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LYELL E.Z. EXPLORATIONS

Queenstown

Report on

STRUCTURAL GEOLOGY OF WESTERN TASMANIA

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Structural Geology of
Western Tasmania
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Report No. G111

February, 1960

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INTRODUCTION

Commencing in 1956, the western area of Tasmania has been investigated by an intensive mineral prospecting campaign over an area of approximately 11,000 square miles. The north-western area of about 4,000 square miles, from Queenstown to Rocky Cape (Fig. 1) has been investigated by Rio Tinto Australian Exploration Pty. Ltd., in association with the Electrolytic Zinc Co. of Australasia Ltd. The south-western area, from Queenstown to Port Davey and eastwards to Adamsfield, has been the responsibility of the Mount Lyell Mining & Railway Co. Ltd. and the Electrolytic Zinc Co. of A'asia Ltd acting through an organisation known as Lyell - E.Z. Explorations. The organisation of these explorations is reviewed in greater detail by Hall (1959, p.32).

The south-western part of Tasmania is the most inaccessible part of the island and for this reason the existing topographical and geological charts were of the sketchiest nature and often inaccurate. Consequently, the entire problem of exploration south of Macquarie Harbour had to be tackled from the first fundamentals, the provision of reasonably accurate maps. This was achieved by the aerial photography of the entire area, preparation of topographical maps and the construction of geological maps from photo interpretation and mapping at a general scale of 2000 ft. to one inch but at 400 ft. to one inch in selected localised areas. The programme also included the extensive use of airborne electromagnetic and magnetic surveys with a ground campaign of geophysics and geochemical prospecting. The general organisation and results of this work are presented elsewhere by Scott and Spooner (1960, in press). Some of the results of the geological mapping campaign are discussed in this paper.

The authors wish to acknowledge the assistance provided by other workers on the west coast of Tasmania. M.L. Wade¹ introduced the senior author to the geology of the Mt. Lyell mines at Queenstown, G. Hall² and

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TASMANIA

Scale in miles

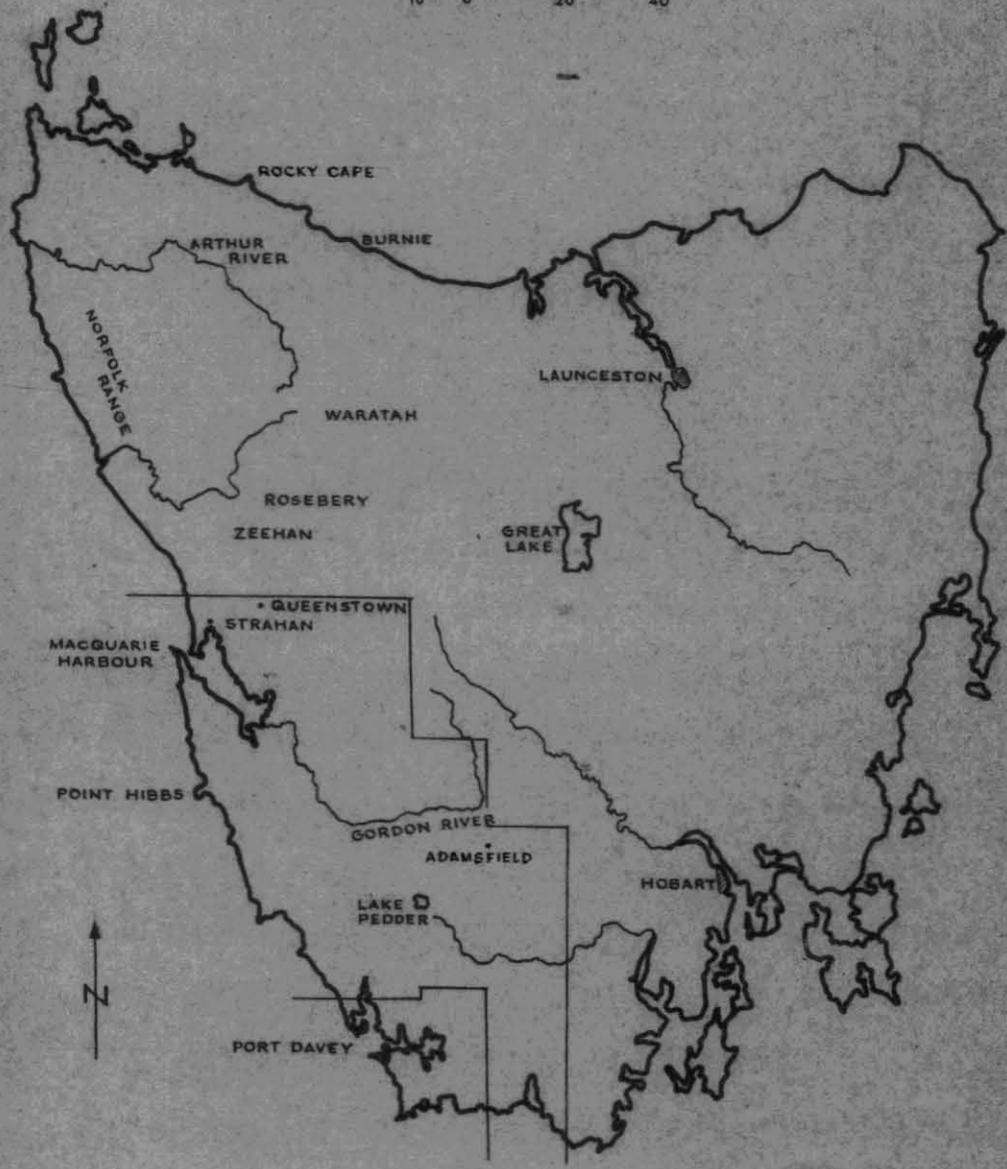
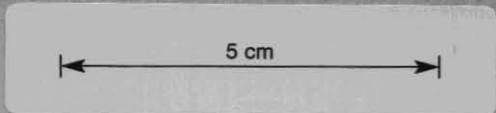


