PALAEONTOLOGY

TR16-41-49

9. The Fisher tunnel Permian section and its relation to the Kansas Creek section, Tasmania.

M.J. Clarke
N. Farmer

The Permian rocks of the extreme north-western margins of the Great Western Tiers (fig. 6) are poorly known largely because of the lack of exposure which results from the widespread occurrence of thick deposits of Quaternary talus, till and alluvium around the lower slopes of Western Bluff. The sole reasonably adequate natural section is that exposed in Kansas Creek which flows down the north-western extremity of Western Bluff (Jennings, 1957, 1963; Banks, 1960). About 9 km to the south-east of the Kansas Creek section, recent tunnelling associated with the development of the Fisher Hydro-Electric Power Scheme has exposed a temporary stratigraphical section of the Permian approximately 100 m in thickness which ranges from the basal unconformity upwards. Characteristic lithological associations and the presence of rich, well-preserved faunas allow the accurate placement of the tunnel sequence within the Tasmanian succession. A comparison of the tunnel sequence with the Kansas Creek section indicates significant variation within the lowermost beds.

KANSAS CREEK SECTION (fig. 9)

The lower parts of this section are given in some detail by Banks (1960) and Jennings (1963). The sequence exposed in Kansas Creek is wholly marine except for a very characteristic horizon of coarse-grained, well-sorted, cross-bedded quartz sandstone with lesser carbonaceous shale and coaly partings. This unit, the Liffey Sandstone, is generally considered to be of non-marine origin and provides an invaluable field marker horizon throughout northern Tasmania. The present authors follow Jennings (1957, 1963) in assigning the entire pre-Liffey Sandstone sequence to an undivided Kansas Creek Formation rather than Banks (1960) who attempted a more detailed correlation with the better known sections at Poatina (McKellar, 1957) and Golden Valley (Wells, 1957). Although the pre-Liffey Sandstone sequence exposed in Kansas Creek shows an overall generalised similarity with the Poatina and Golden Valley sections, no detailed lithological comparison can be made, particularly since the revision of the Golden Valley sequence (Clarke, 1968); and the richly fossiliferous parts of the Kansas Creek Formation (Pkb_2) appear to be significantly older than their broad lithological equivalents at Golden Valley.

Fossils collected from the middle unit of the Kansas Creek Formation include:

Calcitornella stephensi (Howchin) - extremely abundant encrusting the inner shell surfaces of the macrofossil components.
Cyrtella nagmargensis (Bion) *australis* Thomas
Fletcherithyris sp.
Grantonia sp. nov. - this form is externally very close to *Trigonotreta stokesi* Koenig non Armstrong 1968; internally it differs from *Grantonia hobartensis* Brown in possessing a very narrow, notched ventral muscle platform.

