PAP. & PROC. ROY. SOC. TASMANIA, 1940 (23RD MAY, 1941.)

The Lower Tertiary (Miocene) Marine Sedimentary Rocks of the Far North-Western Districts of Tasmania

By

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(Read 11th November, 1940)

The main objectives of this paper are to bring together all references to Tertiary marine rocks; to publish together the various lists of fossils determined from time to time and some of which have not been published; to publish a list of fossils from Marrawah as determined by Mr. F. Chapman in 1932-1933 (see Appendix), and to determine the age of the rocks in accordance with the palaeontological evidence. The age of the rocks is important because that of other rocks (e.g., basalt) in the same region is dependent upon the age of the Tertiary marine rocks.

The far north-western districts are those to the west of a line joining Montagu and Balfour, and they represent the extreme north-western portion of the State (see map).

The generic and specific names of fossils are those given in the original descriptions of the palaeontologist who examined the specimens.

REVIEW OF THE LITERATURE

The rocks now referred to as Tertiary marine rocks were discovered by P. E. de Strzelecki who carried out scientific exploratory trips in New South Wales and Van Diemen's Land in 1841 and 1842. Strzelecki, however, referred to these rocks as 'elevated beaches', and reported their occurrence at Green Is., south-west point of Flinders Is., Table Cape, and ten miles south of Cape Grim. His description of the latter locality is: 'At ten miles south of Cape Grim and west coast of Van Diemen's Land are found, at 100 feet above the present sea, elevated beaches, similar to those of Bass's Straits, and approaching in structure to a coarse and porous sandstone'. No fossils were recorded (Strzelecki, 1845).

R. C. Gunn (1855) referred to raised beaches on certain parts of the north-west coast, but those referred to are of Recent and not of Tertiary age.

The Table Cape beds became the best known of the deposits discovered by Strzelecki as, according to Stephens (1870) several collections of fossils had already been donated to the Tasmanian Museum. Stephens' paper was written

to illustrate the geology of the North Coast, on the occasion of the presentation of a larger collection of fossils by Mr. Hainsworth. Stephens in this paper referred to the Table Cape beds as Tertiary marine beds, and was apparently the first to do so.

Johnston (1879) described certain Tertiary and Post-Tertiary beds on Flinders and other islands in the eastern part of Bass Strait, and also made brief mention of those at Table Cape, 10 miles south of Cape Grim, and Hunter's Island. Johnston stated that the 'elevated beaches' of previous writers had been shown by recent investigations to be 'remains of the floor of a vast but shallow sea of supposed miocene or oligocene age' In this he followed the expressed opinion of Tenison-Woods (1877).

During 1875 and succeeding years, Tenison-Woods, Johnston, and others described fossils from the Table Cape beds, but the rocks and fossils from the Table Cape locality will not be further considered in this paper.

Johnston (1888) refers to Strzelecki's discovery of 'elevated beaches' 10 miles south of Cape Grim, and states that, while he had not visited the beds, samples of polyzoal limestone had been sent to him by Messrs. Emmett and J. Norton-Smith, who described the cliffs south of Cape Grim as consisting mainly of horizontally bedded polyzoal limestone capped by basalt. Mr. Smith also reported that the limestones appeared to the east in the valley of the Welcome River. Johnston recognized the following fossils:—

Polyzoa	Cellepora *gambierensis* (Busk)
	——— *spongiosa* (Busk)
	——— *nummularia* (Busk)
	——— *hemispherica* (Busk)
	Lepralia
	Eschara
Corals	Placotrochus deltoideus (Duncan)
Echinodermata	Lovenia Forbesi (Woods and Duncan)
Brachiopoda	Waldheimia grandis (T. Woods)

Twelvetrees (1908) referred to the polyzoal limestone near Cape Grim and the Welcome R., but the decriptions are based upon those of Johnston (1888).