FIGURE 1



V.M. Cottle¹ of the Electrolytic Zinc Co. of A'asia Ltd. at Rosebery have provided data on the geology of the Rosebery-Williamsford-Fullah area and many stimulating discussions on the geology of Tasmania. General discussions have also been held with D. King² of the Rio Tinto Australian Exploration Pty. Ltd. at Zeehan, A. McKenzie³ of the Mt. Lyell Mining & Railway Co. Ltd. at Queenstown and M.R. Banks⁴ of the University of Tasmania. Credit is also due to H.S. Hancock⁵ of Adastra Hunting Geophysics Pty. Ltd. for his work in the interpretation of the airborne geophysical results.

PREVIOUS WORK

Carey (1953, p.1108) was the first to present an overall picture of the structural geology of the area under discussion. Previous workers in Twelvetreves (1901), Gregory (1905, p.13), Ward (1908) and Hills (1913, 1915 a and b) concentrated on the mining areas at Queenstown-Mt. Darwin and at Rosebery-Williamsford-Fullah. The geology of the latter area is again reviewed by Hall et al. (1953, p.1145) and the Queenstown zone by Alexander (1953, p.1129) and Wade and Solomon (1958, p.367). In the early part of this century a considerable amount of work was completed by the State geological survey and, including those already mentioned, during the period 1908 to 1915 thirteen bulletins were issued covering the large area bounded by Rosebery, Norfolk Range, Macquarie Harbour and Queenstown. Bradley (1954, p.193 and 1956, p.65) presents an account of the geology of the region from Mt. Farrell to Macquarie Harbour and more recently Campana et al. (1958, p.41) have presented an account of the structure of western and central Tasmania. A considerable amount of detailed information was collected by Solomon (1957) in the Macquarie Harbour-Queenstown area and submitted to the University of Tasmania as a Master of Science thesis: unfortunately a great part of this material remains unpublished.

SCOPE OF PRESENT PAPER

The present paper presents a general summary of the lithology and structure of western Tasmania and presents new information regarding these

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aspects in south-west Tasmania. This summary is essentially background information for the main topic which is the discussion of a regional north to south trending structure known as the West Coast Range Anticlinorium, and the influence of major east-west fault structures on this and other regional north to south trending structural components of western Tasmania and their relationship to the problem of ore search. The Anticlinorium is conveniently outlined by the distribution of Owen Conglomerate from Mt. Farrell in the north to Mt. Osmond in the south, a distance of 80 miles following the West Coast Range. It equates the West Coast Range Anticlinorium of Carey (1953, p.1122) from Kelly Basin (immediately south of Mt. Sorell) to Mt. Owen and that of Bradley (1956, p.67) from Mt. Sorell to Mt. Farrell. The results of the present work have allowed the extension of this structure southwards from Kelly Basin to Mt. Osmond, a distance of 36 miles.

One major east-west structure at Queenstown, the Linda Disturbance, has been already described (Bradley 1956, p.74), two others have been located and named the Eagle Creek Disturbance¹ (25 miles south of Queenstown) and the Moore's Valley Disturbance² (47 miles south of Queenstown).

GENERAL GEOLOGY

Preliminary

The succession which is summarised in Table 1 has, in recent years, been described by Gill (1948, p.57); Gill and Banks (1950, p.259); Elliston (1954, p.161); Beryl Scott (1954, p.129); Carey and Banks (1954, p.245); Banks (1956, p.165 and 1957, p.39); Campara and King (1958); Banks and Ahmad (1959, p.117) and Barry Scott (1960 a).

