46.70	9.2	7.5	18.6
Volatile matter (%)	33.45	30.24	22.20	29.82	51.0	57.7	34.5
Fixed carbon (%)	33.5	28.22	15.60	15.98	29.9	12.0	33.9
Sulphur (%)		1.96	0.42	0.36	3.61	0.34	0.62
Specific energy (MJ/kg)						19.72	18.54

1. Lettes Bay, Macquarie Harbour (Blake, 1939*b*).

2, 3. Southern end of Philips Island, Macquarie Harbour (Blake, 1939*b*).

4. Myrtle Hill, north-western Tasmania (Blake, 1940).

5. Muddy Creek, West Tamar, northern Tasmania (Blake, 1940).

6. Richmond area, southern Tasmania (Leaman, 1971).

7. Sea Elephant River area, King Island (Carey, 1946).

depth. Additional thin seams, approximately one metre thick, are known to occur at various localities in the Longford and Launceston Basins, such as at Rosevale, Legana, east of St Leonards, and at Breadalbane. In some parts of the Longford Basin, particularly in the Evandale area, wood fragments have been replaced by iron oxide and leaf impressions are common in iron oxide-rich boulders (Matthews, 1983).

Nye (1929) examined an outcrop of brown coal cropping out in the Rose Rivulet at Harland Rise, near Evandale.

Tamar Valley

Brown coal is known to exist in various localities throughout the Tamar Valley. A small adit was driven in on an outcrop near Kayena [DQ912395] on the west bank of the River Tamar.

Derwent Valley

Occurrences of brown coal have been recorded from near Ouse and around Glenora in the Derwent Valley.

COAL QUALITY

Analyses of brown coal from various localities are given in Table 44.

POTENTIAL FOR FUTURE EXPLORATION

The Rosevale brown coal deposit is of interest for future exploration and is currently held under exploration licence.

COAL RESERVES

In reporting or calculating coal reserves the Department recommends adherence to Australian Standard 2519-1982: Standing Committee on Coalfield Geology of N.S.W.: Codes for calculating and reporting coal reserves (fourth edition).

A brief summary of the reserve categories of AS2519-1982 is as follows:

MEASURED RESERVES are those for which the density of observation points is sufficient to give control on quality, quantity, thickness, depth and other relevant conditions, and to allow for both a reliable estimate of the reserves and the planning of their extraction. The standard suggests that the observation points should be spaced no further than one kilometre apart, and in many instances much closer spacing is needed.

INDICATED RESERVES are those for which the density of observation points is sufficient to allow for a realistic estimate of reserves and for which there is a reasonable expectation that the reserves could be raised to the measured category with further information. Observation points should be spaced no further than two kilometres apart.

INFERRED RESERVES are those for which there is a poor cover of information so that only an uncertain estimate of the reserves can be made. Further information will either raise these reserves to a higher category or show that part or all of them does not exist. Quantitative values are not assigned to inferred reserves, other than to indicate the relative size of the deposit within the following ranges:

very large	>10 000 million tonnes
large	100 to 10 000 million tonnes
small	20 to 100 million tonnes
very small	<20 million tonnes

In view of the fact that a large number of extremely small coal deposits occur in Tasmania the Department has adopted a modification of the inferred reserve category. Indications are made in Table 45 where extremely small deposits contain less than 5 million tonnes or less than 1 million tonnes.

Table 45. *Status of (in situ) reserves.*

Location	*Measured + Indicated (million tonnes)*	*Inferred (million tonnes)*
Mt Nicholas	50	small
Harefield	5	-
Fingal	250	large
Dalmayne	160	large
Douglas River	30	small
Langloh (Hamilton)	10	-
Woodbury	25	-
Merrywood		very small <1
Mt Christie		very small <1
Denison Rivulet		very small <2
Strathblane		very small <1
Moss Glen		very small <1
Catamaran		very small <5
Colebrook		very small <5
York Plains		very small <1
Preolenna		very small <5
Mersey		very small <5
Cygnet		very small <1
Mt Lloyd		very small <2
Kaoota		very small <1

The remainder of areas in which coal is known to occur in Tasmania contain extremely small reserves, or very thin seams which in the current economic climate are not workable.

An intensive exploration programme, which involved the drilling over 70 holes, was undertaken by the Department of Mines, mainly during the 1972–1982 period, to investigate the reserves of coal on Fingal Tier. The results of the programme are given in Threader and Bacon (1983)

CURRENT MINING OPERATIONS

Three major collieries currently produce coal in Tasmania: the Merrywood mine south-east of Avoca, operated by the Merrywood Coal Company (a division of Avoca Transport Company Pty Ltd); and the Duncan Colliery at Fingal and the Blackwood Colliery on Mt Nicholas near St Marys, both owned and operated by the Cornwall Coal Company NL. The coal is mined by open cutting at Merrywood, while the Duncan and Blackwood mines are both underground mines, with mining using the bord and pillar system of extraction.

Duncan

At the Duncan Colliery, which has operated since 1945, coal is produced from the Duncan seam, which ranges from 2.0–5.0 m in thickness. The workforce is employed on a 24 hour cycle nine days per fortnight. Face equipment consists of 'Joy' 12 cm-11, 1000 volt continuous miners, each with two 12 tonne capacity shuttle cars discharging raw coal through 'Hannaford' breaker feeders onto 900 mm width belt conveyors, totalling some 5 km in length. Geological conditions in the mine vary, as over most of the seam the original roof (laminite and claystone) has been eroded. Compaction and faulting are not uncommon and occasional dolerite intrusions have disrupted parts of the seam. Mining of the seam occurs from outcrop to a depth of 420 m, leading to features such as floor heave in some parts of the mine.

Production from the Duncan Colliery for the year ended 30 June 1990 totalled 214 950 tonnes of coal. Further development in the mine during the year was hampered by dolerite intrusions, seam washouts and generally poor mining conditions.

Blackwood

The Blackwood Colliery, on Mt Nicholas, opened in 1980 and works the Blue seam which is approximately 5.0 m thick. Of this 3.6 m is mined. Mining utilises similar machinery and methods as used at the Duncan Colliery. Coal is mined from outcrop to a total depth of around 300 m under part of the Nicholas Range. Vertical loading stress as expressed in floor heave is more common in the areas of thick overburden.

The Blackwood Colliery has been developed into two main collieries (No. 1 and No. 2) and a small open cut, with most of the development of the No. 2 colliery taking place in 1989–90. Coal output for the year ended 30 June 1990 totalled 359 343 tonnes, with the bulk of this (326 275 t) being mined from the No. 1 colliery.

Coal from both the Duncan and Blackwood collieries is treated at a jig washery near Fingal. The washed coal is used in a variety of domestic secondary industries as boiler fuel and in the making of cement, the major consumers being the paper mills at Boyer and South Burnie and the cement works at Railton. Raw coal production for 1989/90 was 574 293 tonnes, with the output of washed saleable coal totalling 359 940 tonnes.

Empty skips for loading at one of the now closed adits on the Nicholas Range (left above) contrast with the current bulk handling methods at the washed coal stockpile at the Duncan washery (below)

Merrywood

At Merrywood, where a mining lease was issued over the area of the old mine in 1984, the old underground workings have been exposed and the remaining pillars mined by open cut means, Mining was intermittent for several years, with up to 50 000 tonnes being produced per year.

Mining recommenced at Merrywood in July 1989, and trial parcels of coal were supplied to a number of users. Contracts were secured to supply several customers, and production for the year ended 30 June 1990 amounted to 23 200 toones. The raw coal mined is crushed and screened before sale.

Fenhope

The Fenhope colliery was opened in 1982 and is worked intermittently by the owner, Mr D. Fenton. Some small quantities of coal have been sold, with sales in 1989/90 totalling less than 500 tonnes.

Coal storage bin and loader, Blackwood Colliery

COAL TRANSPORT

The majority of Tasmanian coal consumed within the State has been moved from the mines to the major consumers by rail, with the opening of the Fingal Line in 1886 enabling expansion of coal mining in the Fingal Valley. Improvements in rail transport since the 1960s has resulted in more efficient coal distribution. Block loads of 50 tonne capacity hopper wagons are now used to transport coal to the major consumers at South Burnie, Railton and Boyer. Coal trains, such as the one below, can now carry over 1000 tonnes of coal per train. This contrasts with the train at right, pictured at Cullenswood in 1904, which consists of sixteen wagons of about seven tonne capacity, for a net coal load of about 110 tonnes.