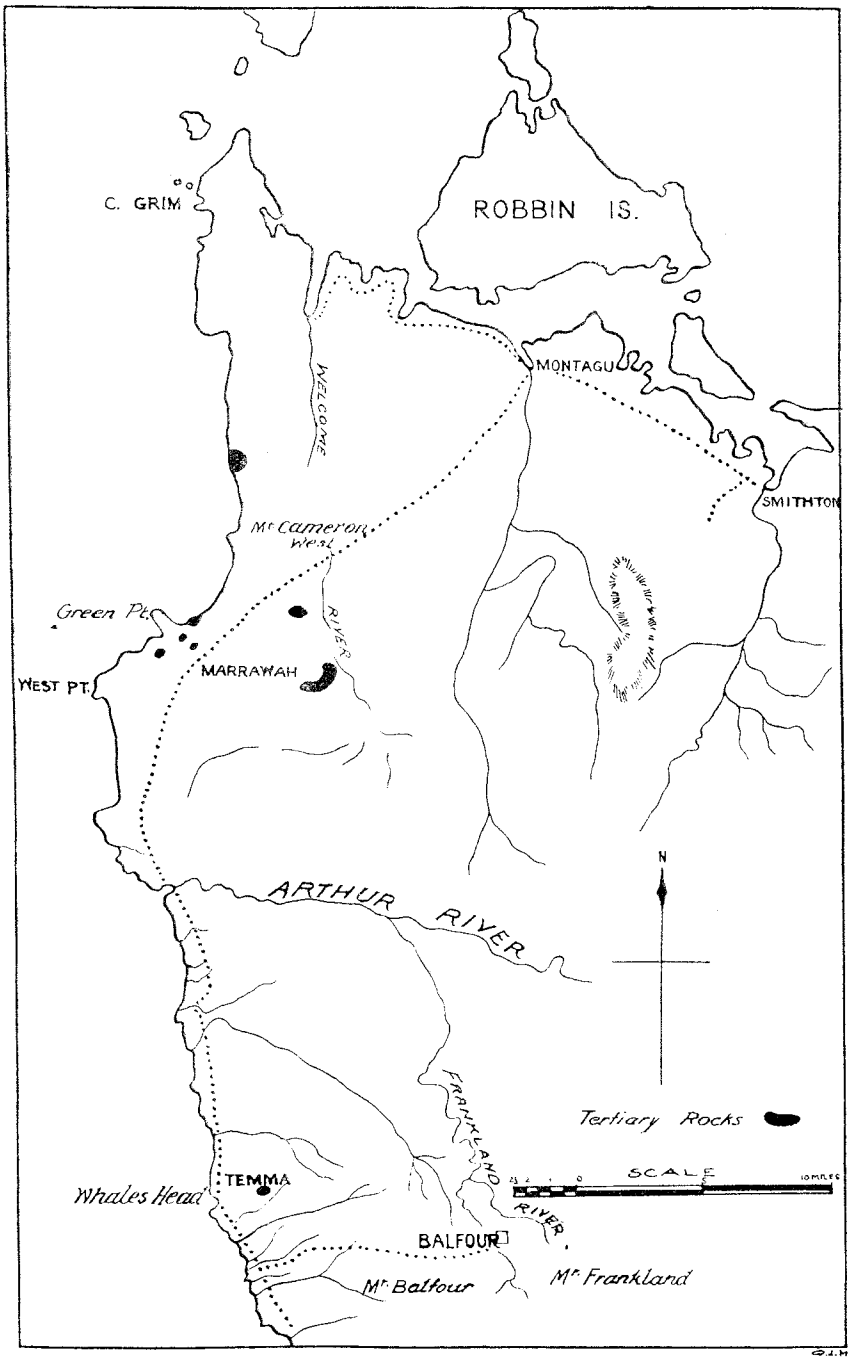
During the course of the geological survey of the Mt. Balfour Mining Field, L. K. Ward (1910) discovered Tertiary limestones near Temma and also near Marrawah, the exact localities being—

(1) In the north-western corner of a 99-acre block charted in the name of Louis Hogg. At height of 250 feet above sea level.
(2) A. Wilson's farm east of Marrawah (Note . . . probably north to north-west of Redpa). At height of 150 feet above sea level.
(3) On beach close to Marrawah, south of Mt. Cameron west and east of Green Point. Between high and low tide.
(4) As pebbles on beach between Ordnance Point and Daisy Creek.