Stratigraphical Succession

A general geological map is shown in Figure II. The Dundas Group occurs in a major north-south trending synclinorium and rests on the underlying Precambrian of the Tynnan Block to the east and the Cape Sorell area to the west. The Owen Conglomerate, which normally overlies the Dundas Group, in some places rests directly on the Precambrian schists

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- 1. Named after Eagle Creek, an east bank tributary of the Gordon River approximately 8 miles from its mouth.
 - 2. Named after Moore's Valley, this name has recently been adopted by the Nomenclature Board of Tasmania; derived from T.B. Moore, an early explorer of the period 1880-1910.

and quartzites, always unconformably. The upper part of the Junee Group, and the Eldon Group are typically preserved in synclinalia, as at Zeehan. To the east these Palaeozoic sediments are overlain unconformably by gently dipping Permian sediments and associated dolerite intrusions.

The following account is primarily concerned with the sediments of south-west Tasmania.

Upper Cainozoic - Macquarie Harbour Beds. Unconsolidated sediments which show a cyclic sedimentation of gravels, sands and lignitic clay bands occupy an area of approximately 250 square miles, from Strahan in the north to the Wanderer River in the south. These sediments, which are masking large areas of the Dundas Group, are several hundred feet thick the greater part of which, in the northern area, is below the present sea level. They are thought to have been deposited in an ancient lake, part of which remains as Macquarie Harbour.

The age of these sediments at Strahan was determined by Dr. Isabel Cookson and her colleagues at the National Museum of Victoria, on specimens collected by E.D. Gill.

Permian - Devonian. A small area of sediments of Triassic and Devonian age has been preserved by faulting in the Pt. Hibbs peninsula. These sediments, which are richly fossiliferous, have been investigated by Banks (1958) who reports that, whilst the Permian sediments can be correlated with sediments of a similar age elsewhere in Tasmania, the Devonian sediments appear to be unique. The Permian sediments are associated with a transgressive dolerite sill of presumably lower Jurassic age. It is interesting to note that the dolerite and Permian sediments are at sea level, whilst to the east in the West Coast Range at Mt. Sedgwick sediments of a similar age are at an elevation of approximately 3700 ft.

Devonian. Several granitic intrusions occur at the south edge of the area to which particular reference is being made. The granites are coarse grained and vary from a potash rich variety (adamellite) at Low Rocky Point to practically a granodiorite to the east in the upper Lewis River. There is no direct evidence as to their age, they are certainly post Cambrian and the absence of granite particles from the nearby Owen Conglomerate would suggest a post Lower Ordovician age.

TABLE I

SUMMARY OF STRATIGRAPHY IN WESTERN TASMANIA

Fleistocene-Pliocene	MACQUARIE HARBOUR BEDS		
Lower Jurassic?	Dolerite	FAULTING	
Permian	Sediments at Point Hibbs, Tillite at Strahan(?) and Zeehan		
Lower Devonian to Silurian	ELDON GROUP.	TABBERABBERAN OROGENY	Elliott Bay granites? Ultrabasics
Ordovician	JUNEE GROUP Gordon Limestone Owen Conglomerate Jukes Breccia	JUKESIAN MVT.	Darwin Granite Ultrabasics
Middle to Upper Cambrian	DUNDAS GROUP	TYENNAN OROGENY STICHTAN MVT.	Ultrabasics
Precambrian			

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Eldon Group - Silurian. Several hundred feet, possibly several thousand feet, of interbedded shales and quartzites occur in the lower reaches of the Gordon River, in the south part of the King synclinorium, and to the east in the Franklin-Hardwood synclinorium. These sediments, which are typically marine, have not been investigated in any detail and although fossiliferous they have not been zonally collected. However, they are correlated with the Eldon Group on lithological grounds and the fact that they overlie the Gordon Limestone of the Gordon and Franklin Rivers with apparent conformity. This Group is best developed in the Zeehan synclinorium, where it is described by Gill and Banks (1950).

Junee Group - Ordovician

Gordon Limestone. The Gordon River, below its junction with the Maxwell River, flows for much of its course through limestone and a similar limestone extends for at least 25 miles along the Franklin, Olga and Hardwood Rivers in the Franklin-Hardwood Synclinorium. Also fossiliferous limestone has been reported at the south end of this structure in the Davey River area. Despite the fact that the limestone in the Gordon River area was described by Gould as early as 1862 and 1866, the general inaccessibility of the area so far has prevented detailed studies. Fossils are numerous but they have not been zonally collected; Banks (1957, p.46) presents a summary of the available information which indicates a possible age as young as Lower or even Middle Silurian for the top of the limestone in the Gordon River. The limestone is also well developed in the Zeehan synclinorium, where it has been described by Gill and Banks (1950), and in the King synclinorium (Bradley, 1954). From Zeehan, Hill (1955, p.237) considers the base of the limestone to be at least older than upper Middle Ordovician.