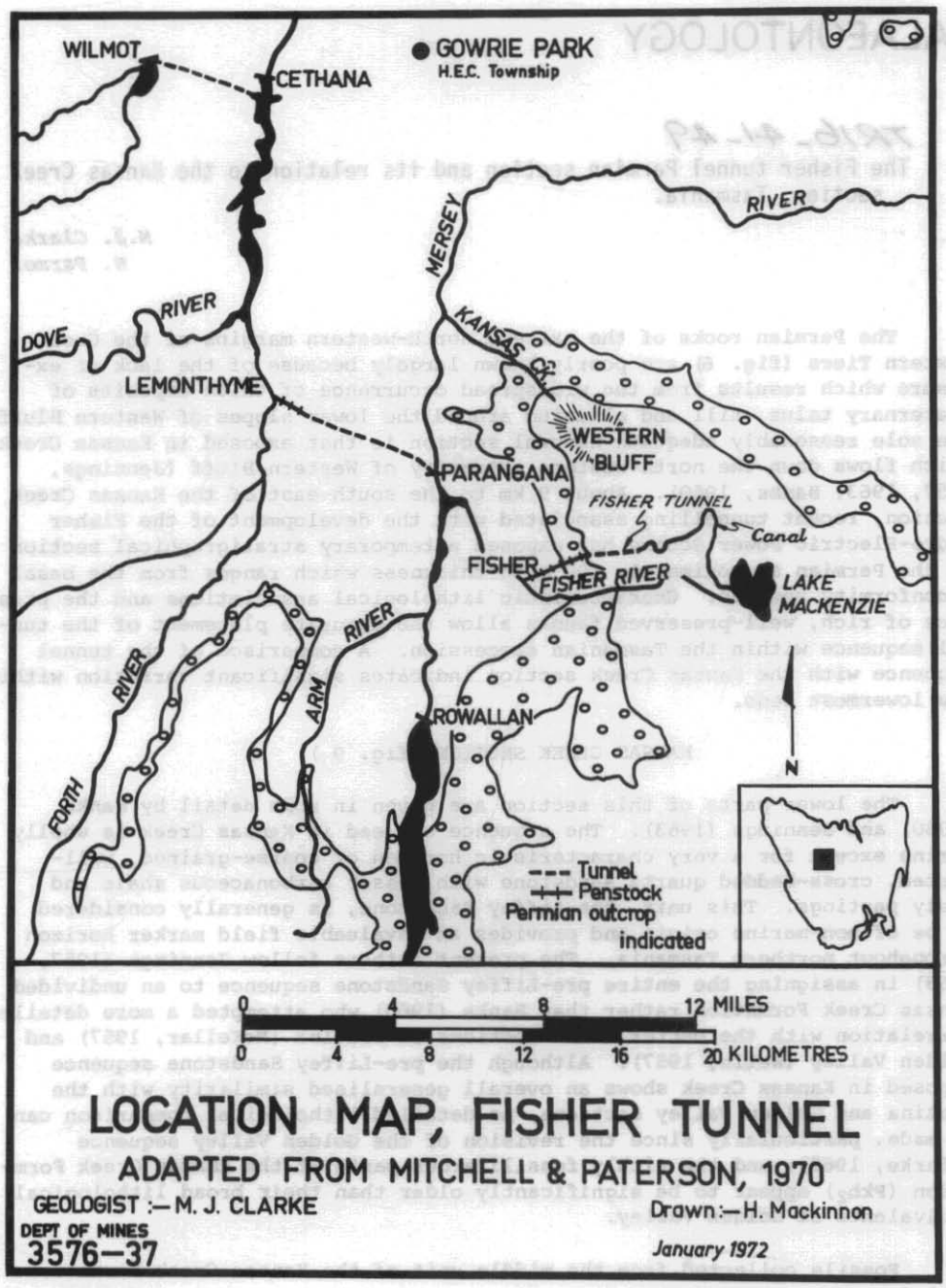

WILMOT
CETHANA
GOWRIE PARK
H.E.C. Township
MERSEY
RIVER
DOVE
RIVER
KANSAS CK.
LEMONTHYME
WESTERN
BLUFF
PARANGANA
FISHER TUNNEL
Canal
FISHER
FISHER RIVER
LAKE
MACKENZIE
RIVER
ARM
RIVER
FORTH
ROWALLAN
N
Tunnel
Penstock
Permian outcrop
indicated
0 4 8 12 MILES
0 4 8 12 16 20 KILOMETRES
LOCATION MAP, FISHER TUNNEL
ADAPTED FROM MITCHELL & PATERSON, 1970
GEOLOGIST :— M. J. CLARKE
Drawn :— H. Mackinnon
DEPT OF MINES
3576—37
January 1972

Figure 6.

5 cm

Martiniopsis ovulum (Waterhouse) - *koninckí* Etheridge group, Runnegar 1969.
Schuchertella sp.
Streptorhynchus sp. - a very large form with a high, twisted interarea.
Strophalosia sp. nov. - like *Wyndhamia ovalis* (Maxwell) in possessing a short, high ventral adductor platform and heavy posterior thickening behind the diductor scars; but is smaller, has a short hinge line, lacks dorsal valve spines and has strong brachial ridges.
Deltopecten illawarensis (Morris)
Deltopecten waterfordi Dickins
Etheripecten tenuicollis (Dana)
Eurydesma hobartensis Johnston
Megadesmus globosus J. Sowerby var. nov. - similar to a form in the Youlambie Conglomerate (Dr B. Runnegar pers. comm.).
Merismopteria carrandibbiensis (Dickins)
Myonia morrisi Etheridge
Keeneia ocula (J. Sowerby) - *platyschismoides* Etheridge
Peruvispira sp.
Fenestellids and stenoporids