The fossils obtained by Ward in 1910 were submitted to W. S. Dun, Government Palaeontologist of New South Wales, who made the following determinations:—

Locality (2) above

Polyzoa: Retepora, Cellepora, Lepralia, Microporella, Schizoporella (?)
Brachiopoda: *Terebratula garibaldiana.*


C. GRIM
ROBBIN IS.
WELCOME
MONTAGU
SMITHTON
Mt Cameron West
Green Pt
RIVER
MARRAWAH
WEST PT.
ARTHUR RIVER
N
Tertiary Rocks
FRANKLAND RIVER
SCALE
TEMMA
Whales Head
BALFOUR
Mt Balfour
Mt Frankland

Locality (1) above

Polyzoa: Most of the polyzoa quoted above.
Brachiopoda: A terebratulid which resembles *T. garibaldiana.*
Gasteropoda: Marginella, Calliostoma.

Mr. Dun added that 'There is in my opinion every reason to correlate these beds with the Table Cape beds and Cape Grim beds.'

In 1916, Mr. H. T. Lawson submitted some fossils from a limestone quarry at Marrawah (the quarry being about 6 or 7 miles from the coast) to the Geological Survey. The specimens were submitted to Mr. F. Chapman who determined the following fossils (Twelvetrees, 1917).

Pleurotomaria sp. (cast) with annectant characters between *P. tertiara*, McCoy, and *P. bassiana*, Pritchard.
Cypraea sp. (cast) resembling *C. subsidua*, Tate, or *C. leptorhyncha.*
Conus cf. *complicatus*, Tate, and added—

'The relationships of this small collection points unmistakably to the Janjukian (Table Cape) series. The condition of the fossil casts resembles that of the limestones of the Moorabool Valley near Maude, Victoria.'

The friable calcareous sandstones referred to by Meston (1933) in his recent paper on aboriginal carvings on the coast, 10 miles south of Cape Grim are close to Strzelecki's locality and undoubtedly belong to the marine beds of Tertiary age.

Other Localities

During 1932, the writer discovered other localities in the Marrawah district, viz.:—

(1) On the western side of the Welcome River plain, 3 miles south-south-east of Redpa. The rock is a hard, pink limestone, horizontally bedded and unconformably overlying steeply dipping beds of Cambro-Ordovician limestone and dolomite. The limestones are fairly extensive and at least 100 feet thick and appear to fringe the basalt hills. The base of the limestone beds is 135 feet above sea-level.

(2) On the eastern portion of G. Loverock's property, one mile west of Marrawah. The rock is white polyzoal limestone. There is no definite outcrop, loose pieces being present in the soil. The extent does not appear to be large and the occurrence is 250 feet above the sea.

(3) On the opposite side of the road to Mr. J. N. Nicholls' house 1½ miles west of Marrawah, Two small quarries in this locality expose a white, polyzoal limestone. The beds are 190 feet above the sea. They cannot be traced beyond the quarries, and the extent does not appear to be large.

(4) Near the south-western portion of J. N. Nicholls' property and on the adjacent property to the south. Several exposures exist in this vicinity at heights ranging from 200 to 250 feet above the sea. The lowest is an excavation at the site of a former spring and reveals a stream of water issuing from a solution channel in white limestone. At a higher level, a small quarry exposes a similar limestone, from which Mr. Nicholls' collection was obtained. On Saward's land block several shafts have been sunk in attempting to obtain a water supply. The material on the dump of the last to be sunk consists of white weathered limestone and brownish mudstones.

The fossils obtained by the writer, together with a private collection loaned by Mr. J. N. Nicholls of Marrawah, were submitted to Mr. F. Chapman, Commonwealth Palaeontologist, in 1932, whose determinations and report are given in the appendix at the end of this report. Mr. Chapman's conclusions were that the age of the limestone was Lower Miocene.