PETROGRAPHY OF TASMANIAN COALS

The petrographic composition of coal has been related to factors prevailing in the environment of deposition. Both the type of vegetation contributing material to the peat and the amount of moisture in the peat swamp are important in determining the final composition of the coal. Earlier workers (Hacquebard *et al.*, 1967; Hacquebard and Donaldson, 1969) examined microlithotypes to determine coal facies and the palaeoenvironments.

The technique of relating vegetation zones to coal compostion has been refined further by Diessel (1986), to a stage where the distribution and abundance of certain macerals, not microlithotypes, can be used to determine the palaeoenvironmental conditions of peat deposition.

Similar source materials may produce quite different maceral products in different conditions of peat formation. Wet conditions, usually associated with fast subsidence, will produce gelified residual tissue (tellinite and telocollinite), while under conditions of slow subsidence a drier environment is more likely and the tissue products may become fusinitised, producing fusinite and semifusinite. The ratio between these two groups of macerals can be used as an indication of the level of moisture in the peat swamp. This ratio was defined by Diessel (1986) as the Gelification Index:

$$GI = \frac{vitrinite + macrinite}{fusinite + semifusinite + inertodetrinite}$$

High ratios represent wet limnotelmatic forest moors while low ratios reveal that the coal formed in a dry terrestrial moor (Diessel, 1986).

The macerals derived from woody tissue (tellinite and tellocollinite in wet habitats, fusinite and semifusinite in dry habitats) can be combined and contrasted with macerals derived from the destruction of cell tissue, to give a measure of the amount of wood to non-wood derived material in a coal. This ratio is defined by Diessel (1986) as the Tissue Preservation Index.

$$TPI = \frac{tellinite + tellocollinite + fusinite + semifusinite}{desmocollinite + macrinite + inertodetrinite}$$

A low TPI indicates the absence of woody tissue in the coal, due to either the absence of suitable habitats (such as the forest moor habitat) or the near-complete destruction of woody tissue due to oxidation of the peat (Diessel, 1983). Coal from a treeless moor may contain an abundance of exinite (especially sporinite) and inertodetrinite, but also some alginite and other evidence of a subaqueous nature, such as cross-lamination or graded bedding. In the case of the woody tissues being destroyed by oxidation, the coal would also contain a high proportion of exinite and the detritus of the fusinite and semifusinite in the form of inertodetrinite, but no alginite or evidence of subaqueous deposition.

Coal facies can be identified using the two indices, and different environments of formation for the various seams or plies determined.

The paper coals are composed of exinite (mainly cutinite), vitrinite and large quantities of clay particles. The *Johnstonia* leaves, which have a very thin cuticle, are found clumped together and matted with mineral matter. The leaves may have been from a type of water-weed, carpeting a shallow pond during times when the peat swamp was inundated. When the swamp dried out, the matted water-weed was deposited on top of the peat. An influx of muddy water may also have caused the water-weed mat to break up and be deposited with the mud, as one of the paper coal plys contains 90% of clay material.

LATE PERMIAN SEAMS

Few analyses are available for these coal measures. The coal appears to be petrographically similar to the Late Triassic coals, with a high proportion of the coal being derived from wood which has become fusinitised.

EARLY PERMIAN SEAMS

These coals, from the Mersey and Preolenna Coal Measures, are typically low in ash (8.12%), high in sulphur (3.5%), and with a specific energy of 29–30 MJ/kg. They are characterised by a high vitrinite content of between 40–60%, although most is in the form of varieties of collinite and not preserved as woody tissue. The exinite content is considerably higher than that of the Late Triassic coals, being around 15–20%. The dominant exinite maceral is sporinite, and alginite has been noted in some samples, indicating that the coal swamp was flooded for part or all of the peat formation. The petrographic composition is shown in Figures 61–63.

These coals have a low wood ratio (0.25–0.75), suggesting that they formed in a habitat which did not produce significant quantities of woody tissue. The moisture index of around 1 suggests a relatively wet environment. These coals probably formed in an open moor habitat. This conclusion is supported by the presence of alginite, indicating a subaqueous environment of deposition; large quantities of sporinite, as spores tend to collect in lakes and ponds; and the high proportion of collinite, which would be derived from the decomposition of soft-tissued leaves, and possibly from grasses and reed-like plants. The coals commonly contain pyrite, found as coatings on the cleat.

Coal facies for the various seams are shown in Figure 67.

LATE TRIASSIC SEAMS

The Late Triassic coals are very dull, with high raw ash contents of 25–30%, and low sulphur (0.5%). The specific energy of the raw coals is 20–24 MJ/kg.

The main component of the coals is inertinite, which makes up 60–70% of most of the Triassic coals. Vitrinite, usually in the form of a collinite, makes up no more than 10% of the coal. The exinite content is similarly low (5–10%). The dominant exinite maceral is cutinite. Finely-dispersed mineral matter, mostly clay and quartz, fills cell lumens and is well dispersed throughout the plant material. The coal cannot be washed to an ash content of below 20%, as the finely disseminated mineral matter cannot be removed.

Coal facies for the various seams are shown in Figure 67 and graphic representations of the coal plies of three Late Triassic seams are shown in Figure 68. The petrographic composition of three Late Triassic coal seams is shown in Figures 64–66.

Most of the seams are banded mudstone or claystone, attesting to periodic inundation of the peat swamps with sediment-bearing floodwaters. Some of the bands are derived from ash-fall material.

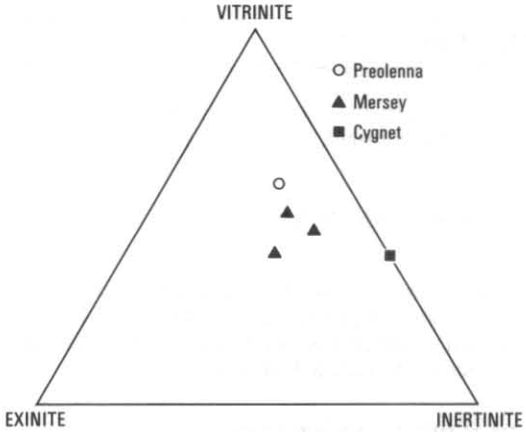


Figure 61. *Petrographic composition of the Early Permian and Late Permian coal seams.*

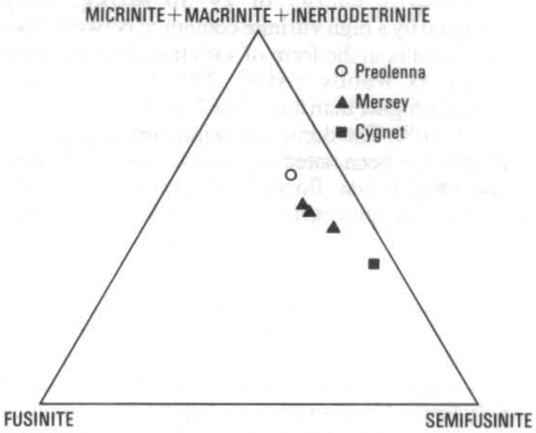


Figure 62. *Inertinite composition of the Early Permian and Late Permian coal seams.*

