

S.P.L. 308

LYELL E.Z. EXPLORATIONS

Queenstown

Report on

COMMENTS ON THE CAINOZOIC HISTORY OF WEST TASMANIA

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REPORT ON COMMENTS ON THE
CAINOZOIC HISTORY OF WEST TAS.
LYELL EZ OPERATIONS

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Comments on the Cainozoic
History of W. Tas

N.S.E. 12/9/59

Report N° G.103

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18th September, 9

To: Mr. G.F. Hudspeth

Attached is a summary report of the information relating
to the Cainozoic of S.W. Tasmania.


Chief Geologist, L.E.E.

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5th August,

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COMMENTS ON THE CAINOZOIC HISTORY OF WEST TASMANIAINTRODUCTION

During the regional mapping campaign of S.W. Tasmania recently carried out by personnel of Lyell-E.Z. Explorations¹, a series of unconsolidated sands and gravels, with bands of clay and lignite, were found to extend from Macquarie Harbour and southwards to cover an area of approximately 225 square miles. These sediments were demonstrated to be masking areas which would contain rocks belonging to the Dundas Group and Owen Conglomerate, of Lower Palaeozoic age. As these older rocks form the host for many of the sulphide deposits which are found on the West Coast, such as at Rosebery and Queenstown, it became necessary to examine these younger rocks in some detail in order to understand their broad outlines of lithology and thickness. As this work progressed, a study was also made of the various levels, or surfaces, to be seen within, and beyond, these unconsolidated sediments.

PREVIOUS WORK

The first observations relating to these sediments were made by Lempriere (1954) who was Commissariat Officer for the period 1835-1839 on the convict settlement which had been established on Settlement Island in Macquarie Harbour. His observations relate to the poor nature of the soil in the area, and the lignite at Coal Head. Later workers in C. Gould (1862), R.M. Johnston (1888, 1890, 1894), T.B. Moore (1894, 1895), A. Montgomery (1894), C.L. Hills (1914), S.W. Carey (1950) and J. Bradley (1954) make reference to these sediments on the east shore of the Harbour. Hills (op. cit.) refers to a thickness of about 100 feet of horizontal beds of clays, sandstones, mudstones and lignites at Kelly Basin, in the S.E. corner of the Harbour. Further to the north, A. Montgomery (1890), R.M. Johnston (1892) and J.W. Gregory (1904) noted the presence of clays and lignites in the lower Henty River area and David (1926) records the presence of lignitic shales and sandstone from the same area. Most recently, Banks and Ahmad (1959)

1. Lyell-E.Z. Explorations - the exploration branch of Mt. Lyell Mining & Railway Co. Ltd. and the Electrolytic Zinc Co. of A'asia Ltd.

have presented a detailed account of the lithology and structure of these sediments in this Henty area. South of Macquarie Harbour the only reference to these sediments is by F. Blake (1936) in his report on the Wanderer River area.

During the last two summers sections were measured by R.G. Elms at the Little Colin River (Locality L) and Moore's Valley (Locality M, Figure 2), by P. Rodda at the Spero River and Moore's Valley, and by B. Scott elsewhere. Apart from these localised studies work of a general nature was carried out by way of helicopter reconnaissance and the examination of aerial photographs.

AGE OF DEPOSITS

Particles of Owen Conglomerate (Ordovician) are common throughout the sediments with particles of sandstones of the Eldon Group (Silurian) being less abundant. In the lower Henty River area, Gregory (1904) and Banks and Ahmad (1959) recorded the presence of particles of dolerite (lower Jurassic) and Permian sandstone and conglomerate. In 1892, Johnston recorded the presence of a Fagus close to F. cunninghami and an Acacia close to A. melanoxylon from the lignites of the latter area. From this same area, Banks and Ahmad (1959) report the presence of seeds and seed cases on cones of Banksia marginata which also bear a close resemblance to the seed cases of forms still living in the area. According to Banks and Ahmad (op. cit.) on this basis the beds in the lower Henty area would best be considered as Upper Cainozoic.

E.D. Gill (personal communication, 1959) collected specimens from two carbonaceous horizons which are present in the cliff near the customs house at Strahan. The fossil determinations were the work of Dr. Isabel Cookson and her colleagues of the National Museum of Victoria. Near the road level there is a carbonaceous horizon containing Triorites Harrisii, Nothofagus (abundant), Dacrydium; Acacia, grasses and herbs are absent. About fifty feet above this is another carbonaceous horizon containing Triorites Harrisii (not abundant), Dacrydium (more abundant), Acacia, herbs and grasses are present. The lower horizon is considered to be Tertiary in age. In view of the similar ecology, and the site being the same, it is probably significant that Acacia, grasses and herbs are absent although present at the higher level. This higher band is Pliocene or Quaternary in age. Acacia is not known in beds older than Pliocene, the herbs and grasses are indicative of an Upper Cainozoic age. Considering the fossils, the

stratification, and the ecology, Gill (~~op. cit.~~) places the more likely age as Pliocene.