CONCLUSIONS

Tertiary marine sedimentary rocks have been discovered at numerous places on the north and west coasts of the far north-western districts of the State. While the outcrops are not connected with one another, they represent in some districts the remnants of beds that were once more extensive, and indicate considerable transgressions of the Tertiary sea in such districts. The beds were probably most extensive in the Marrawah - Cape Grim - Welcome River district, though they have since been largely removed by erosion and probably also covered by later sand deposits. The greatest transgression of the sea probably occurred in this district, and extended inland to a distance of at least 7½ miles from the west coast. The rocks consist mainly of polyzoal limestones, with subordinate amounts of calcareous sandstones and brownish mudstones.

The determinations of fossils from Temma, Marrawah, and Cape Grim prove the rocks to be of Lower Tertiary age, and that they can be correlated with the Table Cape beds further to the east. The latest determination (by Mr. F. Chapman) indicates a Lower Miocene age.

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Appendix

Report on a Collection of Fossils from Marrawah, Smithton

(Received from the Tasmanian Mines Department on 20th December, 1932)

By F. CHAPMAN, F.L.S., Commonwealth Palaeontologist

Marrawah, Tasmania		(Private Collection)
Polyzoa	*Cellepora coronopus*	Busk
	Cellepora biradiata	Waters
	Schizellozoon sp.	
Echinoderma	*Linthia* sp.	
Brachiopoda	*Magellania grandis*	(T. Woods)
	Magellania garibaldiana	Dav.
Pelecypoda	*Chlamys praecursor*	(Chapman)
	Chlamys cf. *praecursor*	(Chapman)
	Ostrea cf. *Hyotidoidea*	Tate
	Cypraea cf. *leptorhyncha*	McCoy
Pisces	*Isurus retroflexus*	Ag.

The age of these fossils is Lower Miocene.

Marrawah, Tasmania (Geol. Surv. Coll.)

Pink limestone, 3 miles S.E. of Redpa:—

Hard, pink polyzoal limestone. In this section, it consists almost entirely of polyzoal fragments set in a calcitic matrix. A few foraminifera are present, including *Textularia gibbosa, Quinqueloculina* sp., and numerous small rotalines; also echinoid plates and spines.

The age of the rock is Lower Miocene. It compares closely with the pink limestone from Mt. Gambier, South Australia, which is also Lower Miocene.

Limestones, 1½ miles S.S.E. of Green Point, Marrawah:

(*a*) Weathered, yellowish, polyzoal limestone (with foraminifera (*Carpentaria rotaliformis*), polyzoa (*Cellepora fossa*) and cidaroid plates.

(*b*) Whitish, marly, polyzoal limestone. Washings contain foraminifera, polyzoa and brachiopoda.

Foraminifera:—

Textularia carinata d'Orb.
Textularia sagittula Defr.
Lenticulina orbicularis d'Orb.
Globigerina bulloides d'Orb.
Globigerina triloba Reuss.
Globigerina cf. *inflata* d'Orb.
Carpentaria alternata Chapm. & Crespin.
Carpentaria rotaliformis Chapm. & Crespin.
Anomalina nonionoides Parr
Discorbis turbo D'Orb.
Heronallenia lingulata (Burr. & Holl.)
Cibicides refulgens (Montf.)
Cibicides ungerianus (d'Orb)
Cibicides culter (P. & J.)

Siphonina australis (Cushman)
? *Spirillina decorata* Brady
Eponides scabriculus (Chapman)
Eponides karsteni (Reuss)
Elphidium antonina (d'Orb)
Planorbulinella larvata (P. & J.) var. plana H. & E.

Anthozoa:—

Mopsea tenisoni Chapman
Mopsea sp. nov.

Polyzoa:—

Cellaria australis McG.
Schizolavella phymatopora (McG.)
Acropora gracilis (M. Edws.)
Hornera striata M. Edws.
Idmonea trigona McG.
Idmonea incurva McG.
Lichenopora sp.

Brachiopoda:—

Murravia triangularis

The age of these two limestones is Lower Miocene.