Owen Conglomerate. The Owen Conglomerate forms most of the peaks above 2500 on the West Coast at Mt. Lee and Mt. Discovery in the D'Aguliar Range; Mt. Sorell, Mt. Jukes, Mt. Sedgwick, Mt. Murchison, Mt. Farrell and Mt. Zeehan to the north. The Conglomerate can readily be traced some 80 miles from Mt. Farrell in the north to Mt. Osmond in the south (see Figures II and IV). This somewhat spectacular formation has received the attention of geologists for many years, the earliest descriptions being by Gould (1866) and later by Officer, Balfour and Hogg (1895) and most recently by Campara et al. (1959). The formation is usually taken to be represented

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by a pebble/cobble conglomerate with sandstone bands but with rock particle size occasionally being much larger and up to 24 inches in size. Typically the fragments are siliceous and appear to have been primarily derived from the Precambrian rocks but in some instances particles of the Dundas Group are relatively common. The base of the Conglomerate is marked by the Jukes Breccia.

Descriptions of the Conglomerate south of Macquarie Harbour have only recently appeared (Elms, 1960a). In many aspects it resembles that seen elsewhere on the West Coast but with an important difference in grain size. The conglomerates are generally subordinate to the sandstone/shale association and particles above 9 inches in size rarely occur, in particular shale forms approximately 25% of the measured sequence of plus 3000 feet. Also absent from this area are the red and deep purple tinted rocks which form such conspicuous outcrops in the north and Mt. Jukes and Mt. Sedgwick.

The Owen Conglomerate thins rapidly to the east, overlaps the underlying Dundas Group and eventually rests unconformably on the Precambrian. Also there is unconformity in some localities between the Owen Conglomerate and Dundas Group (Carey and Banks, 1954 and Barry Scott, 1960b).

The age of these sediments in Western Tasmania is not known with any degree of precision: they are older than the Gordon Limestone (Middle Ordovician) and younger than the Dundas Group (basal Upper Cambrian) and are consequently usually taken as Lower Ordovician.

Dundas Group - Cambrian. The sediments of the Dundas Group have received considerable attention in the past since with the exception of Zeehan where important lead mineralisation occurs in the Gordon Limestone, sulphide mineralisation of economic significance is restricted to this Group and the immediately overlying Owen Conglomerate. Examples of this can be seen in the mineralisation at Rosebery, ^WWilliamsford, Queenstown, Mount Farrell (Tullah) and Magnet mines which have produced a considerable tonnage of lead, zinc and copper, as summarised in Table II.

In general the Group south of Macquarie Harbour (Barry Scott, 1960c) contains the same rock types which are present at the Dundas section (Elliston, 1954, p.163); that is interbedded shales, siltstones, quartzites, greywackes, greywacke conglomerates/breccias and subordinate tuffs and basic lavas. It differs in containing notable chert bands,

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calcareous shales and thin bands of limestone or dolomite.

In some localities the Dundas Group rests unconformably on the underlying Precambrian, as at the Modder River (Carey & Banks, 1954, Barry Scott, 1960b).

The age of the Dundas Group in the general Dundas area has been given by Opik (1951, a,b,c and 1955 in Banks, 1956, p.174) as Middle and basal Upper Cambrian.

Precambrian. The Precambrian on the eastern margin of the area being described consists of metaquartzites, quartz mica and garnet mica schists. On the west side the metamorphic grade is lower although the severity of the folding appears to be the same in both localities. In this latter area calcareous beds are relatively abundant to give an association of dolomite, calcareous shales, siltstones, shales and quartzites (Barry Scott, 1960d).

The Precambrian of the eastern area has not revealed mineralisation of economic significance.

Ultrabasic Rocks: A hitherto unsuspected belt of ultrabasic rocks was located during the exploration campaign along the Precambrian/Dundas Group contact from Macquarie Harbour to Pt. Hibbs (Elms, 1960b). The belt which has not been investigated in detail, consists of a series of lenticular shaped bodies of basic and ultrabasic rocks each showing a rapid variation in mineralogical character. Structurally their position closely resembles the occurrence of the ultrabasics at Dundas, some 35 miles to the north (Elliston, 1954 and Taylor, 1955).

STRUCTURAL GEOLOGY

General Outline

The regional structure of western Tasmania is shown in Figure III¹ and its development is summarised in Table I. With the exception of the folds between Macquarie Harbour and Point Hibbs which are in the Dundas Group the fold axes in this figure are located by the distribution and attitude of sediments of the Junee and Eldon Groups. However, in common with other workers, it is considered that some of these structures which are essentially of the Tabberabberan Orogeny of Devonian age were influenced

1. Figures II and III are prepared primarily from information supplied or published by Lyell-E.Z. Explorations, Mt. Lyell M&R Co. Ltd., E.Z. Co. of A'asia Ltd., Carey (1953), Dept. of Mines, Tasmania and University of Tasmania, Geology Dept. one inch to one mile sheets 3684 and 3683.