In summary the sediments in the Strahan area and northwards to the Henty River can be considered as being Upper Cainozoic in age, probably belonging to the Pliocene period. These sediments have in the past been called Macquarie Harbour Leaf Beds (Johnston, 1890), Macquarie Harbour Group (Carey, 1950), Macquarie Beds (Bradley, 1954) and Macquarie Harbour Beds (Banks and Ahmad, 1959). It is suggested that the term Macquarie Harbour Group is retained and it is defined as that Group of unconsolidated sands and gravels with shale and lignite bands unconformably overlying the Dundas and Junee Groups. It is several hundred feet/^{thick}and Upper Cainozoic in age, probably Pliocene. It is named after Macquarie Harbour on the west coast of Tasmania where the type area occurs. The co-ordinates of this area are (Zone 7 Grid) 810,000N, 340,000E (Strahan) for the unconsolidated sands and gravels and 788,000N, 351,000E for the shales and lignite (Braddon Cliff).

DEPOSITS

It will be convenient to describe the deposits exposed from Macquarie Harbour southwards to Moore's Valley. To arrive at some overall coverage a description of the Cainozoic sediments at the lower Henty River is also included. The description is from the recent paper by Banks and Ahmad (1959).

1. Lower Henty Area, Section from Govt. Railway cuttings between Malarna and the Henty River (Locality A on Figure 2)

"The Cainozoic deposits exposed in the railway cuttings consist of more or less unconsolidated rocks, with gravels, cross bedded sands, clays and lignites being represented. The gravels are commonly bedded and the boulders in them are mainly sub-rounded. No striated pebbles were found although they were looked for. The rock fragments consist mainly of Permian sandstone, siltstone or granule conglomerate, dolerite, Owen Conglomerate, quartz and quartzite and more rarely fragments of clay or clayey sand or lignite. Some of these boulders are now deeply weathered."

"It is also significant that the rock types present are all potentially of local derivation and could all come from within three miles to the east. The matrix of the gravels is predominantly sandy and they contain little clay." Banks and Ahmad (~~op. cit.~~) also note that the sands are cross bedded.

2. Macquarie Harbour (Localities B to F on Figure 2)

The Cainozoic sediments are well exposed in the cliffs of the NE shore of Macquarie Harbour. These unconsolidated sediments form cliffs of up to 200 ft. high and were graphically described by Moore (1894) as forming "a formidable wall of consolidated sand and mud".

In contrast to the sediments to the south of the Harbour, these sections contain two distinct sedimentary types, one distinguished by a predominance of sands and gravels (arenaceous) and the other by a predominance of shales and mudstones with thin bands of low rank coal (lutaceous). Analyses of these coals, and associated pyritic mudstones is shown in Table II. The lutaceous type is exposed in the cliff sections at Braddon Cliff (E) and Coal Head (D). Above and below these sections a regional dip of 5° to 10° to the NW exposes arenaceous sediments at Sophia Bay (B) and Neilson's Cliff (C), and Farm Cove (F) and Clarks Bay (G) respectively. These sediments are identical in most respects to the lignitic clay/sand/gravel noted south of Macquarie Harbour but with a maximum size range of only up to the cobble gravel grade¹. Particles of Owen Conglomerate and Precambrian siliceous sediments (quartz-mica schists and metaquartzite) predominate but north of Coal Head, that is in the upper group of arenaceous beds, particles of granite and rocks of the Dundas Group are relatively common. The colour of these sediments varies from cream to yellow, some of those iron stained sands containing sufficient iron hydroxides to form a cement. The particles are generally rounded; current bedding and gulleying are common, with angular unconformities of up to 25 degrees. The cement bedding direction varies from horizon to horizon in the sequence, giving both a northerly and southerly trend. The upper arenaceous beds are exposed at Neilson's Cliff (C) in a section showing 90 feet of sand and gravel, the low cliffs in Sophia Bay (B) show the same type of sedimentation, as do the sections at Strahan. The lower arenaceous beds are exposed in the cliff at Clarks Bay and show 75 feet of sand/gravel, at Farm Cove a cliff 54 feet high shows an identical sequence but with a 4 feet band of lignitic shale interbedded in the sand.

The lutaceous beds consist essentially of a thickness of sands and brown shales with minor clay bands. Lignitic bands are relatively common and thin seams of low grade coal and pyritic mudstones are also conspicuous (Table I). The sections at Braddon Cliff (E) and Coal Head (D), which are

1. Grain sizes follow Pettijohn (1957), p. 20.

2½ miles apart, appear to correlate reasonably well but between them, at Phillip Island and on the shore immediately to the north-east, the proportion of sand is higher than that at Localities E and D. Assuming that the shale beds were once continuous between Braddon Cliff and Coal Head, this emplacement of the arenaceous lens may well represent erosion, and later infilling, by an old river course. An example of this type of structure in the upper arenaceous beds can be seen at Sophia Bay.

The top of the lutaceous beds is present in the cliff near Coal Head (D). Its contact with overlying arenaceous beds appears to be conformable, via a transitional unit 38 feet thick consisting of rapidly alternating layers of sand and brown shale/lignitic shale, each layer less than one inch in thickness.