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On a Remnant of a Stripped Peneplain of Palaeozoic Age at Mount Sedgwick in Western Tasmania

By

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(Read 11th November, 1940)

PLATE V

It is well established (Nye and Blake, 1938, pp. 22, 42) that a peneplain existed over much of Tasmania at the beginning of the Permo-Carboniferous sedimentation. Beds of Permo-Carboniferous and Trias-Jura sediments were laid down on this surface, and, apart from tilting, retain their original horizontal relations. At, or near, the close of the Trias-Jura sedimentation, the intrusion of a dolerite magma occurred on a widespread scale, forming huge dykes and sills. The sills were confined to the horizontally bedded strata, or to the plane of weakness at their base where they rested on the surface of the peneplain.

It is not known whether this peneplain extended to Western Tasmania, or whether it gave place to an irregular erosion surface in that region. The distribution of the Permo-Carboniferous rocks (see below) makes it clear that, even in the latter case, the irregularities of the erosion surface were nothing like as great as those existing to-day. This view is implicit in the opinion of Loftus Hills (1914, p. 25) that at one period ' the central plateau was practically continuous with the West Coast Range, which did not then exist as a separate mountain range '.

THE STRIPPED PENEPLAIN

At Mount Sedgwick, in the West Coast Range, there occurs a small plateau which appears to be an uncovered portion of this old peneplain. Mount Sedgwick, which is about 4000 feet high, is the highest peak of the West Coast Range in this part of Tasmania (Table I). The summit consists of a pyramidal hill of columnar dolerite, about 300 feet thick (1), portion of an originally thicker and more extensive sill or laccolith. The base of this sill or laccolith is practically horizontal (Plate V, fig. 1), and it lies on a flat surface composed of quartz-felspar-porphyry (Devonian age), West Coast Range Conglomerate (Silurian age),

(1) T. B. Moore (1894) gives the thickness of the dolerite as 800 to 1000 feet, but this is an exaggeration, and is contradicted by his further statement (p. 148) that he discovered a bed of glacial conglomerate containing coal measure (Permo-Carboniferous) fossils ' at an elevation of 3500 feet above sea-level, adjoining the greenstone on the south-east side of the mount.'

and possibly a small remnant of Permo-Carboniferous sandstone (2) at its north-east margin. The dolerite was, therefore, intruded practically between the base of the Permo-Carboniferous at this locality and the Palaeozoic erosion surface.

This surface continues as a small, relatively flat plateau, where it emerges from beneath the dolerite (Plate V, fig. 2). It has been scored by the Pleistocene glaciers, which carved hanging valleys in its margins (Plate V, figs. 1 and 3), and left channels now occupied by lakes. There seems little doubt, therefore, that this plateau, which forms the 'pedestal' on which the dolerite cap of Mount Sedgwick rests, is portion of a stripped peneplain, or of an erosion surface contiguous with the pre-Permo-Carboniferous peneplain that existed in other parts of Tasmania. Some conception of its extent can be obtained from the aerial view of it shown in Plate V, fig. 1. The dolerite summit of Mount Sedgwick appears on the right, and the dolerite-capped peaks of the Eldon Range show in the centre background. The photo is reproduced by the courtesy of Messrs. Nankivell, of Queenstown.

The surface of this uncovered erosion surface stands at about 3700 feet above sea level (3), and is not greatly lower that the present summits of the other mountains of the southern end of the West Coast Range (Table 1).

TABLE 1

Mountain.	*Height above Sea-level.*	*Source.*
	Feet.	
Sedgwick	4000	Blake
Tyndall	3875	Moore (1893)
Giekie	3950	Moore (1893)
Jukes	3790	Loftus Hills (1914)
Sorell	3730	Loftus Hills (1914)
Owen	3600	Loftus Hills (1914)
	3800	Gregory (1904)
Darwin	3340	Loftus Hills (1914)
Huxley	3200	Blake
Lyell	3050	Gregory (1904)

If its level is assumed to represent the general level of the erosion surface or peneplain in this region, then it is apparent that several of the present mountains formed monadnocks rising several hundred feet above the level of the peneplain.