The occurrence in this fauna of forms like *Martiniopsis ovulum-koninckí* group, *Grantonia* sp. nov., very coarsely-ribbed species of *Deltopecten* belonging to the *waterfordi-illawarensis* group, *Eurydesma*, *Megadesmus globosus* var. nov., *Myonia morrisi*, and *Keeneia* spp. in abundance, indicates a broad correlation with the Allandale Fauna of the Sydney Basin (Runnegar, 1967; 1969). This fauna occurs very widely throughout Tasmania below the Liffey Sandstone and its lithological correlates. The occurrence of *Cyrtella nagmargensis australis*, a characteristic large species of *Streptorhynchus* and *Strophalosia* sp. nov., together with an abundance of *Megadesmus globosus* var. nov. is similar to a number of other Tasmanian localities notably immediately above the Tasmanite Oil Shale at Latrobe (Burns, 1964), Scolyers Hill (Gee and Gulline, 1974), Andersons Creek (Gee and Legge, 1974), and Cygnet where associated forms include *Promytilus cancellatus* Maxwell, *Phestia darwini* (de Koninck) and *Neoschizodus australis* Runnegar, the last-named in abundance. All these forms are either absent or rare in the fauna from the Glencoe Formation, Golden Valley Group or the main part of the Bundella Mudstone of southern Tasmania where *Pseudosyrinx allandalensis* Armstrong, *Eurydesma cordatum* Morris and *Strophalosia subcircularis* Clarke occur in profusion. At Beaconsfield and Cygnet the 'Latrobe' fauna occurs stratigraphically below the 'Glencoe' fauna so it is probable that the two assemblages represent significant temporal subdivisions of a more broadly conceived Allandale Fauna. Hence the present fauna from the Kansas Creek Formation is considered to be older than those collected from the Glencoe Formation at Golden Valley and Poatina, and the main part of the Bundella Mudstone of southern Tasmania.

The beds immediately above the Liffey Sandstone in Kansas Creek are poorly exposed; however, about 35 m above the top of the Liffey Sandstone there is an abundance of loose blocks of fossiliferous pebbly siltstone and fine sandstone. This material, although not in place, has probably not moved far. Fossils collected include:

'Aperispirifer' wairakiensis - lethamensis (Waterhouse) group.
Martiniopsis angulata (Campbell)
Martiniopsis ingelarensis (Campbell)
Sulciplica stutchburii (Etheridge) auctorum - may be juvenile *S. transversa* Waterhouse.
Wyndhamia preovalis (Maxwell)

Megadesmus nobilissimus (de Koninck)
Streblopteria parkesi Campbell
Vacunella curvata (Morris)
Keeneia sp.
Fenestellids

This fauna is undoubtedly post-Fauna II and pre-Fauna IV (Dickins, 1964). A more detailed assessment of its age and correlation is considered in conjunction with similar, but richer and more diverse faunas obtained from the Fisher Tunnel.

FISHER TUNNEL SECTION

The location of the Fisher Scheme within the Mersey-Forth Hydro-Electric Power Development is shown in Figure 6. The Fisher Scheme will utilise water from the Lake Mackenzie storage. The water will pass over the dolerite plateau by way of flume and canal, and thence by a partly vertical and partly inclined shaft through the dolerite to an almost horizontal 'mole'-driven tunnel in subhorizontal Permian sandstone, siltstone and mudstone below. These rocks rest unconformably on a basement of Precambrian quartzite and schist, the surface of which has a pronounced relief. (Mitchell and Paterson, 1970).

The tunnel (fig. 7, 8) is 2 m in diameter, 3,000 m long and slopes gently to the west at a gradient of 1 in 250. Permian rocks occur continuously west of the major fault at 715 m through to the outlet portal, giving a total tunnel intersection length of 2,285 m. The beds show an apparent easterly dip of 2-3° with respect to the tunnel intersection. No dip readings were taken in the tunnel because of the inherent difficulty of accurately measuring small angles of dip, the variation in dips, the presence of