TABLE II

RECORDED MINERAL PRODUCTION - WEST COAST MINES¹

Mine/Company	Mineralisation	Tonnage	Grade	Period	Source
Electrolytic Zinc Co. of A'asia Ltd.: Rosebery and Hercules	Zinc/lead	3,330,000 (500,000 tons also produced 1900-1930)	20% Zn 6% Pb 0.5% Cu 7 ozs. Ag/ton	Feb. 1936 - June 1957	Handbook issued by Company in 1958
Magnet Mine, Magnet	Silver/Lead	620,000	5.7% Pb 11* ozs. Ag/ton	1895-1940	Geology of Australian Ore Deposits, Vol. I, 1953
Zeehan District	Silver/Lead				
Mount Farrell Mines, Tullah.	Silver/Lead	600,000	13% Pb 10-12 ozs. Ag/ton	To 1953	Geology of Australian Ore Deposits, 1953
Mount Lyell Mining & Railway Co. Ltd., Queenstown	Copper	40,759,445	1.4% Cu 0.446 ozs. Ag/ton	1892- June 1957	Handbook issued by Company in 1958
Mount Bischoff Mine, Waratah	Tin	5,500,000	1% Sn	1893- 1953	Geology of Australian Ore Deposits, 1953
Renison Bell	Tin	4300 of concentrate (70% tin)	1% Sn	1890- 1956	Tasmanian Dept. of Mines booklet, 1957
Dundas District (Razorback)	Tin	2000 of tin	?	1890-1910	Pres. Address A.I.M.M. March 1958
Five Mile Copper/Nickel Deposit, near Renison Bell	Copper/Nickel	(a) 4038 of "ore" (b) 222 of nickel	?	(a) before 1914 (b) 1927-1938	Tasmanian Dept. of Mines booklet, 1957

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This list is not intended to be exhaustive.

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by fold directions which were the result of earlier orogenic movements (Bradley, 1956, p.66).

The unconformable relationship between the Dundas Group and Precambrian (Carey and Banks, 1954, Barry Scott, 1960b) indicates that the latter was folded, and regionally metamorphosed, at least once prior to the Middle Cambrian. The trend of the fold axes associated with this movement appears to have been about a general north-south direction. The unconformable relationship between the Dundas Group and the Owen Conglomerate (Banks, 1956 pp.204-205) and the overlap of the Conglomerate on to the Precambrian to the east indicates another orogenic movement at the close of the Cambrian period. However, this picture is complicated in that, whilst an undoubted unconformity exists between the Owen Conglomerate and the Dundas Group at several localities, as at Mt. South Darwin, further to the south in the Mt. Osmund area there is no evidence of an unconformable relationship. The Tabberabberan Orogeny of Lower to Middle Devonian age marked the final phase of folding on the West Coast, folding the great thickness of sediments which had accumulated during the Ordovician, Silurian and Lower Devonian (Junee and Eldon Groups) as well as the older sediments. Within or near the edge of the Tyennan Block the major Tabberabberan fold directions usually follow the earlier north to south trend but with subsidiary north-west folds whilst further to the west the major Tabberabberan structures trend north-west, as originally discussed by Carey (1953, p.1122). These north-west folds are evident as synclinoria which preserve the sediments of the Junee and Eldon Groups in the Zeehan and Huskisson basins. South of Macquarie Harbour there is no counterpart of this stratigraphical preservation but structurally it is considered reasonable to assume that the large north-west folds which occur in the Dundas Group between the Harbour and Point Hibbs (the Modder Synclinorium)¹ can be equated with the Zeehan and Huskisson fold structures. The major north-south structures appear as the West Coast Range Anticlinorium, the King Synclinorium with the Sophia synclinorium further to the north, the Elliott Anticline² and furthest to the east on Figure IV the Franklin-Hardwood Synclinorium.³ Approximately

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- 1. Named after the River Modder.
 - 2. Named after the Elliott Range.
 - 3. Named after the Franklin-Hardwood Rivers.

8 to 10 miles to the east of the Franklin River there is evidence to indicate another major north-south trending syncline containing Palaeozoic rocks in the Loddon River-Warnes Lookout area (Ward, 1909, p.50) whose limits have been largely determined by photo interpretation; this structure is provisionally named the Loddon Syncline.¹ Influencing all of these major north-south fold structures are at least three east-west fault systems, as already indicated on page 3 (Figure III). The relationship of these east-west structures and the West Coast Range Anticlinorium appears to offer a clue as to the prediction of areas which should be thoroughly investigated by ground methods of exploration in a mineral prospecting campaign. The effect of the east-west structures on the Anticlinorium is profound and will be discussed under the next headings.

West Coast Range Anticlinorium

The Anticlinorium appears to be divided into four structural units by the three east-west fault zones, as shown in Figure III. Each unit shows differing structural characteristics and they will be briefly described from south to north; this will be followed by a discussion on these east-west components and their influence on the other structures of the area, and finally by a general review.