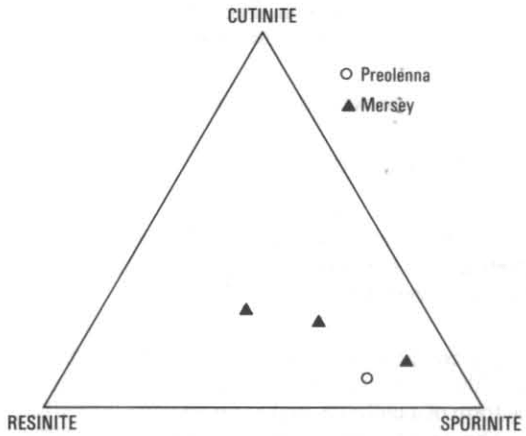


Figure 63. *Exinite composition of the Early Permian coal seams.*

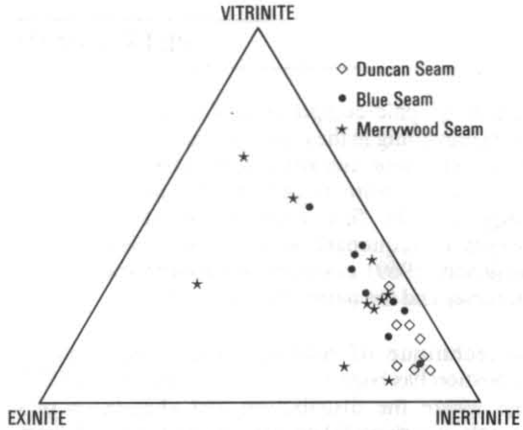


Figure 64. *Petrographic composition of the Late Triassic coal seams.*

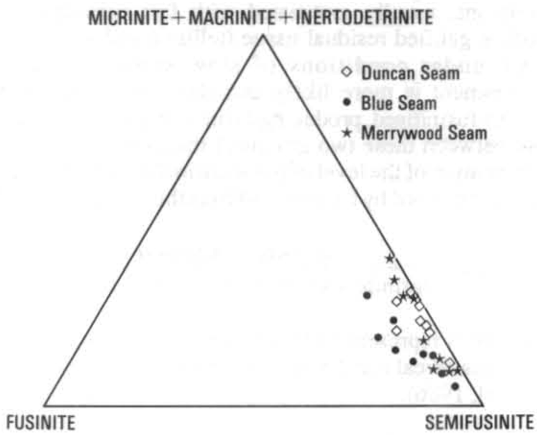


Figure 65. *Inertinite composition of the Late Triassic coal seams.*

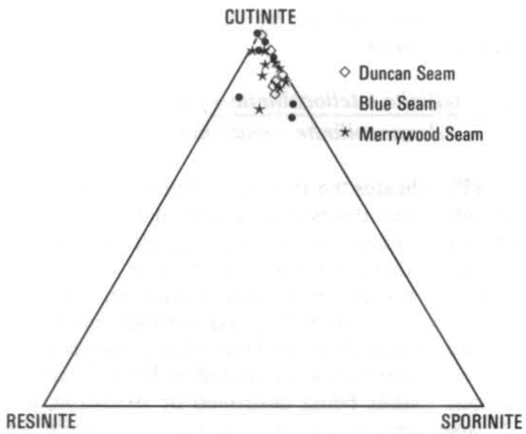


Figure 66. *Exinite composition of the Late Triassic coal seams.*

Duncan Seam

This seam is mined at the Duncan Colliery near Fingal. The dominant maceral group of this seam is inertinite, and overall the seam composition does not vary greatly from ply to ply. The vitrinite content is low throughout the whole seam, with most of the vitrinite being various forms of collinite. The vitrinite content is slightly higher at the base of the seam (30%), possibly indicating the existence of wetter conditions at the time the peat swamp became established. The dominant inertinite maceral is semifusinite in all plys of the seam. The content of inertodetinite is also quite high. Exinite is distributed evenly thoughout the seam, with cutinite being the dominant exinite maceral.

All coal plies of the Duncan seam have a GI of 0.25, which indicates that the environment of coal formation was dry. The TPI (wood ratio) for most plys of the seam has a value of 3–4, which indicates that a substantial proportion of wood-derived macerals are present in the coal.

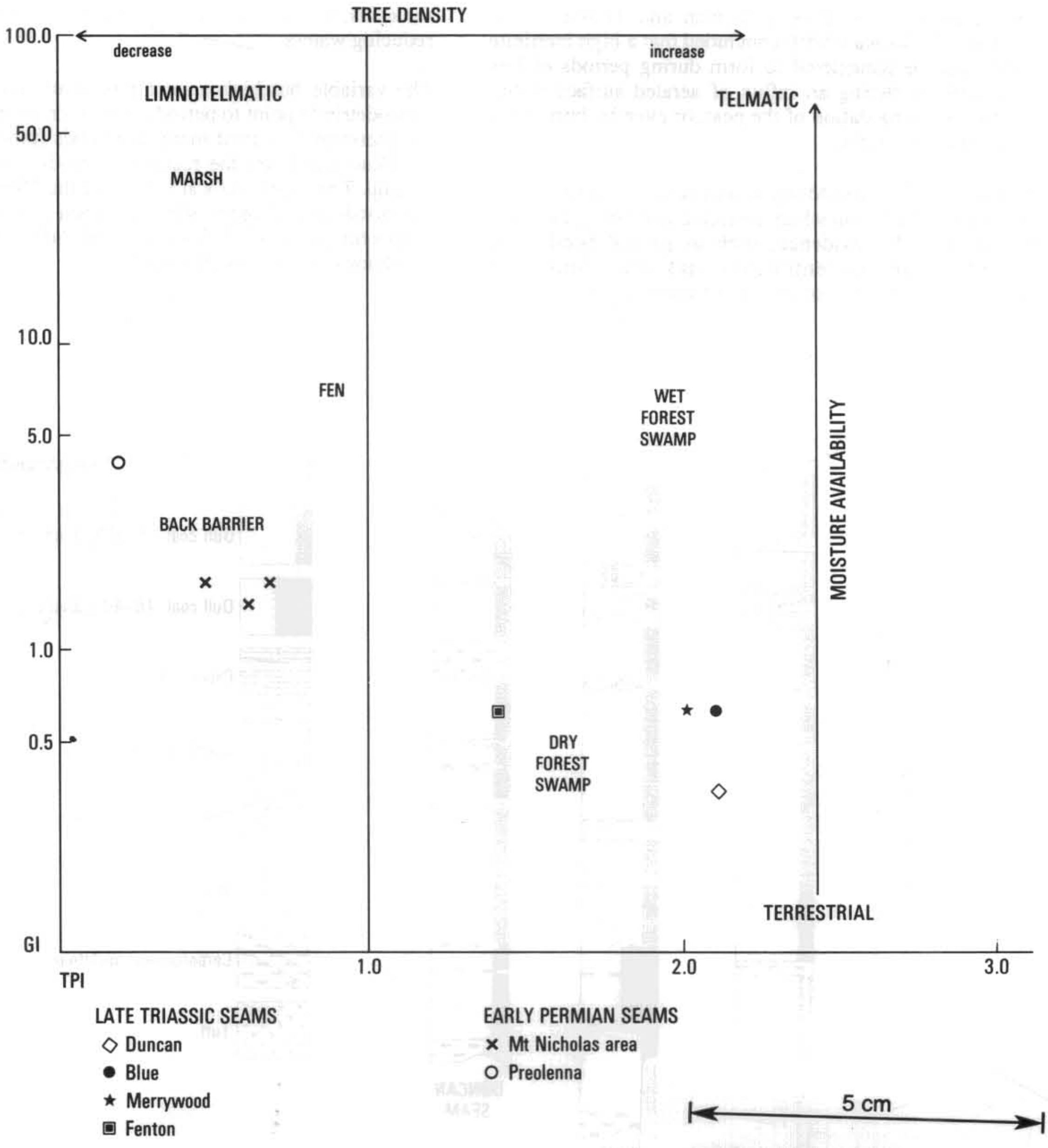


Figure 67. *Coal facies diagram showing environments of formation of some coal seams (graph construction after Diessel, 1986).*

The two indices indicate that the peat formed from accumulated woody material in a relatively dry environment. The peat was subject to frequent drying and oxidation which resulted in the abundance of inertinite. Periodic flooding of the peat swamp is indicated by the presence of a number of claystone bands.

Blue Seam

This seam is mined at the Blackwood Colliery on Mt Nicholas in north-eastern Tasmania.

The Blue seam is similar to the Duncan seam, being inertinite (mainly semifusinite) but has a higher vitrinite content. The vitrinite content is highest at the base of the seam (40%), generally decreasing towards the top of the seam (10%). The seam is extremely banded, containing about nine claystone and mudstone bands. The dominant exinite maceral is cutinite.

The GI for the plys of the Blue seam indicates that the environment was relatively dry, but not as dry as that in which the Duncan seam was deposited. The wood ratio shows that about 50% of the macerals in the seam are derived from woody tissue.

Merrywood Seam

The Merrywood seam is mined intermittently at a small open cut south-west of Fingal. The most distinctive feature of the seam is three plys of 'paper coal' found towards the top of the seam. These paper coals are composed of tightly compacted *Johnstonia* leaves.

SUMMARY OF PETROGRAPHY

A considerable proportion of Tasmanian coal has evidently been derived from woody tissue, as shown by the TPI indices (wood ratio) for the various plies of each seam, and the woody component is fusinitised. Figure 67 shows the seams plotted on a coal facies diagram.

From a study of Australian Permian and Triassic coals, Gould and Shibaoka (1980) concluded that a high inertinite content can be considered to form during periods of low water table or during an influx of aerated surface water, causing partial oxidation of the peat, or even by burning of the peat prior to burial.

The Duncan, Blue and Merrywood seams are considered to have formed from peat which collected in a dry forest-moor environment. No evidence, such as graded bedding in inertodetrinite concentrations, has been found for subaqueous deposition of any of the coals. Pyrite is rare in the coals, indicating that the peat did not form in stagnant reducing waters.