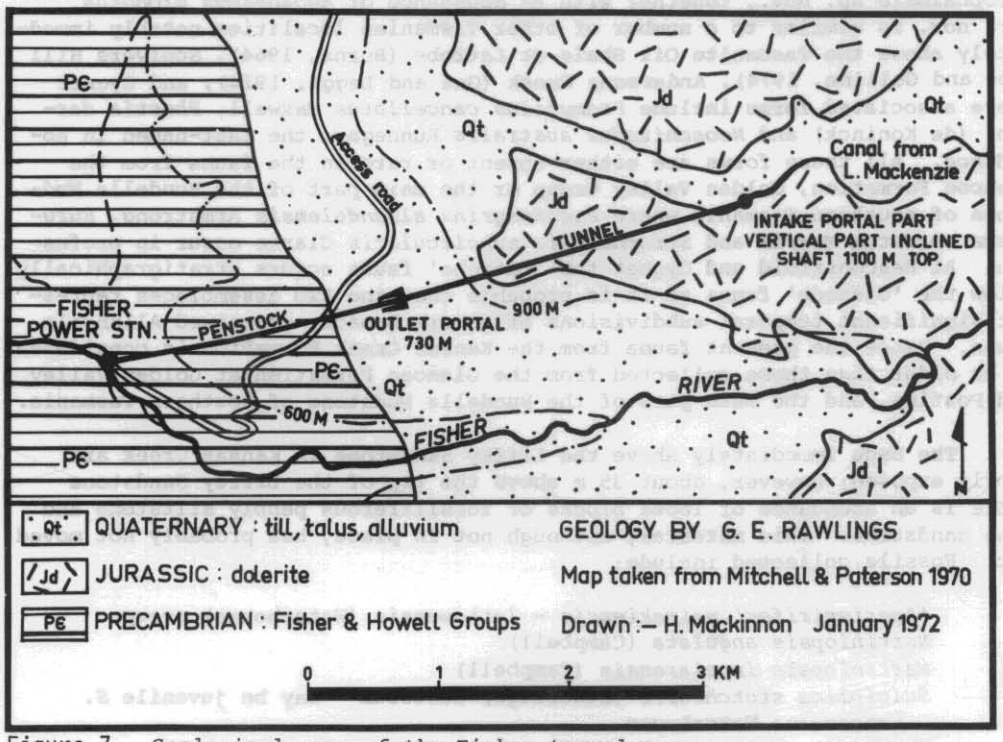


Figure 7. *Geological map of the Fisher tunnel area.*

5 cm

lensing and wedge-bedding in the Liffey Sandstone, and the difficulty of taking readings on the curved traces of the bedding on the tunnel walls. The thicknesses of the various units within the Permian succession (fig. 9) have therefore been calculated on the basis of assuming a mean apparent dip of 2½° with respect to the tunnel intersection. Owing to the slope of the tunnel this figure is about ¼° greater than the mean apparent dip of the beds in the tunnel, had the mean apparent dip been deduced from actual readings. However, such a consideration does not affect the validity of the figures quoted subsequently. A mean apparent dip of 2½° with respect to the tunnel intersection gives a very close fit between the calculated thickness of the Liffey Sandstone as exposed in the tunnel (24.8 m) and a measured thickness encountered in DDH 5905 (25.3 m). All other thicknesses are calculated on this basis.

The Precambrian basement is exposed below and to the west of the outlet portal. Above this in a drainage channel more or less parallel with, and alongside the upper penstock, the immediate basal Permian is intermittently exposed. The lowermost beds comprise quartzose conglomerate (Pkb_1) containing well-rounded tabular quartzite pebbles up to 100 mm in diameter. Some schist, chert and granitic pebbles are also present. The matrix is angular, quartzose and of coarse sand grade. The thickness appears to be about 6-8 m which agrees with thicknesses encountered in DDH 5905, DDH 5919 and DDH 5921.

Above this there is an abrupt change in lithology. The conglomerate gives way to massive-bedded, dark, uniform, pyritic siltstone devoid of fossils (Pkb_3). The first metre above the conglomerate is pebbly, but otherwise erratics are rare. Large lenticular calcareous concretions with their long axes parallel with the bedding are a feature of the fresh tunnel surfaces. This unit is about 37 m thick of which 33 m occur in the tunnel, and about 3.5-4.5 m occur below the outlet portal.

The Liffey Sandstone (Pl) comprises 24-26 m of well-sorted, coarse-grained, massive- and cross-bedded, quartz sandstone with subordinate carbonaceous shale, coaly partings, laminated flaggy micaceous sandstone, and conglomerate. Its base is abrupt, irregular and marked by discontinuous pods of conglomerate. Its top is equally abrupt and consists of a one metre bed of darker, ill-sorted worm-cast sandstone. Similar worm-cast sandstone has been reported from the top of the Liffey Sandstone at Poatina (McKellar, 1957) and Beaconsfield (Gee and Legge, 1974). Poorly preserved *Glossopteris* and *Gangamopteris* occur at intervals.

The uppermost unit (Pp) in the tunnel section is exposed to a thickness of about 45 m. It comprises dark, compact and slightly calcareous siltstone interbedded with coarser grained, pebbly siltstone and fine sandstone. Fossils are abundant throughout with the original shell material preserved. A large collection was made at a point about 24 m above the Liffey Sandstone mainly because of the ease of collection resulting from the part collapse of the tunnel wall. Smaller collections were also made above and below this level where practicable. A collection was also made from the spoil heaps below the outlet portal. No significant differences are present between the various collections and all are considered to belong to a single palaeontological horizon. Preservation is excellent and all external and internal details were obtained by leaching blocks with dilute hydrochloric acid. The forms obtained are listed below. Those species marked with an asterisk are the commonest and occur in all samples.