Mt. Osmund Unit: The type of folding in this unit can be seen from Section A in Figure IV. The folds are broad, open, symmetrical structures with a complete absence of overturning or thrust faults or indeed major faults of any nature. The western syncline is the dominant component with a subsidiary anticline to the east both of which are gently plunging to the north at 15 degrees.

The subsidiary north-west folds which are a prominent feature in the Mt. Darwin-Mt. Owen unit to the north are represented here by minor faults.

The Great Lyell Fault or Lyell Shear, which is on the western edge of the syncline, faults Owen Conglomerate against the Dundas Group with a downthrow to the east. It has a similar effect on the strike of the north-west trending structures as in the Queenstown-Mt. Sorell area in that as they approach the fault on its west side they swing in strike to the north.

1. Named after the Loddon River.

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D'Aguilar Range Unit: The type of folding in this unit can be seen in section B of Figure IV where the major fold is decidedly asymmetrical with an overturned or vertical east limb and a uniformly dipping and relatively undisturbed west limb. A major fault occurs in the former limb which is suspected to be a thrust fault, this fault eventually eliminates the Owen Conglomerate and brings the Dundas Group into strong structural discordance against the Precambrian. The anticline is the dominant component, the syncline to the west has now become subsidiary but both retain their northerly plunge of 15 to 20 degrees. The subsidiary north-west folds are again absent from this unit. The Great Lyell Fault is in the same structural position as in the Osmond unit, on the west edge of the syncline.

Mt. Darwin-Mt. Owen Unit: The type of folding in this unit can be seen from section C in Figure IV, the section follows the work of Bradley (1956, p.69, Figure 6) and Wade and Solomon (1958, p.381). The type of folding strongly resembles that in the D'Aguilar Range unit in being markedly asymmetrical with a vertical or overturned east limb and a relatively uniformly dipping and undisturbed west limb. The anticline is now entirely dominant with but a small syncline on its western side, the anticline plunges to the south at a low angle.

The subsidiary north-west folds have their greatest development in this unit, they trend obliquely (20° to 60°) to the main north to south anti-clinorium and they are commonly overthrust to the north-east. In this unit the Great Lyell Fault appears to be transgressive to the trend of the West Coast Range Anticlinorium in that from Mt. South Darwin to Mt. Jukes it is in the centre or on the east side of the anticlinorium but north of Mt. Huxley it is positioned on its west limb.

Mt. Sedgwick-Mt. Marchison Unit: The type of folding in this unit can be seen from section D in Figure IV, it follows that of previous workers as Banks (1952), Bradley (1956) and Campara et al (1956, p.42, Figure 3, sections D, E and F). The structure at the south end of this unit is dominated by a broad, almost horizontally topped anticline (Tyndall Anticline of Bradley, 1956) which plunges southwards from Red Hills. On its eastern side the Dora syncline of Bradley continues northwards from Red Hills with a gentle plunge to the N.N.W. The Tyndall Anticline is bounded on its west side by a subsidiary syncline which is overturned to the east along the Tyndall Fault or Thrust. Several other northerly trending steep thrusts cut these folds and the fold structures as a whole show slight asymmetry to the east.

The north-west folds in this unit parallel the axis of the main anticline in contrast to the Mt. Owen unit immediately to the south where they are oblique; this is discussed by Bradley (1956, p.90). The northerly extension of the Great Lyell Fault from Queenstown has recently been the subject of discussion (Hall and Cottle, 1959, p.190). Its position had been earlier discussed by Gregory (1905, p.131), Carey (1953, p.1124), Bradley (1956, p.52 and 92), Solomon (1957, p.74), Campara et al. (1956, p.55) and the general concensus of opinion appears to be to equate the Tyndall Fault with this structure. The major fault occurs on the west side of the West Coast Range Anticlinorium, faulting Dundas Group to

to the west against the Owen Conglomerate to the east.

North of Mt. Murchison there is a gap in the outcrop of Owen Conglomerate in the West Coast Range Anticlinorium which appears to be caused by a pitch culmination. The Conglomerate reappears some four miles to the north in Mt. Farrell and according to Bradley (1956, p.69 and 95) the Tabberabberan structures in this latter area are asymmetrical to the east with a vertical or steeply inclined west limb in the Sophia syncline. This gap in the outcrop of the Conglomerate here resembles the break at the south end of the West Coast Range immediately to the south of Mt. Osmund.