Thickness of Cainozoic Sediments on Macquarie Harbour

Neither the base nor the top of the sequence has been seen. As has already been stated, the top of the lutaceous beds has been seen at Coal Head, with a measured thickness of 71 feet. Using these measured sequences the following thickness are obtained:

Measured Thickness of Cainozoic Sediments - Macquarie Harbour

Northwest - Top

Upper arenaceous group	At least 90 feet . . .	Neilson's Cliff (C)
Lutaceous group	71 feet . . .	Coal Head (D)
Lower arenaceous group	78 feet . . .	Clarks Bay (G)

Southeast - Bottom

A vertical bore drilled by the Tasmanian Department of Mines is summarised in Table III. The exact location of the collar is not known but from the description it would have been in the near vicinity of Braddon Cliff (E). Assuming a regional dip of 5° to the northwest and that the hole stayed vertical, the base of the lutaceous beds was located at a depth of 87 feet, after which the hole continued in 481 feet of the lower arenaceous beds. Using this result with that of the field observations, the minimum thickness of the lutaceous beds can be taken as 158 feet.

Minimum Thickness of Cainozoic Sediments - Macquarie Harbour

Northwest - Top

Upper arenaceous group	90 feet
Lutaceous group	158 feet
Lower arenaceous group	<u>481 feet</u>
	730 feet (to nearest 10 feet)

It is interesting to note that of this thickness of 730 feet, approximately 560 feet is below the present sea level.

3. Eastern Margin - D'Aguilar Range & Mt. Sorell (Localities I & H)

The sediments immediately to the west of these two localities are poorly exposed and there has not been the opportunity for the measurement of a section.

Lithologically, the sediments are boulder gravels with particles of Owen Conglomerate up to 3 to 4 feet in size, in an unconsolidated matrix of sand. Structurally, these friable sediments are faulted against the Owen Conglomerate to the east, a rock noted for its hardness and durability. However, the Cainozoic sediments near the D'Aguilar Range form a prominent cliff 100 to 200 feet higher than the flat Henty surface which has been cut into the western flank of the mountain range here (see Figure 3). This cliff and associated surface, which is also present at the south end of Mt. Sorell is rapidly being removed by erosion.

4. Birch Inlet (Locality J)

The sediments at the south end of Birch Inlet consist of pebble/cobble gravels and sands. Particles of the Owen Conglomerate and Precambrian are common, but sandstone pebbles derived from the Eldon Group also occur. Particles of the Dundas Group are not apparent.

5. Spero River (Locality K)

The sediments contain a similar series of gravels, sands and clays as seen elsewhere in the area, with a maximum size range into the boulder grade (+10"). Again the particles are predominantly siliceous and consist of Owen Conglomerate and Precambrian metaquartzites and quartz-mica schists. The measured sequences show a rapid variation in character as they are traced northwards from the Spero River. This change is expressed in the wedging out to the north of the sand grade and a concomitant increase in the gravel. Westwards there appears to be a reverse in this trend. Two other examples of this rapid horizontal variation in the character of the sediments here are the appearance of a band of lignitic clay 4 feet thick over two sections 70 yards apart and the thickening of a sand unit from 12 inches to double this thickness with a 3" band of pebble gravel over two sections six feet apart. All units show marked current bedding and gulleying, with angular unconformities of up to 13 degrees.

These observations all reflect unsettled conditions of deposition and it is considered that this may be due to movement during deposition on the western boundary fault of the basin of accumulation (Figure 2) which is placed as only approximately 900 yards west of this locality. Immediately to the west of this boundary, the base of the Cainozoic sequence, resting on the Dundas Group, can be seen in the Spero River. This base is several hundred feet above sea-level.

6. Little Colin River (Locality L)

The generalised sequence at the Little Colin River has been built up from a study of three sections. The succession resembles that seen elsewhere, sands, pebble and cobble gravels consisting of particles of Precambrian metaquartzites and quartz-mica schist and of Owen Conglomerate. Particles of chert and shale also occasionally occur.

The column of 248 feet can be broadly divided into 5 stages, of which only the middle three are fully represented. Each stage is characterised by a decrease in grain size from bottom to top, from cobble and pebble gravels (plus 2") to pebble gravels (less than 2") and sands. There is also some evidence to suggest that the degree of sorting improves with decreasing grain size.

7. Moore's Valley (Locality M)

The generalised sequence here has been built up from a study of three different sections. The succession is similar to those already described and consists of a series of sands, pebble and cobble gravels with lignitic clay bands which dip 5° to 10° to the north. In contrast, these sediments occasionally contain appreciable (up to 50%) quantities of detritus from the Dundas Group, particularly towards the base of the measured sequence. Otherwise the particles consist of Owen Conglomerate, quartz-mica schist and metaquartzite. Usually the gravels have a sand matrix with less amounts of clay particles. However, occasionally the matrix is mainly clay. Cementing of some of the sands by iron hydroxide is still taking place.

In one of the measured sequences, of 235 feet, six cycles or parts of cycles, can be distinguished. A cycle typically follows the pattern already outlined at the Little Colin River locality except that the top unit is sometimes a thin band of lignitic clay up to 2 feet in thickness. A complete cycle would be about 40 feet thick.

An investigation of the detrital minerals in the sediments established the obvious abundance of quartz, with muscovite. Rutile, hematite, topaz, zircon, kyanite and biotite were also identified, magnetite and chromite were not seen.