'Aperispirifer' wairakiensis - lethamensis (Waterhouse) group.
**Fusispirifer* cf. *avicula* (G.B. Sowerby), Morris - rather smaller

and less transverse than Fauna IV forms.
Grantonia cracovensis Wass
**Martiniopsis angulata* (Campbell)
**Martiniopsis ingelarensis* (Campbell) - a few specimens are variants towards *M. undulosa* (Campbell).
**Sulciplica transversa* Waterhouse
Terrakea brachythaera (Morris)
**Wyndhamia preovalis* (Maxwell) - most of the specimens are identical with the Queensland types. Rare specimens possess much coarser dorsal valve spines.
Conocardium sp.
**Deltopecten limaeformis* (Morris)
**Etheripecten fittoni* (Morris)
Streblopteria parkesi Campbell
Stutchburia sp.
**Vacunella curvata* (Morris)
Keeneia cf. *twelvetreesi* Dun
Paraconularia derwentensis (Johnston)
Stenopora crinita Lonsdale
Other stenoporid and fenestellid bryozoa

This fauna, although more diverse, is essentially similar to that obtained from above the Liffey Sandstone in Kansas Creek. It is a most characteristic assemblage which is unquestionably post-Fauna II and pre-Fauna IV (Dickins, 1964). Similar assemblages occur widely throughout Tasmania in a variety of rock types. Important examples include Malbina A at Mt Nassau (coarse sandstone), Arcadian Siding near Maydena (glauconitic sandstone), the Dabool-Weston association at Poatina (pebbly sandstone and bryozoal shale), at Beaconsfield (sandy limestone), and at Deep Bay, Cygnet (siltstone and sandstone). The sole unusual feature of the present fauna with respect to the other Tasmanian occurrences of the same age is the presence of *Wyndhamia preovalis* (Maxwell) in abundance rather than *W. jukesi* (Etheridge) or *W. dalwoodensis* Booker. The typical Tasmanian representatives of *preovalis*, which are probably best referred to *W. preovalis pristina* (Maxwell), are considerably smaller than the present material and characterise the lower parts of Fauna II (the Nassau Siltstone of the Hobart section, and the 'Strophalosia' Zone on Maria Island). The associated rock type is always a compact, calcareous siltstone and it is possible that *preovalis* is a facies fossil. In coarser grained rocks like sandstone and calcarenite, *preovalis* is replaced by the more robust *W. jukesi* or *W. dalwoodensis*. In Queensland and New South Wales *preovalis* occurs both in Fauna II and Fauna III assemblages.

A detailed correlation of the present fauna with assemblages in Queensland, New South Wales and New Zealand is not easy. In Queensland, Fauna III (Dickins, 1964) is based largely on characteristic bivalve species, and has not been recognised with certainty outside the Gebbie area (Runnegar, 1969). In New South Wales the same stratigraphical interval is occupied by the Ulladulla Fauna (Runnegar, 1969) which comprises a mixture of species otherwise confined to Fauna II and Fauna IV in Queensland. The present Tasmanian assemblage is probably closest to the fauna of the New Zealand Barrettian Stage (Waterhouse, 1969). However the correlation of New Zealand and eastern Australian faunas is currently the subject of much debate. Thus Waterhouse (1969; 1970) equates Fauna II wholly with the Telfordian Stage, Fauna IV wholly with the Flettian Stage, and tentatively suggests that Fauna III includes both the Mangapirian and Barrettian Stages. On the other hand Runnegar and Armstrong (1969) place the Mangapirian with the Telfordian as equivalent to Fauna II. These conflicting views are due, at least in part, to taxonomic and nomenclatorial problems. For instance, in Queensland and New South Wales

the characteristic Fauna II neospiriferid is generally termed *Trigonotreta stokesi* Koenig which is further regarded as a senior synonym of *Grantonia hobartensis* Brown (Armstrong, 1968). Waterhouse (1964; 1966; 1968; 1970), however, retains *Trigonotreta, Grantonia* and *Aperispirifer* as separate genera. In the view of the present authors, *Grantonia hobartensis* Brown is not synonymous with *Trigonotreta stokesi* Koenig which is probably the characteristic form which occurs in abundance in Tasmanian Allandale Fauna assemblages and recorded as *Grantonia* sp. nov. (Clarke, 1968 *et seq*). *Grantonia hobartensis* probably belongs to the *'Aperispirifer' wairakiensis* (Waterhouse) group. Similarly, there are doubts as to the exact equivalence of Queensland and Tasmanian *Taeniothaerus subquadratus* (Morris) and *Wyndhamia jukesi* (Etheridge) (Waterhouse, 1970). It is important to remember, however, that the Tasmanian form is *Taeniothaerus subquadratus* (Morris) whereas Muir-Wood and Cooper (1960), Muir-Wood (*in* Williams, 1965) interpret the species, and hence the genus, on West Australian material which Coleman (1957) considered not to be conspecific. *Wyndhamia jukesi* (Etheridge) is not readily separable from *W. dalwoodensis* Booker.