The variable but high concentrations of semifusinite and inertodetrinite point to periodic oxidation of the peat, while the presence of a great many dirt bands (predominantly in the Blue seam) are the result of periodic flooding of the swamp. The paper coals at the top of the Merrywood seam are possibly analogous with an 'open moor' facies, and represent periods of flooding and 'algal bloom' type conditions over the swamp surface.

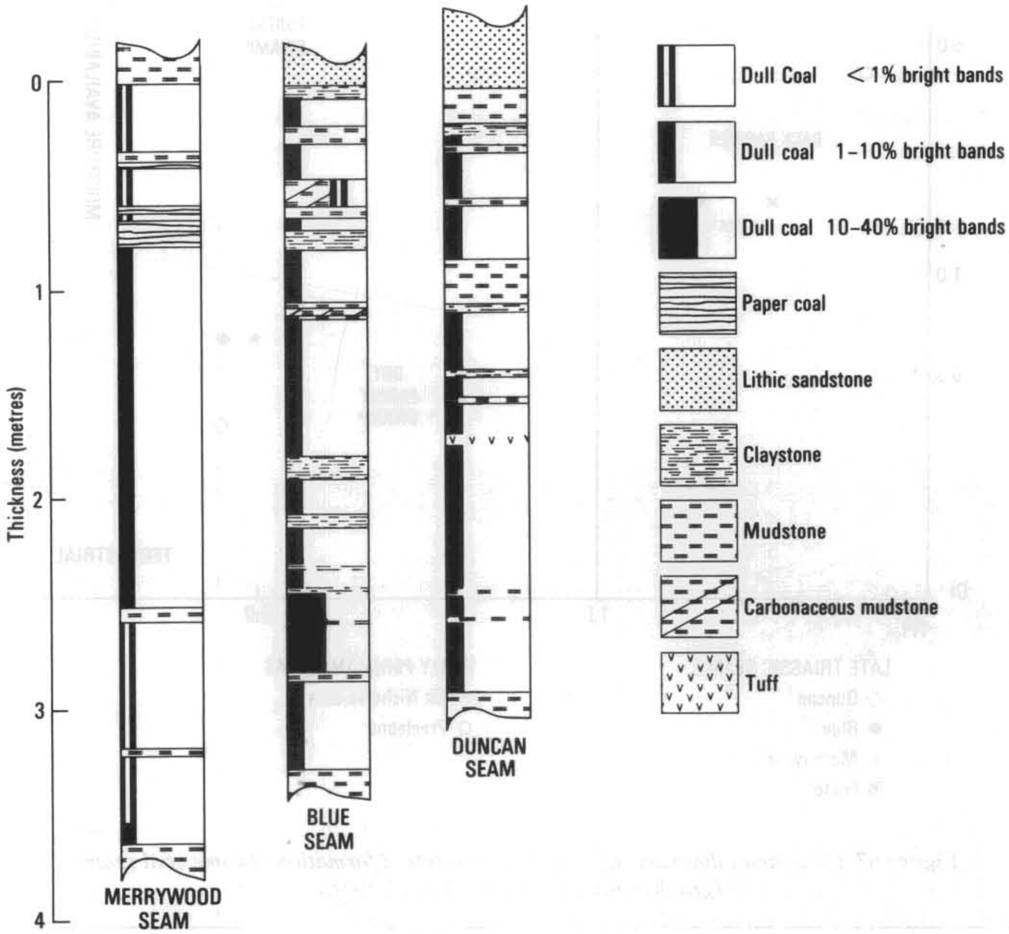
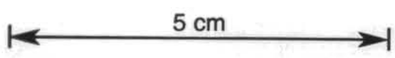


Figure 68. *Graphic representation of the Merrywood, Blue and Duncan Seams.*



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APPENDIX 1

Some recent statistics on the Tasmanian coal industry

INTRODUCTION

The consumption of coal by Tasmanian industry has doubled during the ten years from 1980/81 and local coal is now used by a number of Tasmanian secondary industry as a boiler fuel. The largest users are the paper factories and the cement works, which together use around three-quarters of the Tasmanian coal produced.

Statistics relating to Tasmanian coal consumption and production are given in tabular form, along with an account of coal reserves within the State. These statistics are taken from figures collated by the NSW Joint Coal Board, published in yearbooks *Black Coal in Australia* to 1987/88 (wherein figures are given on a financial year basis) and more recently in *Australian Black Coal Statistics*, which gives figures on a calendar year basis. Figures from various sources can differ, and users should be aware of the basis of calculation: financial or calendar year, and even whether the end of the year is deemed to be at the end of, or part way through, a production fortnight.

COAL CONSUMPTION ('000 t)

	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989	1990*
Cement Works	71	94	77	49	78	87	67	71	81	84	92
Paper Mills	93	100	172	195	200	203	219	218	235	228	218
General Industry	43	73	75	61	67	101	99	119	132	126	137
TOTAL	207	267	324	305	345	391	385	408	448	438	447
NSW coal used	10	4	13	12	26	46	26	47	60	63	60
Local coal used#	197	263	311	293	319	345	359	361	388	375	387

1980/81 to 1988/89 from NSW Joint Coal Board financial year statistics
* calendar year JCB statistics
\# calculated from total coal used less imported coal.

COAL PRODUCTION ('000 t)

	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989*	1990*
Raw coal	302	390	557	453	491	502	617	600	645	571	628
Saleable coal	208	249	329	280	321	310	394	380	407	312	390
Closing stocks#	57	42	87	92	95	60	92	110	?	95	98

1980/81 to 1988/89 from NSW Joint Coal Board financial year statistics
* calendar year JCB statistics
\# 1980/81 to 1987/88 stocks as at June; 1989, 1990 stocks as at December

EMPLOYMENT (persons)

1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90
135	141	140	138	143	155	150	146	134	136

The patterns of coal consumption, production and employment are shown graphically in Figures 69 and 70.