A minimum thickness of 425 feet has been measured with an unknown thickness removed from the top and an unknown thickness below the base of the measured column. Geophysical results indicate a thickness of 300 to 400 feet below the present valley floor but this figure cannot be directly added to that of 425 feet. A minimum thickness of 600 to 700 feet is indicated, the base of which is at an elevation of approximately 100 feet below sea-level.

BASIN OF DEPOSITION

Figure 2 shows that the borders of the Macquarie Basin¹ are primarily limited by fault planes. Those to the east and north-east are readily apparent, those to the south are based on geological and geophysical evidence but the western boundary fault running through Birch Inlet is primarily located on the results of an airborne magnetic survey. The boundary to the north-west is now covered by Macquarie Harbour but the lack of correlation between the geological features on either side of the Harbour strongly suggest the presence of a substantial fault running through this area. Some information as to its more precise location can perhaps be arrived at by contouring the soundings in the Harbour². The isobaths show that the bottom of the Harbour is 'V' shaped with the depths of plus 90 feet located in its centre and running northwesterly, towards Sophia Point (Locality B on Figure 2), and then north-north-westerly towards Strahan, this is the trace marked on Figure 2 as the location of the boundary fault here. The vertical throw on these boundary faults is not known although it must obviously have been considerable. One of these faults near Strahan brings the Dundas Group (Upper and Middle Cambrian) against quartzites of the Eldon Group (Silurian) but a reasonable estimate based on stratigraphic thicknesses involved is not possible owing to the possible wedging out of sediments (particularly the Owen Conglomerate of Ordovician age) in this area. However, a conservative

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1. The term Macquarie Basin is used as a general term to signify the general locality of deposition.
 2. It is interesting to note from these isobaths that a relative drop in the water level of 25 feet would isolate the Harbour from the Ocean and deplete its extent by approximately 25%. A relative drop of 100 feet would reduce the Harbour into two small, shallow (20-70 ft. deep) isolated lakes.

estimate would be several hundred feet, possibly over a thousand feet.

From the descriptions given of the Cainozoic sediments, they are not a typically marine series and the presence of lignite/coal bands indicates that these bands at least can be ascribed to formation in a paludal environment. When it is considered that the Basin now borders the open ocean it is difficult to visualise what prevented a marine invasion into this area.

In summary then, the Cainozoic sediments are believed to have been deposited into a faulted basin, resembling a rift valley. The thickness of these sediments on the north-east shore of Macquarie Harbour is at least 730 feet, 560 of which is below the present sea-level. At Moore's Valley, there is good evidence for a similar minimum thickness but only with approximately 100 feet of these sediments below the present sea-level. At neither of these localities has the top of the Cainozoic sediments been recognised and, once inside the graben structure, only at Moore's Valley (and this is on the basis of apparent resistivity surveys) is there a definite suggestion of the base of these sediments. The abundance of particles of Precambrian and Owen Conglomerate (Ordovician) and the comparative absence of particles of the Dundas Group (Cambrian) can be explained in two premises. Firstly, on the relative durability of each type, with the lavas and shales etc. of the latter Group rapidly breaking up on weathering and transportation, and secondly on the assumption that the land to the east of the basin was higher than that to the west and that, as a consequence, most of the debris for sedimentation came from this former direction. As the stratigraphy to the east is primarily of Precambrian and Owen Conglomerate rocks, the absence of particles belonging to the Dundas Group is not surprising. Continued movement on the boundary faults during deposition is suggested and the unsettled conditions of deposition at the Spero River locality which is close to the western boundary fault appears to support this contention. The cyclic nature of the gravel/sand/lignitic clay could also be related to this movement.

LEVELS WITHIN AND BEYOND THE BASIN

When the Macquarie Basin is viewed from the Harbour, one of the most striking points of interest is the various levels which are developed in the Cainozoic and associated Lower Palaeozoic sediments. These levels are very well developed in the former sediments at the south end of Birch Inlet but the most striking example is the 900 and 1250 feet level which has been cut into

the Owen Conglomerate on the western sides of the D'Aguilar and Mt. Sorell Ranges respectively (Figure 3). The heights of these various levels are summarised in Table IV.

Considering those to the south of the Harbour first of all, the level of 800 feet is considered to represent the general level of the Henty surface¹ of Gregory (1903) with the lower levels developed along the river valleys which have cut into this surface (Figure 3). At the D'Aguilar Range, it rises to 900 feet and gently slopes to the west at an average rate of 80 feet to the mile, to within about one mile of the sea coast. Its grade then steepens and it typically appears at the coast as cliffs up to 100 feet in height, such as at High Rocky Point, forming a rugged shore line. The surface also appears to be gently sloping to the south and the effect of this is readily apparent in the more hospitable coastline south of the Wanderer River, and especially so south of Low Rocky Point, where wide sandy beaches, with an absence of cliffs, are apparent. The plain can be seen continuing southwards towards Port Davey as a narrow coastal strip which rises inland towards the Lawson and De Witt Ranges.

The surface is gently undulating with low monadnocks of Precambrian, such as Elliott Hill, Owen Conglomerate (Ordovician) at Mt. Osmund and of the Dundas Group (Cambrian) at Wart Hill. On a broader scale the West Coast, D'Aguilar and Lewis Ranges also appear to be monadnocks rising 2,500 to 3,500 feet. It is interesting to note that whilst the D'Aguilar Range is the direct southerly continuation of the West Coast Range, south of the Wanderer River this feature has been reduced to the Henty surface level and forms the area known as Tabletop. The only remnant of what must have been its former grandeur and ruggedness in this locality is the monadnock of Mt. Osmund, a low round hill rising to 1,210 feet.