The present authors therefore tentatively conclude that Fauna II in Queensland (Dickins, 1964) is broadly equivalent to both the Telfordian and Mangapirian Stages in New Zealand (compare Runnegar and Armstrong, 1969) with the added proviso that the Mangapirian may include part of Fauna III A. On this basis the New Zealand Barrettian Stage appears to be the equivalent of Fauna III B and Fauna III A at least in part. The present fauna from the Fisher Tunnel is correlated with this interval.

SUMMARY AND CONCLUSIONS

Overall the stratigraphical successions exposed in Kansas Creek and the Fisher Tunnel agree very closely except that the richly fossiliferous middle unit of the Kansas Creek Formation (Pkb_2) is absent in the Fisher Tunnel section. The similarity of the succession above this level in the two sections suggests that the basal conglomerate (Pkb_1) is diachronous and that the pre-Permian basement relief was progressively drowned by the succeeding units. Elsewhere the basal Permian beds are reported to range as high as the Liffey Sandstone (Jennings, 1963).

At Golden Valley a rich Allandale macrofauna from the Glencoe Formation occurs in association with a Stage 2 microflora which persists throughout the Stockers Tillite, the Quamby Mudstone, the Golden Valley Group and the Liffey Sandstone (Dr R. Helby, pers. comm.). Assuming a similar microfloral sequence at Kansas Creek and the Fisher Tunnel it is evident that a pronounced hiatus must occur between the Liffey Sandstone and the overlying Poatina Group. A similar hiatus may be widespread in Tasmania since Fauna II is known with certainty only in the Hobart area, Frankford, Maria Island and various other East Coast localities. The statement that the Liffey Sandstone (Mersey Coal Measures) of northern Tasmania is a lateral facies of the Berriedale Limestone of the Hobart area (Waterhouse, 1970) appears to be unwarranted.

ACKNOWLEDGEMENTS

The authors would like to thank G.E.A. Hale, Chief Geologist, Hydro-Electric Commission, for bringing the Fisher Tunnel section to their notice; S.J. Paterson, Geologist-in-Charge, Mersey-Forth Scheme, and M.J. Pollington for every assistance in their examination of the Fisher Tunnel section, the examination of certain borehole cores, and the provision of numerous plans and diagrams. They would also like to thank Sir Allan Knight, Commissioner, Hydro-Electric Commission for permission to use unpublished information gathered by a number of Hydro-Electric Commission geologists, particularly G.E. Rawlings and M. Andric. Dr E. Williams read the manuscript.

REFERENCES

ARMSTRONG, J.D. 1968. Synonomy of the Australian spiriferid genera *Trigonotreta* Koenig, 1825 and *Grantonia* Brown, 1953. *J.geol.Soc.Aust.* 15:79-86.

BANKS, M.R. 1960, *in* FORD, R.J. The geology of the Fisher River area. *Pap. Proc.R.Soc.Tasm.* 94:25-32.

BURNS, K.L. 1964. One mile geological map series. K/55-6-29. Devonport. *Explan.Rep.geol.Surv.Tasm.*

CLARKE, M.J. 1968. A reappraisal of a Lower Permian Type Section, Golden Valley, Tasmania. *Rec.geol.Surv.Tasm.* 7.

COLEMAN, P.J. 1957. Permian Productacea of Western Australia. *Bull.Bur. miner.Resour.Geol.Geophys.Aust.* 40.

DICKINS, J.M.; MALONE, E.J.; JENSEN, A.R. 1964. Subdivision and correlation of the Permian Middle Bowen Beds, Bowen Basin, Queensland. *Rep.Bur. miner.Resour.Geol.Geophys.Aust.* 70.

GEE, R.D.; LEGGE, P.J. 1974. Geological atlas 1 mile series. Zone 7 Sheet 30 (8215N) Beaconsfield. *Explan.Rep.geol.Surv.Tasm.*

GEE, R.D.; GULLINE, A.B. 1974. Geological atlas 1 mile series Zone 7, Sheet 28 (8015N) Burnie. *Explan.Rep.geol.Surv.Tasm.*

JENNINGS, I.B. 1957. Geological atlas 1 mile series. Zone 7 Sheet 45. (8114N) Middlesex. *Department of Mines, Tasmania.*

JENNINGS, I.B. 1963. One mile geological map series. K/55-6-45. Middlesex. *Explan.Rep.geol.Surv.Tasm.*

McKELLAR, J.B.A. 1957. Geology of portion of the Western Tiers. *Rec.Qn Vict.Mus.* N.S. 7.

MITCHELL, W.R.; PATERSON, S.J. 1970. Introduction to the Engineering Geology of the Mersey-Forth Hydro-Electric Development, Tasmania. *Trans.Instn Civ.Engrs Aust.* CE 12(2):197-212.