Figure 69

TASMANIAN COAL PRODUCTION, 1980/81–1989/90

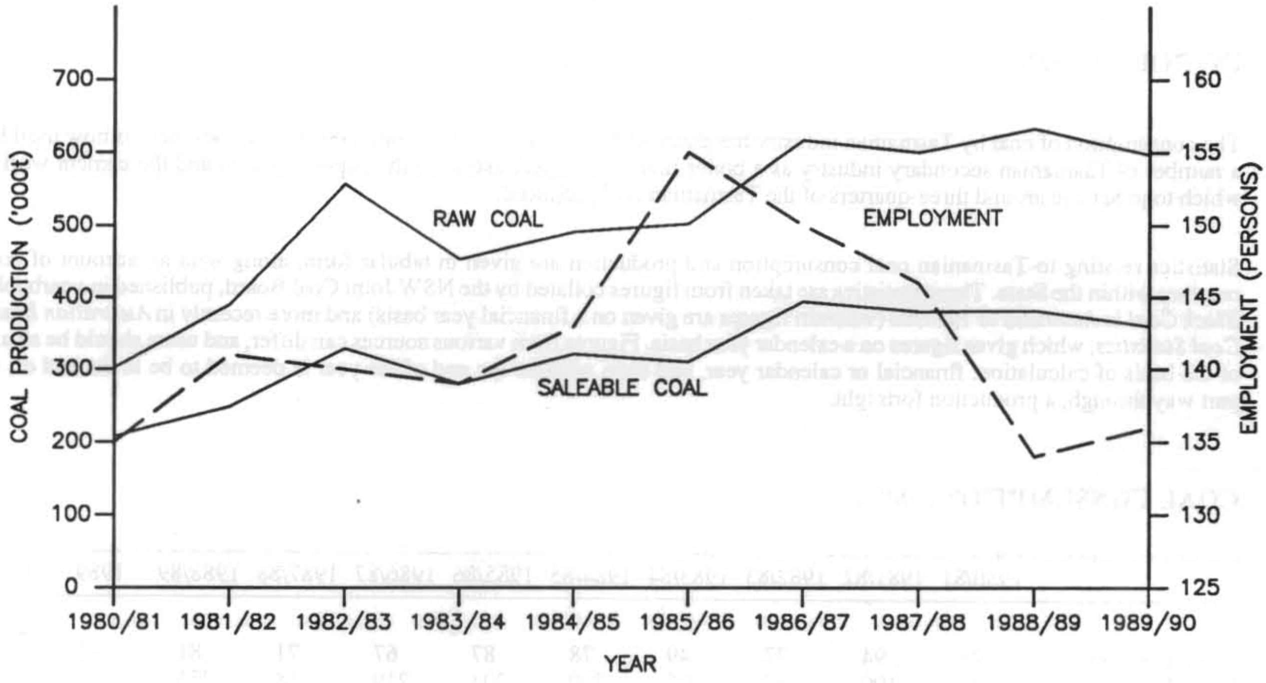
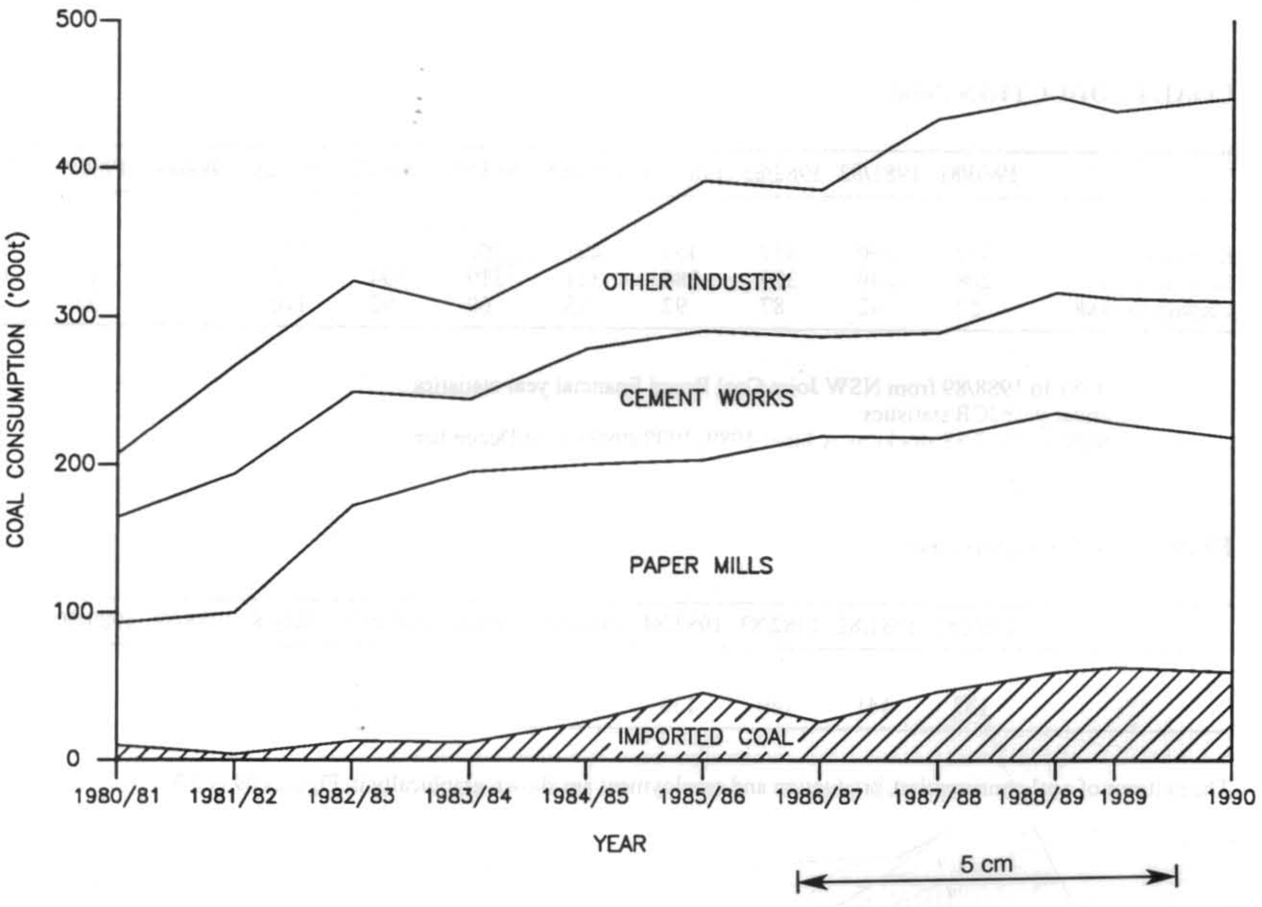


Figure 70

TASMANIAN COAL CONSUMPTION, 1980/81–1989/90



COAL RESERVES

In reporting or calculating coal reserves the Department recommends adherence to Australian Standard 2519-1982: *Standing Committee on Coalfield Geology of NSW: Codes for calculating and reporting coal reserves (fourth edition).*

A brief summary of the reserve categories of AS2519-1982 is as follows:–

MEASURED RESERVES are those for which the density of observation points is sufficient to give control on quality, quantity, thickness, depth and other relevant conditions, and to allow for both a reliable estimate of the reserves and the planning of their extraction. The standard suggests that the observation points should be spaced no further than one kilometre apart, and in many instances much closer spacing is needed.

INDICATED RESERVES are those for which the density of observation points is sufficient to allow for a realistic estimate of reserves and for which there is a reasonable expectation that the reserves could be raised to the measured category with further information. Observation points should be spaced no further than two kilometres apart.

INFERRED RESERVES are those for which there is a poor cover of information so that only an uncertain estimate of the reserves can be made. Further information will either raise these reserves to a higher category or show that part or all of them does not exist. Quantitative values are not assigned to inferred reserves, other than to indicate the relative size of the deposit within the following ranges:

very large	>10,000 million tonnes
large	100 to 10,000 million tonnes
small	20 to 100 million tonnes
very small	<20 million tonnes

In view of the fact that a large number of extremely small coal deposits occur in Tasmania the Department has adopted a modification of the inferred reserve category. Indications are made in the table where extremely small deposits contain less than 5 million tonnes or less than 1 million tonnes.

STATUS OF (IN SITU) RESERVES (Revised August 1991)

Location	Measured + Indicated (million tonnes)	Inferred (million tonnes)
Mt Nicholas	98	small
Harefield	5	-
Fingal	250	large
Dalmayne	160	large
Douglas River	30	small
Langloh (Hamilton)	10	-
Woodbury	25	-
Merrywood		very small <1
Mt Christie		very small <1
Denison Rivulet		very small <2
Strathblane		very small <1
Moss Glen		very small <1
Catamaran		very small <5
Colebrook		very small <5
York Plains		very small <1
Preolenna		very small <5
Mersey		very small <5
Cygnet		very small <1
Mt Lloyd		very small <2
Kaoota		very small <1
Total	578	

The remainder of areas in which coal is known to occur in Tasmania contain extremely small reserves, or very thin seams which in the current economic climate are not workable.

PREVIOUSLY REPORTED RESERVE FIGURES

Coal figures reported in the 1983/84 JCB Year Book *Black Coal in Australia* (as supplied by the Tasmanian Department of Mines) are: (million tonnes)

Measured and indicated (*in situ*) (non-coking)		530
Recoverable*		
	Open cut	22
	Underground	224
	TOTAL	246
Marketable# (non-coking)		147
Inferred resources (*in situ* coal)		large

* derived by taking 50% of the measured and indicated (*in situ*) reserves, minus those thought to be entirely without mining access.
\# derived by taking 60% of the recoverable reserves.

Reserve figures in the 1989 NSW JCB Year Book are given under new definitions. The source for the figures quoted is the Bureau of Mineral Resources.

The categories of both identified *in situ* resources and identified recoverable resources may be: economic, subeconomic, paramarginal or submarginal, depending on the data available.

The categories relating to Tasmania are:

	Tasmania	Australia (total)
Identified in situ resources (Mt) (Economic)	530	71 230
Identified recoverable resources (Mt) (Economic)	250	50 776

Firm statistics can only be obtained on individual blocks of coal after a proper feasibility study has been conducted, however, the above figures have been used to give "ball park" figures of the resources.

With the measured and indicated reserves estimated at 578 Mt, and present production (raw coal) at just over half a million tonnes per year, there is little incentive for explorers who hold ground to actively increase the status of other reserves, as there is, at present, no call for greater production. With further exploration no doubt part of the "inferred" category reserves could be firmed up, and taken into the "measured" category.

No attempt has been made to delineate what constitutes "economic recoverable coal" as this depends on such variable factors as the market price which could be obtained, proximity to infrastructure, freight charges or subsidies, as well as constant technological changes. There is the possibility that at some time in the future some coal may possibly be burnt *in situ*, with factories or power plants using the coal sited above the seam, drawing up hot gases and/or circulated (heated) water. This technique is referred to as "in situ gasification". This can enable coal which cannot be extracted by usual means, due to problems of mining access, to be profitably used.