Within the Macquarie Basin on the western flank of the D'Aguilar Range there is a localised surface in Cainozoic sediments at 1200 feet (Figure 3). This surface can be traced for several miles northwards to the Gordon

1. Gregory (1903, pl. XX) restricted his term Henty Peneplain to an area banded on the east by the West Coast Range, on the south by the King River, north by the Little Henty River and to within a few miles of the coast where his Western Peneplain commenced. However, earlier in this paper (op. cit., p.177) he describes the peneplain, which he first recognised in N.W. Tasmania, as extending in a broad band parallel to the west coast, at least from the Arthur River in the north to some distance south of Macquarie Harbour. This southerly continuation of the Henty surface is most apparent when the Macquarie Harbour area is viewed from a low flying aircraft. Thus the use of the term Henty surface beyond its original limits is considered to be justified.

River and remnants of it can be seen further to the north on the western flank of Mt. Sorell where it is at plus 1300 feet. The development of this localised surface is considered to be due to vertical movement on the Lyell Shear and Long Fault which post dates the formation of the Henty surface.

The Henty surface, and its extension, to the north of the Harbour has been adequately described elsewhere by Gregory (1903), Twelvetrees and Ward (1910), Ward (1911), Hills (1914), Waterhouse (1916) and recently by Bradley (1954), Wade and Solomon (1958) and Banks and Ahmad (1959). In the Queenstown area, the plain is at 1000 feet, rising to 1200 in the West Coast Range and falling to 5 to 600 feet above sea-level at the sea coast near Strahan at an average slope of about 50 feet per mile. It is considered to be equivalent to the Little Henty Peneplain near the Heemskirk Range which is at 700 feet (Waterhouse, 1916) and the surface described by Ward (1911) at 800 feet near Balfour in N.W. Tasmania (see also Gregory, 1903, pp. 177-178).

Banks and Ahmad (1959) describe the Henty surface at the Henty River area (Malarna) at an elevation of 720 feet (± 10 feet) above sea-level and sloping seaward at an average rate of 60 feet per mile. Associated with this is a lower, and apparently younger, surface at an elevation of 350 to 400 feet which Banks and Ahmad (op. cit.) call the Firewood Siding surface. This lower surface appears to be part of the Western Peneplain of Gregory (1903, pl. XX).

AGE OF HENTY SURFACE

Banks and Ahmad (1959), in their description of the surface in the lower Henty River area, describe its development in Permian sandstone and dolerite, the latter being presumably of lower Jurassic age. In the Macquarie Basin the surface is developed in the Cainozoic sediments and consequently must post-date the deposition of these. The age of these sediments has been given as Upper Cainozoic, probably Pliocene, thus also placing the formation of the Henty surface as post Pliocene. Since this event, the surface has been relatively uplifted several hundred feet with the result that the rejuvenated rivers have cut gorges up to 100 to 200 feet below the level of the plain with the development of knick points, incised meanders and examples of river capture. The extensive development of the local surfaces (see Table IV) of lower elevation than that of the Henty is considered to be related to this ^{relative} uplift and following erosion, their horizontal development would indicate that the uplift was not continuous but

but occurred in a cycle of a maximum and then a minimum movement. As has already been discussed on page 10, the localised surface at 1200 feet is considered to be due to vertical movement on the Lyell Shear and Long Fault which post-dated the development of the Henty surface. This higher surface is being rapidly removed by erosion in an area of high rainfall (+ 50 inches per annum). Faults disturbing the Cainozoic sediments have also been noted at Clarks Bay on Macquarie Harbour and in Moore's Valley.

RELATIONSHIP OF HENTY SURFACE TO OTHER WEST COAST SURFACES

The relative position of three of the known surfaces on the West Coast is diagrammatically shown in Figure 4. The surface at 3700 feet, at Mt. Sedgewick, is that described by Edwards (1940) as a stripped Carboniferous surface, on which Permian sediments are lying. A similar surface, in Lower Palaeozoic sediments, can be recognised further to the north at Mt. Dundas and Mt. Read. Eastwards from Mt. Sedgewick the same surface can be seen at approximately 3400 feet in the Round Hill/Pyramid Hill area, 7 miles S.E. of the Raglan Range. Here Permian sediments rest unconformably on Precambrian quartzites and schists. Also the plateau on the Raglan Range at 3450 feet is probably the same, stripped, surface. Permian sediments have also been recognised at the coast in the lower Henty River area and at Point Hibbs. The position of these sediments is at least 3500 feet lower than the Permian found in the West Coast Range and their faulted relationship with the associated Palaeozoic sediments indicates that they have been brought to this position by a post-Permian fault movement.