MUIR-WOOD, H.M. 1965. Productidina, *in* MOORE, R.C. (ed.). *Treatise on invertebrate paleontology.* Part H. 1:439-510. Geological Society of America, University of Kansas Press : New York.

MUIR-WOOD, H.M.; COOPER, G.A. 1960. Morphology, classification and life habits of the Productoidea (Brachiopoda). *Mem.geol.Soc.Am.* 81.

RUNNEGAR, B.N. 1967. Preliminary faunal zonation of the eastern Australian Permian. *Qd Govt Min.J.* 68:552-553, 555-556.

RUNNEGAR, B.N. 1969. The Permian faunal succession in eastern Australia. *Spec.Publ.geol.Soc.Aust.* 2:73-98.

RUNNEGAR, B.N.; ARMSTRONG, J.D. 1969. Comments on series and stages in the Permian of New Zealand. *Trans.R.Soc.N.Z.(Geol.)* 6(15):209-212.

WATERHOUSE, J.B. 1964. Permian brachiopods of New Zealand. *Paleont.Bull. geol.Surv.N.Z.* 35.

WATERHOUSE, J.B. 1966. Lower Carboniferous and Upper Permian Brachiopods from Nepal. *Jb.geol.Bundesanst.Wien,Sonderbd.* 12:5-99.

WATERHOUSE, J.B. 1968. The classification and description of Permian Spiriferida (Brachiopoda) from New Zealand. *Palaeontographica* A 129:1-94.

WATERHOUSE, J.B. 1969. World correlations of New Zealand Permian stages. *N.Z.J.geol.Geophys.* 12:713-737.

WATERHOUSE, J.B. 1970. Correlation of Marine Permian faunas for Gondwana. *Proc.Pap.2nd Gondwana Symp.*:381-387.

FISHER TUNNEL SECTION

QUATERNARY

Qt — *Dolerite talus & scree*

PERMIAN

Pp — *Poatina Group*

Pl — *Liffey Sandstone*

Pkb — *Kansas Creek Beds including basal conglomerate.*

PRECAMBRIAN

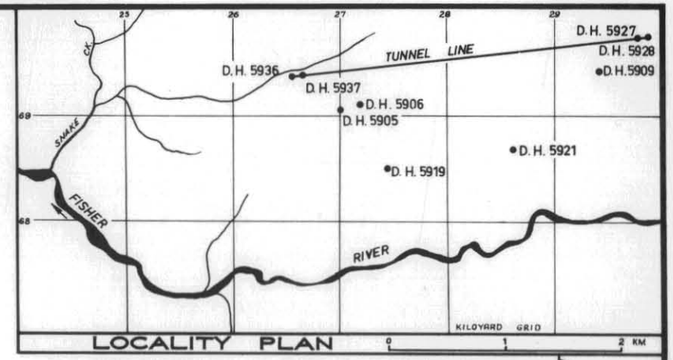
PEf — *Fisher Group :– jointed & foliated quartzite with occasional schist.*

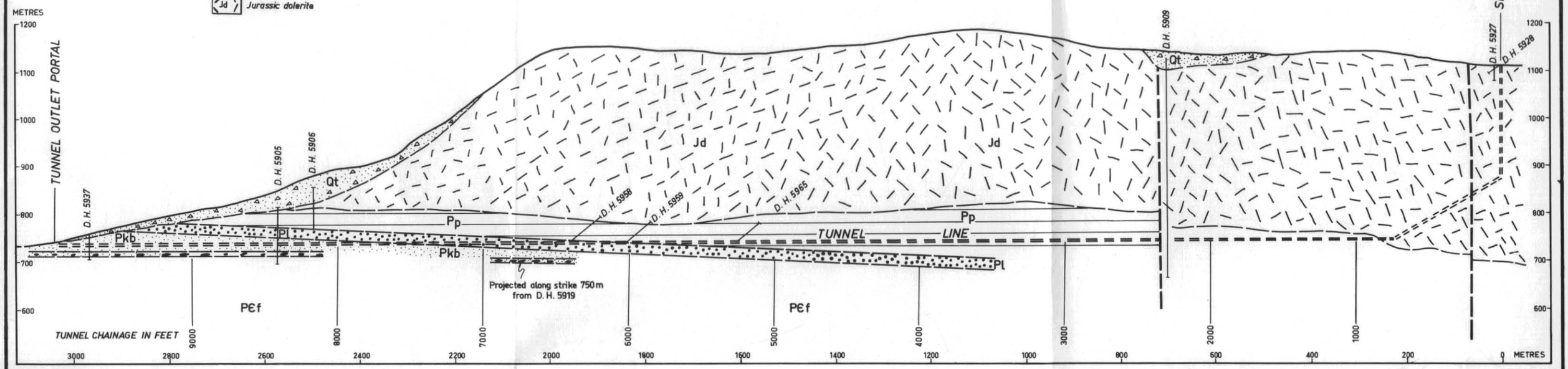
IGNEOUS ROCKS

Jd — *Jurassic dolerite*

0 100 200 300 400 500 METRES

ADAPTED FROM H.E.C. MAP BY M.J. CLARKE.
Drawn: H. Mackinnon *March 1972*





DEPT OF MINES
3605–37

Figure 8.