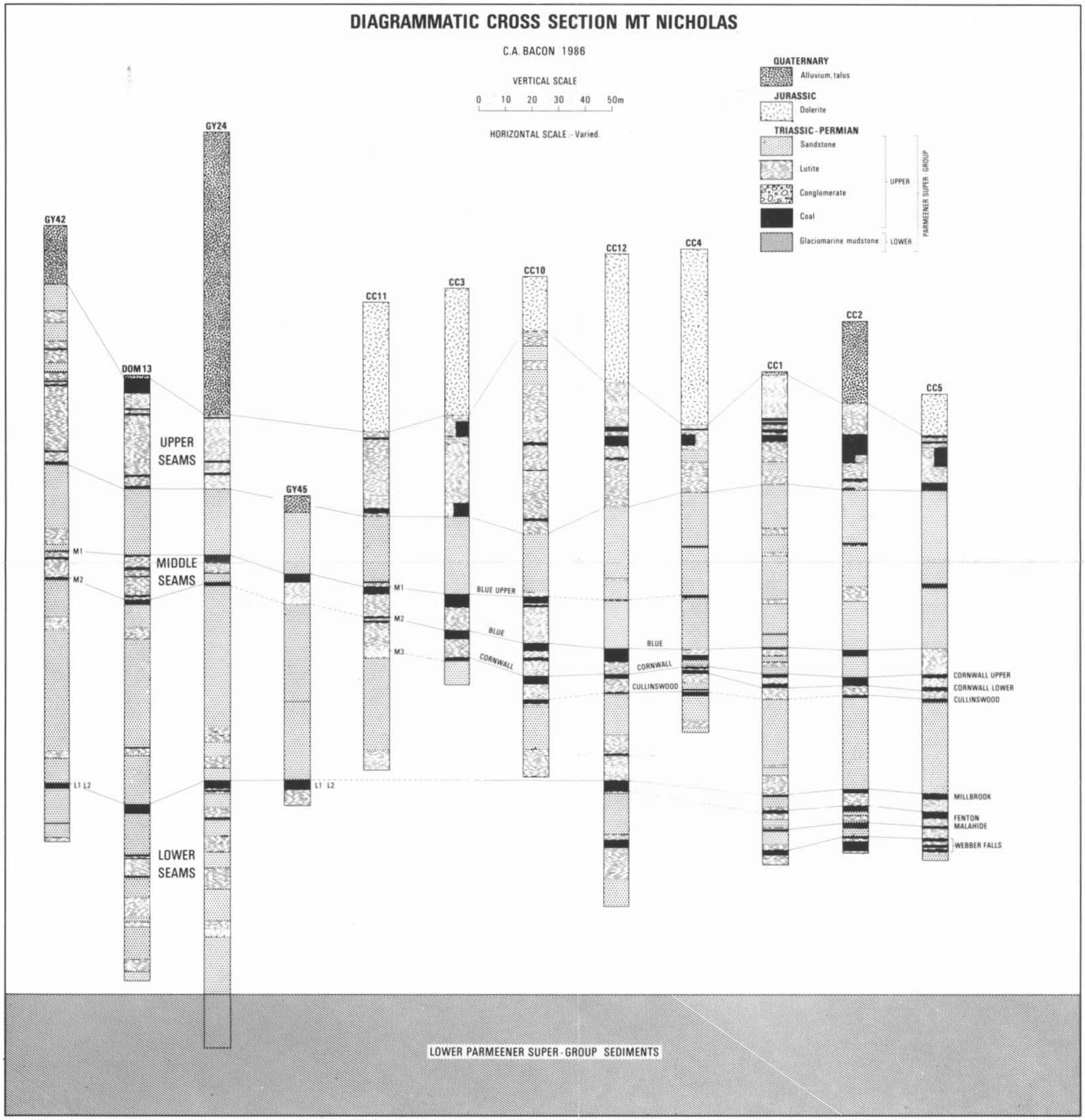

DIAGRAMMATIC CROSS SECTION MT NICHOLAS
C.A. BACON 1986
VERTICAL SCALE
0 10 20 30 40 50m
HORIZONTAL SCALE - Varied.
QUATERNARY
Alluvium, talus
JURASSIC
Dolerite
TRIASSIC - PERMIAN
Sandstone
Lutite
Conglomerate
Coal
Glaciomarine mudstone
UPPER
LOWER
PARMEENER SUPER GROUP
GY42
DOM13
GY24
GY45
CC11
CC3
CC10
CC12
CC4
CC1
CC2
CC5
UPPER SEAMS
MIDDLE SEAMS
LOWER SEAMS
M1
M2
M3
L1 L2
BLUE UPPER
BLUE
CORNWALL
CULLINSWOOD
CORNWALL UPPER
CORNWALL LOWER
MILLBROOK
FENTON
MALAHIDE
WEBBER FALLS
LOWER PARMEENER SUPER-GROUP SEDIMENTS