The 2500 feet surface (actually 2250 to 2750) is indicated by the accordance of summits recognised to the north of Queenstown as at the Norfolk Range and in the Waratah area in N.W. Tasmania, the Heemskirk Range, Mt. Zeehan and the plateau below Mts. Sedgewick and Tyndall. This surface would have been disturbed by the faulting which led to the formation of the Macquarie Harbour graben. Previous workers such as Moore (1894), Johnston (1894), Twelvetrees and Ward (1910), Ward (1911) and Waterhouse (1916) had recognised this level. Similarly Solomon (1956) recognised a 2000 feet level in the Mount Jukes-Mount Darwin area. The level of 2500 feet can be traced south of Queenstown in the height of the D'Aguilar Range, Mt. Lewis and the Lawson and De Witt Ranges, the last named Range trending towards Port Davey. These "Summits" exist as monadnocks which stand above the Henty surface.

On this basis at least three surfaces can be recognised on the West

Coast. An early one related to the Carboniferous period of planation on which Permian sediments were deposited. After uplift and block faulting with downthrow to the west, a younger surface (2500 feet surface) was carved from this older level. The last cycle of uplift and erosion was similarly accompanied by block faulting which formed the Macquarie Basin in which several hundred feet of Cainozoic sediments were deposited. This youngest surface, the Henty, is formed in these Upper Cainozoic sediments, as well as in Permian and older sediments, and is of post Pliocene age. The age of this middle surface is not at all apparent, it is later than the Carboniferous and earlier than the Upper Cainozoic surfaces since it is formed out of the former and exists as monadnocks in the latter. It is tempting to equate this 2500 feet surface with that of the St. Clair surface of David (1950, p.111) which exists over large areas on the Central Plateau of Tasmania. David (op. cit. p.118) correlates this latter surface with the Miocene peneplain of New South Wales. However, the lack of any direct evidence apart from this similarity of elevation brings to light the weakness of attempting to correlate erosion surfaces solely on this basis. This can be seen with the Carboniferous surface on the West Coast where at Mt. Sedgewick it is at 3700 feet whilst some 20 miles to the west it is below sea-level. It is axiomatic that in areas of extensive block faulting which post-date the development of such surfaces that they must be primarily correlated on the basis of the stratigraphy involved (i.e. the Carboniferous surface would be developed in Palaeozoic sediments/intrusions and covered unconformably by Permian sediments) with its elevation above sea-level being of secondary consideration.



Chief Geologist, L.E.E.

Table I

SECTION IN CAINOZOIC SEDIMENTS AT BRADDON CLIFF, MACQUARIE HARBOUR

	<u>Lutaceous Type</u>
Approx. 43 ft. to <u>TOP OF CLIFF</u>	5' sand
	12' brown shale becoming darker to top, pyritic (?)
	$\frac{1}{2}$ ' coal (at top.)
	8' brown shale with thin lignitic partings
	1' pyritic mudstone
	2' brown sandy shale
	7' brown shale with thin ($\frac{1}{4}$ ") coal partings
	$\frac{1}{2}$ ' coal
	$\frac{3}{4}$ ' brown shale
Spcm. 1 in Table II	3' coal
Spcm. 4 in Table II	1' pyritic mudstone
	2' brown shale
	1' light grey clay
<u>BOTTOM</u>	BEACH LEVEL

Table II

ANALYSES OF COAL & PYRITIC MUDSTONE FROM CAINOZOIC SEDIMENTSMACQUARIE HARBOUR

	1	2	3	4	5	6	7	8	9
Moisture	9.40	7.7	7.76				8.29		
Fixed Carbon	35.96	20.89	33.08				29.31		
Volatile	38.39	23.63	43.85				35.29		
Ash	19.06	48.33	15.87				27.75		
Total Iron				32.44	26.11	27.54		28.69	26.82
Ferrous Iron				1.53	18.26	18.97		12.92	18.61
Sulphur				0.61	7.20	4.50		4.10	5.85

- Spcm. 1 Coal from Braddon Cliff (Locality E)
 2 Coal from Coal Head (Locality D)
 3 Coal from Phillip Island
 4 Pyritic nodule from Braddon Cliff (Locality E)
 5 Pyritic nodule from Coal Head (Locality D)
 6 Pyritic nodule from Coal Head (Locality D)

- Column 7 Average of Spcms. 1 to 3
 8 Average of Spcms. 4 to 6
 9 Average of Spcms. 5 & 6

034

Table III

FARM COVE BORE, MACQUARIE HARBOUR (Locality E on Figure 2)

Commenced 11th November, 1902. Completed 23rd January, 1903.

Total Depth 571 feet.

0'	- 33'10"	Alternating bands of lignite and clay none of the bands of lignite over twelve inches. No bands of lignite below 18'1".	} Lutaceous beds
33'10"	- 88' 3"	Alternating bands of grey, dark and light shales/sandy shales.	}
88' 3"	- 180'10"	Sandstone, light and dark, very soft and friable.	} Arenaceous
180'10"	- 571' 0"	Alternating sandstones (soft and friable) with occasional lignite bands up to 5" thick.	} beds