TR16-41-49

5 cm

WELLS, A.T. 1957. Geology of the Deloraine-Golden Valley area, Tasmania. *Rec.Qn Vict.Mus.* N.S. 8.

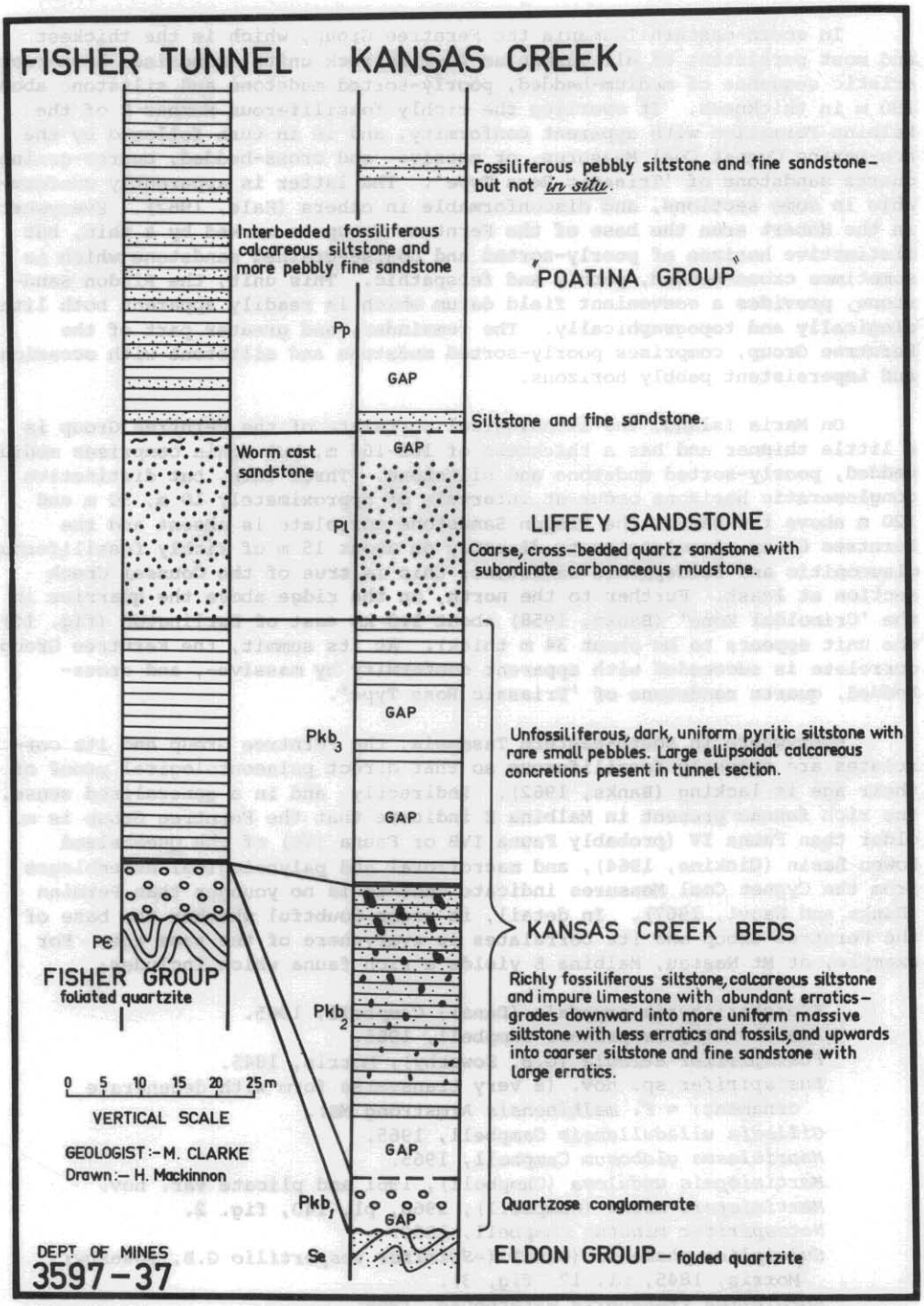


Figure 9. *Comparison of Permian sections at Kansas Creek and at Fisher tunnel.*