East-West Trending Structures

Moore's Valley Disturbance: This east-west structure is defined by two boundary faults which are approximately $3\frac{1}{2}$ miles apart. The structure can be traced eastwards into the Precambrian and to the Franklin-Hardwood Synclinorium, a distance of 15 miles. Westwards the structure is suspected to continue as a single fault zone but the area is obscured by a thickness of Cainozoic sediments. The vertical movement on each boundary fault is at least several hundred feet with a late Tertiary (Pliocene) movement which has preserved a thickness of 200 to 400 feet of these Cainozoic sediments within the graben. Further east to west faults are suspected to occur between the two boundary faults but obviously direct observations are not possible. The structure has a considerable influence on the type and trend of folding in the West Coast Range Anticlinorium, which has already been discussed (page 4) and it causes an apparent horizontal displacement in the Great Lyell Fault and folds in the anticlinorium of approximately 2 miles, north side moving east (right handed movements). The direction of movement is also expressed in the pronounced swing of the strike of the Great Lyell Fault and Anticlinorium in the Osmund unit of the West Coast Range from south-north to 020 degrees. The effect of this Disturbance on the regional plunge of the West Coast Range Anticlinorium is obvious from Figure II, at its south edge the anticline has practically closed whilst on its north side it is some ten miles further to the north before the same structural situation is realised. The Moore's Valley Disturbance also marks the northern boundary of the belt of granite which extends 10 to 12 miles from Elliott Bay along the Precambrian/Dundas Group boundary.

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Eagle Creek Disturbance: The Eagle Creek Disturbance is a single fault zone which has been traced eastwards from the Gordon River for approximately 26 miles to the Permian sediments which occur to the north of Adamsfield. Vertical movement on the fault in the Eagle Creek area is north side down with a throw of at least several hundred feet. Westward, mapping indicates that the fault zone itself stops at the eastern edge of the West Coast Range Anticlinorium although a strong east-west influence continues to give the pronounced structural depression in this latter structure (Figure IV, longitudinal section). Further to the west the structure possibly continues as a major fault zone on which late Tertiary movement has localised the Macquarie Harbour graben with the preservation of a thickness of several hundred feet of Cainozoic sediments. This possible westward continuation is further emphasised by the lack of correlation of the major geological structures on both sides of the Harbour, as is evident from Figures II and III. The crosscutting structure exerts a considerable influence on other north-south structural components, its influence on the type of folding in the West Coast Range Anticlinorium has already been discussed on page 10. It marks the north end of the Elliott Anticline and the Franklin-Hardwood Synclinorium and the south end of the Loddon Syncline further to the east. In this latter area the swing in the fold direction in the Precambrian is interesting: some fifteen miles to the south of this structure the fold direction is essentially north-south but as the structure is approached the fold axes swing to the east until they reach 035 degrees. North of the Disturbance although a north-south fold direction is thought to exist (Wells, 1955) the fold direction in the Precambrian is prominently 345 degrees (Spry, 1957, p.95).

On the most easterly known limit of the Eagle Creek Disturbance, in the Gell River, it appears to exert a considerable influence on one of the Tabberabberan folds which exist in the Junee and Eldon Groups in the Rasselas Valley. The general trend of the folds in the Valley is approximately 345 degrees but in the Gell River locality a branch fold swings to 285 degrees. This fold, and associated valley, marked the northern end of the Denison Range which is a prominent ridge formed of Precambrian schists. The strike of the folds in the Precambrian rocks swings easterly into the

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Disturbance, as already described, and reaches 025 degrees and plunges beneath the 285 degree fold trend in the overlying Junee Group of the Gell River. This relationship is obviously important in regard to dating the movement on the Disturbance and will be discussed in a later Section (page 15).

Linda Disturbance: This structure was named and described by Bradley (1954, p.74) and further discussed by Solomon (1957) and Wade and Solomon (1958, p.382 and Figure 10b). The Disturbance in the Queenstown area is in the form of a graben with boundary faults approximately five miles apart, within this zone several other substantial east-west faults are also known to occur. The zone as a whole forms a structural low which causes a stratigraphical depression in the West Coast Range Anticlinorium of several thousand feet. It has been traced some 16 miles to the east of Queenstown as a strong zone of faulting with a pronounced downthrow to the north. This movement brings Precambrian against sediments of the Junee and Eldon Groups and causes the considerable eastward extension of these latter sediments which is evident on Figure II. Further to the east it appears to mark the northern edge of the Loddon Syncline. West of Queenstown it is considered by Solomon (1957) to continue as a single fault zone with a vertical throw of several thousand feet to the south bringing the Eldon Group against the Dundas Group.

Its effect on the type of folding in the West Coast Range Anticlinorium has already been discussed on page 10.

Summary

The influence of the east-west structures on the north-south structural components can be summarised under three headings:

Influence on type of folding: The broad, open and symmetrical folds which exist in the West Coast Range Anticlinorium to the south of the Moore's Valley Disturbance form a complete contrast to the tight and markedly asymmetrical folds which occur to the north. North of the Linda Disturbance the type of folding changes again, ~~as summarised in Figure V.~~

Relative Importance of Fold Structures: The cessation of Tabberabberan fold structures, deflection of fold directions in the Precambrian and Junee Group and the relative importance of the synclinal and anticlinal components in the West Coast Range Anticlinorium are directly

related to the presence of these east-west structures.