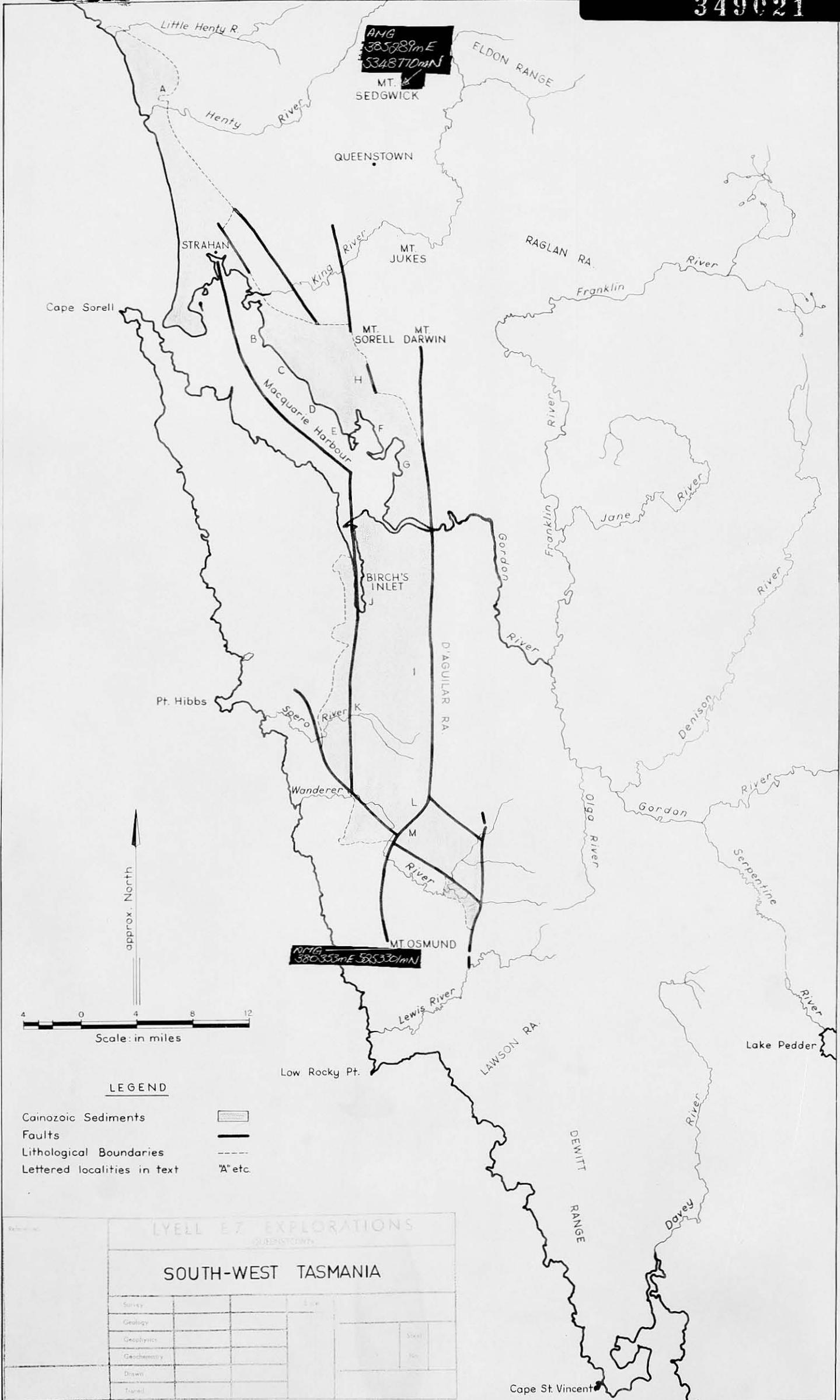
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Cape Sorell

STRAHAN

QUEENSTOWN

AMG
385831mE
5348710mN
MT. SEDGWICK

ELDON RANGE

MT. JUKES

RAGLAN RA.

MT. SORELL MT. DARWIN

Macquarie Harbour

BIRCH'S INLET

D'AGUILAR RA.

Pt. Hibbs

MT OSMUND
AMG
380353mE 525330mN

LAWSON RA.

Low Rocky Pt.

DEMITT RANGE

Lake Pedder

Cape St. Vincent

approx. North

Scale: in miles
0 4 8 12

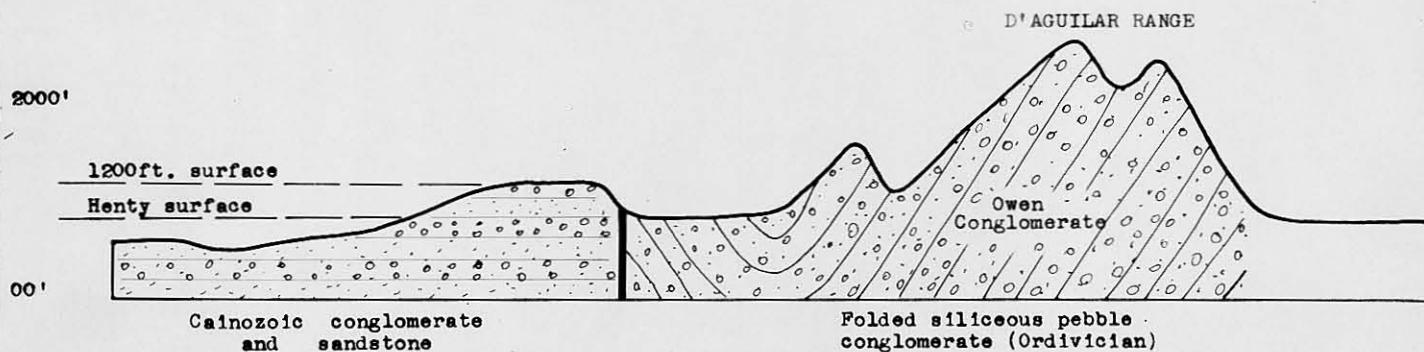
LEGEND

- Cainozoic Sediments
- Faults
- Lithological Boundaries
- Lettered localities in text "A" etc. A