POST-PALAEOZOIC FAULTING

Similar monadnocks also occurred further to the west, because granite pebbles, presumably derived from the Heemskirk massif, have been found near Zeehan in a tillite which is regarded as belonging to the basal stage of the Permo-Carboniferous (Twelvetrees and Ward, 1910, pp. 9, 42). Mount Heemskirk (2700 feet) and Mount Zeehan (2500 feet) stand considerably higher than this tillite, and presumably they stood still higher at the beginning of the Permo-Carboniferous.

(2) Fossiliferous sandstones containing casts of *Spirifer* and *Aviculopecten* have been collected from this point by Mr. W. Morris of the Survey Staff of the Lyell Comstock Mine.

(3) T. B. Moore (*loc. cit.*, p. 147) refers to Mounts Tyndall and Sedgwick as rising '1500 to 1600 feet above an elevated plateau, on which are situated Lake Dora and numerous other lakes and tarns at an altitude of 2400 feet above sea-level.' R. M. Johnston (*Proc. Roy. Soc. Tas.*, 1893, p. 100) also refers to 'the 2182 to 2400 feet plateau at their bases' (i.e., bases of Mounts Tyndall and Sedgwick). This plateau is not to be confused with the small peneplain remnant which is *part* of Mount Sedgwick.

Both they and the tillite are, however, much lower than the stripped erosion surface at Mount Sedgwick, which was also capped by Permo-Carboniferous rocks, so that one is forced to postulate either post-Palaeozic faulting between these two sets of monadnocks, or that the post-Devonian erosion surface was as irregular as the present-day surface.

Another line of evidence suggests that the former postulate is the correct one. Thus, Voisey (1938, p. 322) places the fossiliferous marine Permo-Carboniferous (Kamilaroi) beds between Malanna and Strahan, and along the northern side of the Henty River, in his Achilles Stage, which in this area is characterized by *Fenestella* and *Spirifer*, while in the Pelion district, where it occurs at a much greater altitude, it is characterized by *Fenestella*, *Spirifer*, and *Aviculopecten*. In view of the reported occurrence of *Spirifer* and *Aviculopecten* in the Permo-Carboniferous remnant at the north-east edge of the dolerite cap of Mount Sedgwick, it seems possible that the lowermost beds of the Permo-Carboniferous at this locality also belonged to the Achilles Stage; and since there is a difference in elevation of about 3000 feet between this locality and that of the Strahan-Malanna-Henty River localities, there is a suggestion (*a*) that these two localities were at more or less similar elevations at the beginning of the Permo-Carboniferous period, and (*b*) that the more westerly part of the region was faulted down in post-Palaeozoic times. Nye and Blake (1938, p. 21) suggest that such a fault, with a throw of the order of 2000 to 3000 feet, runs parallel to and west of the West Coast Range (presumably some miles to the west), and continues as far as the north coast.

In view of the dolerite cap on Mount Sedgwick, it is presumed that such faulting did not occur until after the close of the Mesozoic.

Relation to the Western Coastal Plain

This remnant of the Palaeozoic peneplain (erosion surface) stands at more than 1500 feet above the erosion surface which Gregory (1903, p. 179) termed the Henty peneplain, and which is now called the Western Coastal Plain (Nye and Blake, 1938, p. 4), and is regarded as having been formed during the Pliocene. The Coastal Plain is now considerably dissected as the result of rejuvenated stream action associated with changes of sea-level during the Pleistocene and Recent.

The difference in elevation between the West Coast Range and the Coastal Plain is not, however, directly due to the Tertiary faulting described above, nor as Loftus Hills (1914, p. 24) has pointed out, is it in any way connected with post-glacial uplift of the region.

The elevation of the West Coast Range conglomerates to their present position relative to the Queen River sandstones and shales in which the coastal plain is cut is thought to be due to Devonian (?) faulting, prior to the peneplanation of the area (Gregory, 1905; Edwards, 1939); and there is nothing to indicate that there has been any later fault movement. Differential erosion during the Tertiary has 'exhumed' this Palaeozoic fault line, so that the scarp which delimits the western side of the West Coast Range (Plate V, fig. 4) is probably a fault-line scarp. The eastern face of the range appears to be simply an erosion scarp; and some possibility exists that this may be true of the western scarp also, since the Queen River series may prove to be of Upper Ordovician, rather than Silurian, age (Hills and Edwards, 1941), in which case much of the evidence for the fault disappears.