Figure 22

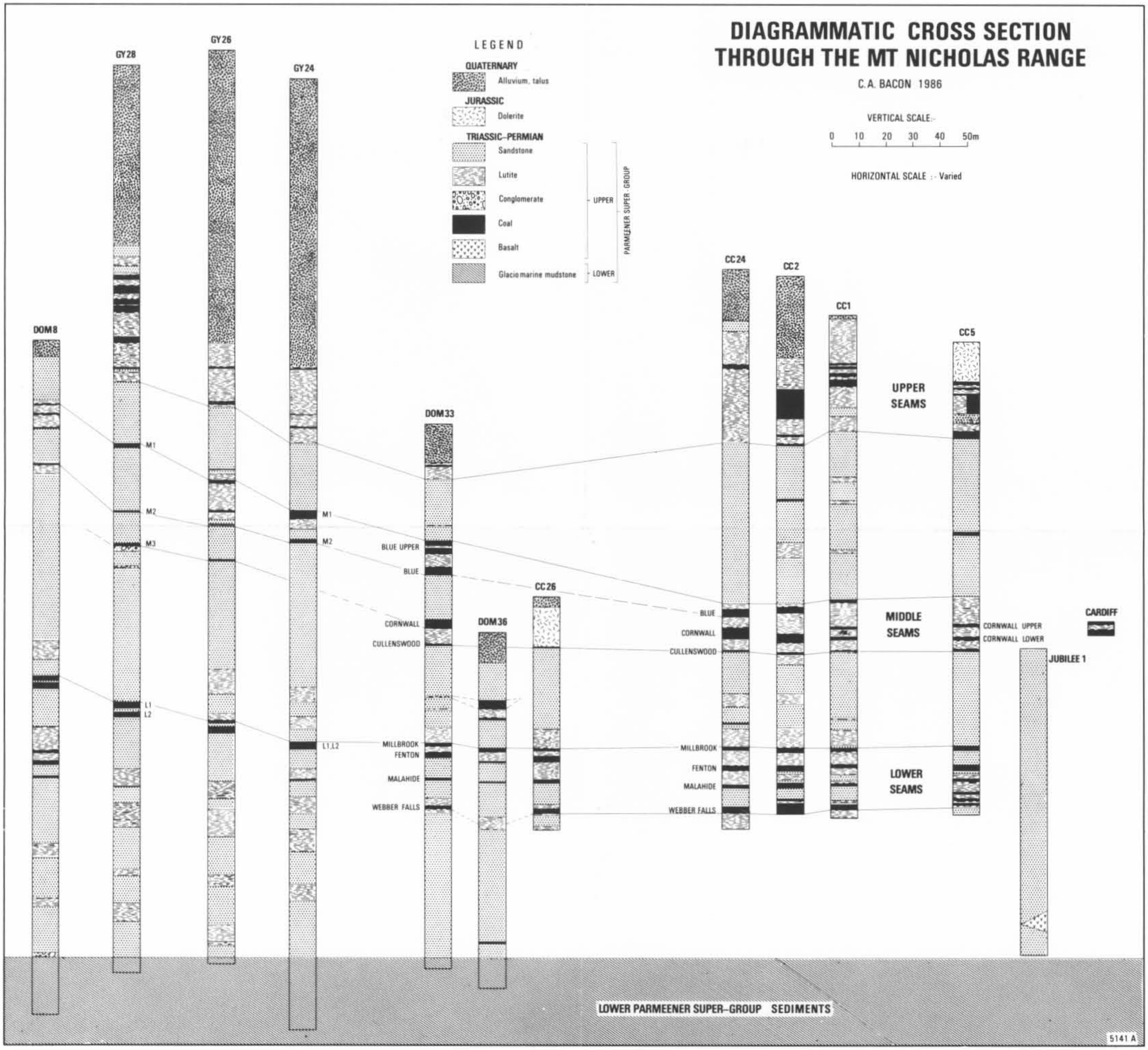


Figure 23

5 cm

GSB64

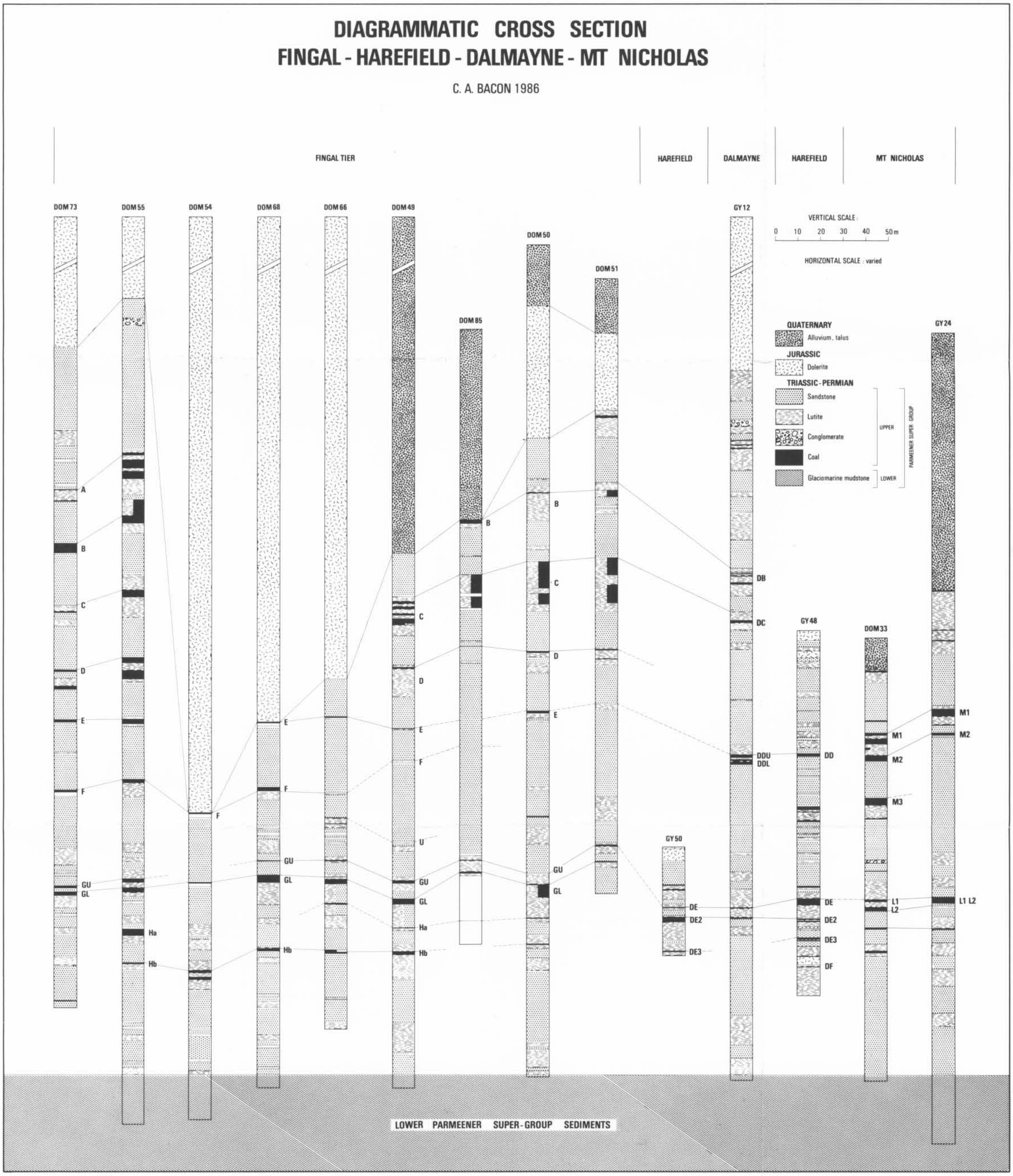


Figure 24

5 cm

GSB64

DIAGRAMMATIC CROSS SECTION: FINGAL TIER TO DALMAYNE

C. A. BACON 1986

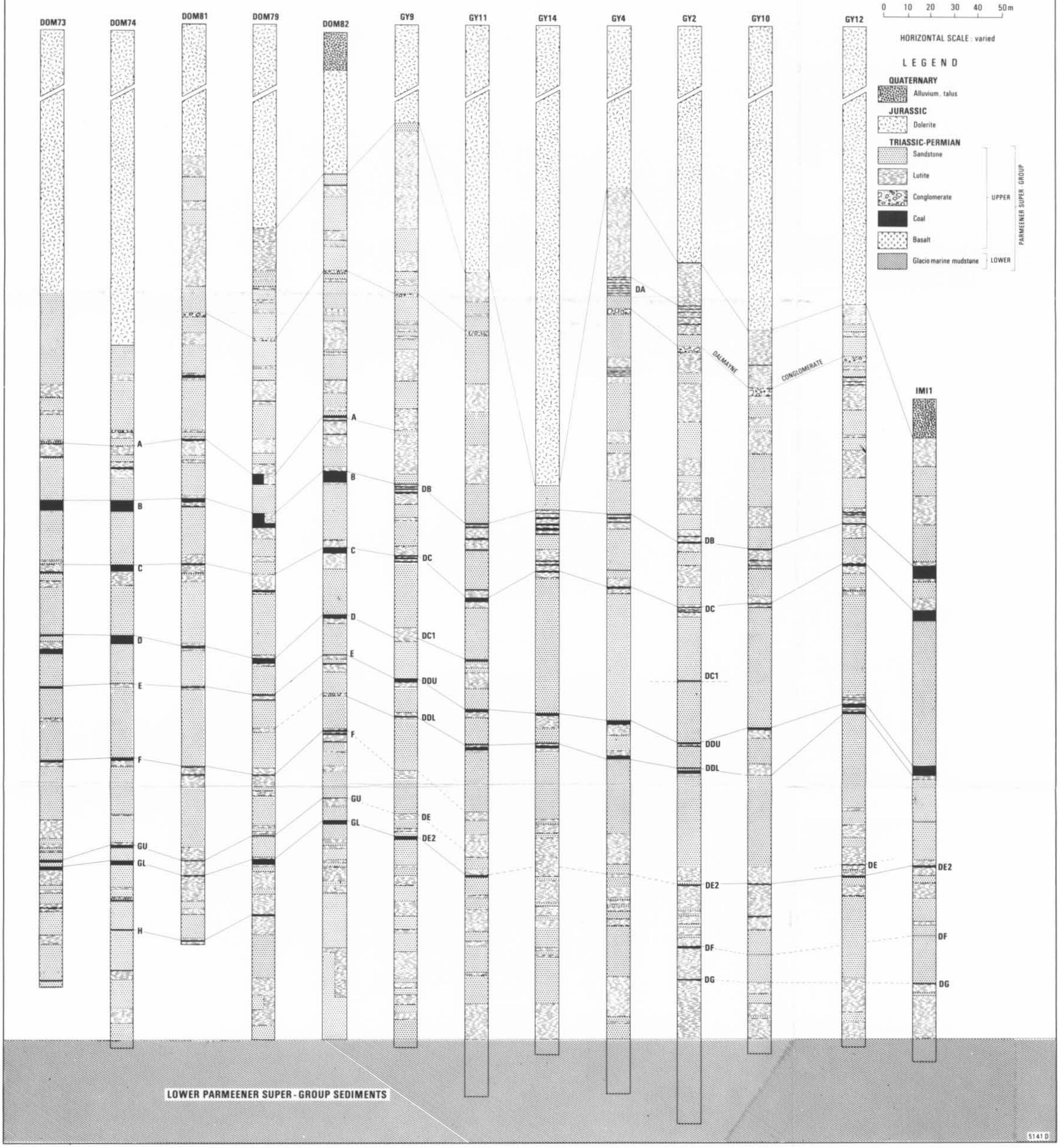
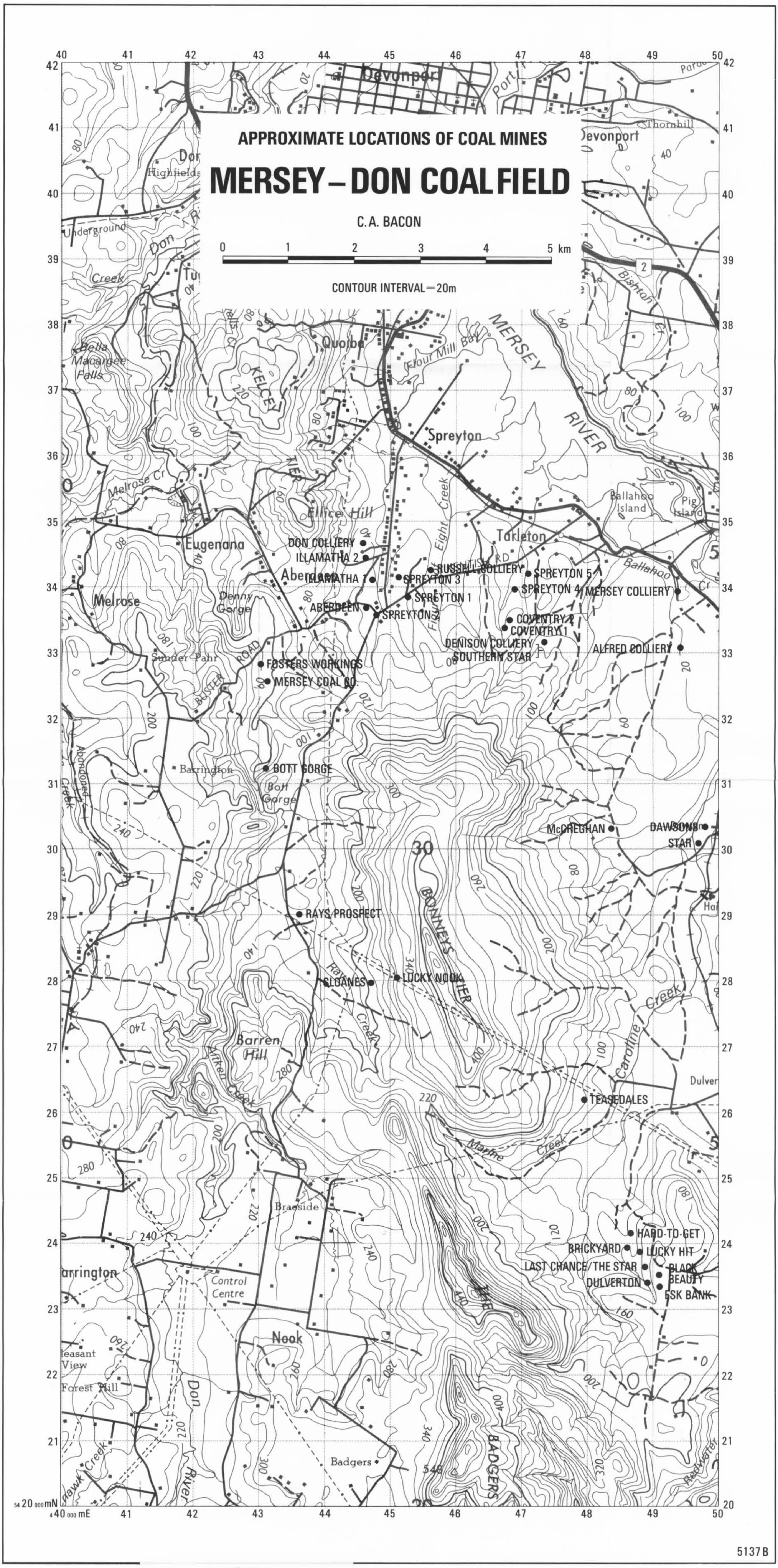