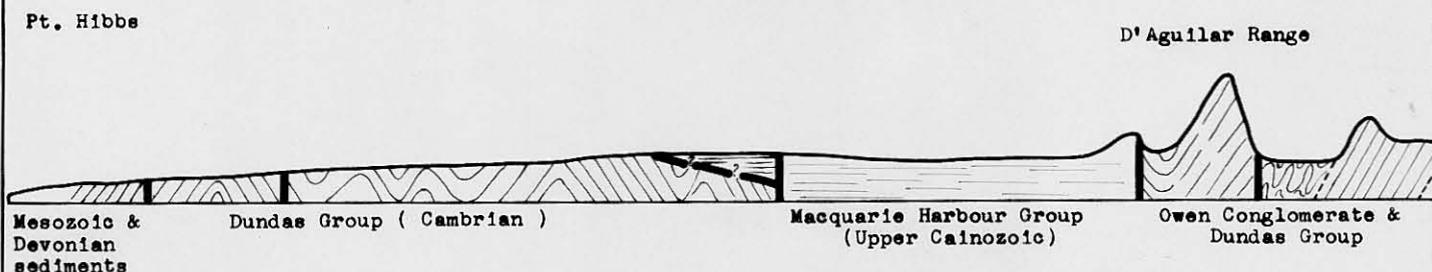
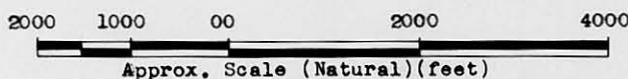
LYELL E7 EXPLORATIONS QUEENSTOWN			
SOUTH-WEST TASMANIA			
Survey		Date	
Geology			Sheet
Geophysics			No.
Geochemistry			
Drawn			
Traced			

FIG. 3

DIAGRAMATIC SECTIONS
SHOWING RELATIONSHIP OF SURFACES
TO STRUCTURE AND LITHOLOGY



Section through locality '1' on fig. 2
Looking North



Section Pt. Hibbs — locality '1' on fig. 2

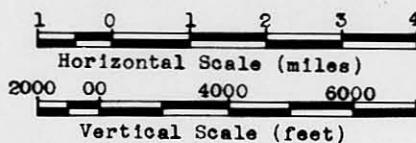
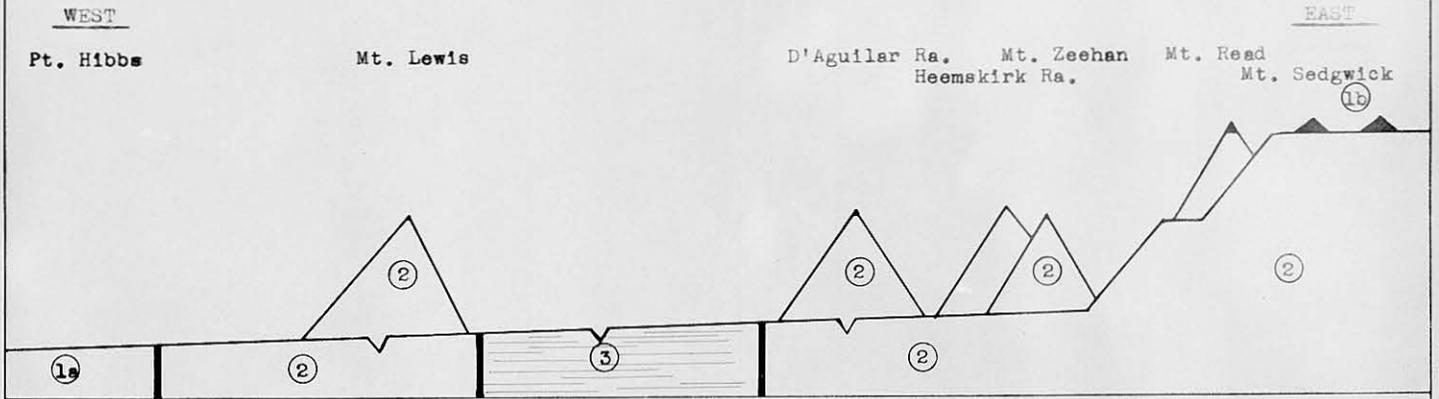


FIG. 4

DIAGRAMATIC RELATIONSHIP
OF
THREE EROSION SURFACES



- ①a Devonian, Permian sediments, Lower Jurassic(?) dolerite.
- ①b Permian, Lower Jurassic(?) dolerite.
- ② Dundas Group to Bell Shale (Cambrian to Lower Devonian?)
- ③ Macquarie Harbour Group (Upper Cainozoic)

2000 0 4000
Vertical Scale(feet)
No Horizontal Scale

5 cm
249022