Either view of the origin of the West Coast Range supports the contention of Loftus Hills (1914, p. 25) that the King River is an antecedent stream which developed on the surface of the post-Devonian sediments, and subsequently was superimposed on the West Coast Range conglomerates; and that the wide alluvial flats that mark its course at the Long Marsh are caused by the slowing up of the river where it enters its gorge tract between Mount Huxley and Mount Jukes.

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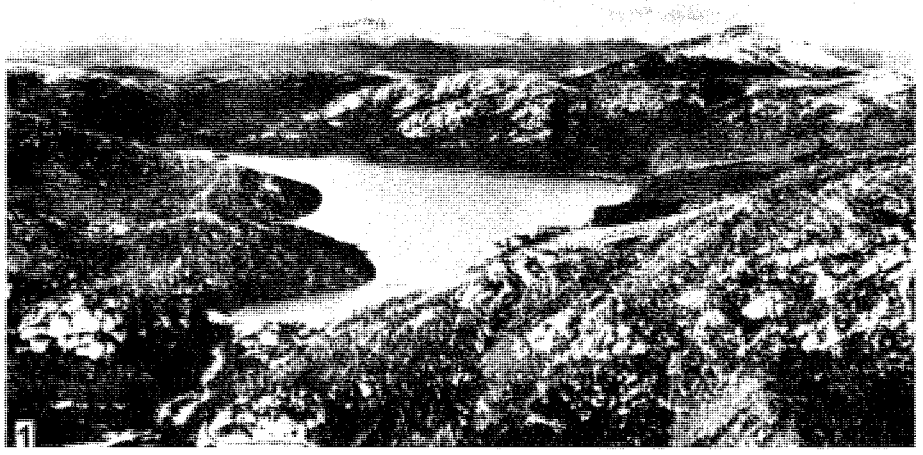
PLATE V

FIGURE 1.—Aerial view of Lake Margaret, showing the dolerite cap of Mount Sedgwick (on the right) resting on the surface of the Palaeozoic peneplain. Lake Margaret occupies a hanging valley eroded in this peneplain remnant. The dolerite-capped peaks of the Eldon Range show in the centre background. (T. F. Nankivell photo.)

FIGURE 2.—Showing the flat surface of the stripped peneplain remnant where it emerges from beneath the dolerite cap of Mount Sedgwick (eastern side).

FIGURE 3.—A U-shaped hanging valley on the eastern margin of the peneplain remnant.

FIGURE 4.—View of the southern end of the West Coast Range from the Lake Margaret haulage, showing the 'exhumed' fault-line scarp which delimits the western side of the range from the eastern margin of the Western Coastal Plain (dark foreground).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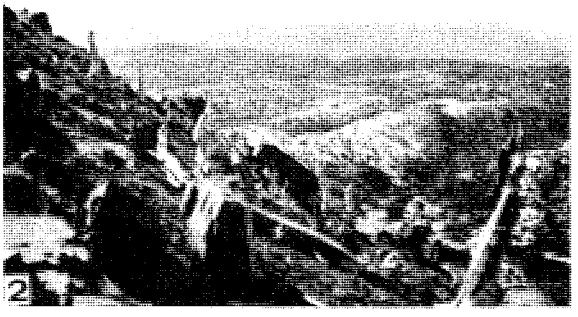
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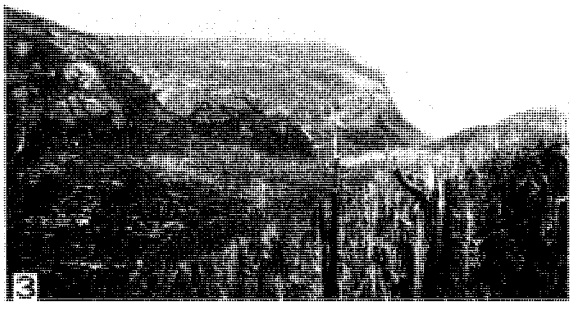
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