Figure 25

5 cm

GS864



5 cm

Figure 57

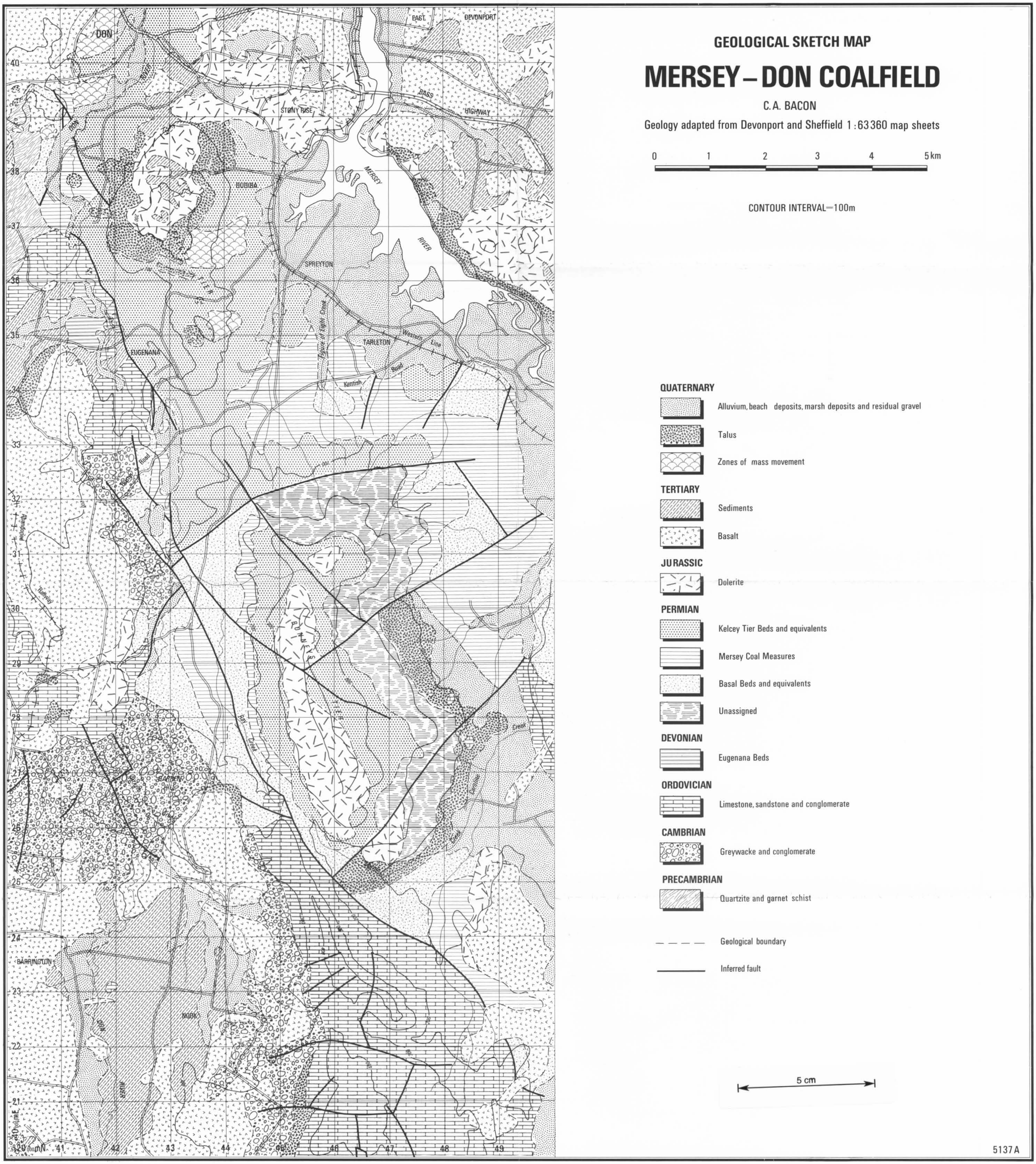

GEOLOGICAL SKETCH MAP
MERSEY – DON COALFIELD
C.A. BACON
Geology adapted from Devonport and Sheffield 1 : 63 360 map sheets
0 1 2 3 4 5 km
CONTOUR INTERVAL—100m
QUATERNARY
Alluvium, beach deposits, marsh deposits and residual gravel
Talus
Zones of mass movement
TERTIARY
Sediments
Basalt
JURASSIC
Dolerite
PERMIAN
Kelcey Tier Beds and equivalents
Mersey Coal Measures
Basal Beds and equivalents
Unassigned
DEVONIAN
Eugenana Beds
ORDOVICIAN
Limestone, sandstone and conglomerate
CAMBRIAN
Greywacke and conglomerate
PRECAMBRIAN
Quartzite and garnet schist
Geological boundary
Inferred fault
5 cm
5137 A
DON
EAST
DEVONPORT
STONY RISE
BASS
HIGHWAY
HOBIBA
MERSEY
RIVER
SPREYTON
TARLETON
Western
Line
Kentish
Road
EUGENANA
BARRINGTON
NOOK

Figure 58