Influence on type and extent of Faulting: The type of faulting in the north to south components will obviously in many ways be closely related to the type of folding. Similarly the relative importance of faults in each of the structural units appears to be controlled by these east-west structures and the Great Lyell Fault would appear to be the only one which can be traced through these crosscutting features, from Queenstown to Mt. Osmund, with any degree of confidence: this fault is horizontally displaced by the Moore's Valley Disturbance and if the correlation of the Tyndall with the Great Lyell Fault is correct it is similarly displaced across the Linda Disturbance.

GENERAL DISCUSSION

There is a crude symmetry in the arrangement of the structures within the West Coast Range Anticlinorium which have been described above, this is apparent from the longitudinal section in Figure IV, and shown ~~diagrammatically in Figure V.~~

There is a major pitch culmination at each end which brings the Owen Conglomerate above the present level of erosion and exposes the Dundas Group. At the north end (Mt. Marchison) the Owen Conglomerate reappears after a gap of approximately 4 miles, at Mt. Farrell. At the south end (Mt. Osmund) the Owen Conglomerate has not reappeared in the distance of 7 miles to Elliott Bay. There is a major pitch depression at Macquarie Harbour which is associated with the Eagle Creek Disturbance. Between each of these regional changes in the pitch of the Anticlinorium there is a graben structure of some magnitude, the Linda and Moore's Valley Disturbances. These two structures are approximately of the same magnitude and to the south and north respectively they have similar influences on the type of folding in the West Coast Range Anticlinorium, a similarity which the centrally placed east-west Eagle Creek structure does not essentially disturb. In the Queenstown area, if the Tyndall Fault to the north of the Linda Disturbance can be equated with the Great Lyell Fault to the south (page 10), this symmetry is all the more remarkable.

The age of formation of the structures discussed above is a complex subject. Carey (1953, p.1118) was the first to suggest that the West Coast

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Range Anticlinorium, which is a structure of the Tabberabberan Orogeny (Lower to Middle Devonian), approximately coincided with an earlier anticlinal structure resulting from the Tyennan Orogeny (Upper Cambrian), the Porphyroid Anticlinorium. This concept is followed by later workers as Bradley (1956, p.66) and Banks (1956, p.205). Similarly although the main movement took place on the Great Lyell Fault during the Tabberabberan Orogeny, Wade and Solomon (1958, p.381) present evidence of movement during the deposition of the Owen Conglomerate and the Dundas Group (Middle Cambrian to Lower Ordovician). At the other extreme studies in the Cainozoic sediments south of Macquarie Harbour show that the Fault was active during the late Tertiary, probably Pliocene.

The influence of the east-west structures on the structure of the West Coast Range Anticlinorium and other north-south structures of the Tabberabberan Orogeny is so fundamental that they must have been in existence in some form prior to this orogeny. The influence of the Eagle Creek Disturbance on the Tabberabberan fold which involves the sediments of the Junee Group in the Gell River (page 12) implies that the swing to the east in the trend of the folds in the Precambrian was in existence prior to the deposition of this Group, that is, prior to Lower Ordovician. Consequently, on this basis this Disturbance would appear to have been in existence and active at least during the Tyennan Orogeny. It would also appear that although the main movement on the five major structural components which are discussed in this paragraph took place during the Tabberabberan Orogeny, some of them at least were already in existence during the earlier Tyennan Orogeny and the possibility of them having still earlier origins in the Precambrian cannot be entirely discounted.

STRUCTURES IN RELATION TO ORE SEARCH

The Great Lyell Fault can be traced with some degree of confidence from Queenstown southwards to Elliott Bay, a distance of 65 miles. North of Queenstown the position of this fault appears to be known as far as the Red Hills (14 miles), north of here there is a divergence of opinion with Campara et al. (1959) continuing it through the mines at Hercules and Rosebery, and Carey (1953) and Hall and Cottle (1959) through the Mt. Farrell (Tullah) area. Gregory (1905) was the first to realise the association of the mineralisation at the Mt. Lyell M. & R. Co. Ltd. mines at Queenstown and

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this fault and during the period 1890 to 1910 many copper prospects were located along or near this structure between Mt. Murchison and Mt. Darwin, all within the West Coast Range Anticlinorium. However, despite the impressive number of these prospects, none have produced anything but trifling quantities of ore amounting to several hundred of tons and the great majority of them appear to be the result of mineralisation on a very small scale. The 41 million tons of copper ore that the Mt. Lyell company have produced to 1957 has come exclusively from mines that were placed on or near the Great Lyell Fault and within the east-west crosscutting structure of the Linda Disturbance; this structural association of the mineralisation at Queenstown was first pointed out by Gregory (1905). Therefore, one of the main inferences regarding the search for sulphide mineralisation in a prospecting area of 4500 square miles becomes obvious, to find the continuation of the Great Lyell Fault and West Coast Range Anticlinorium southwards from Mt. Darwin and the location of any further east-west structures which resemble the Linda Disturbance. The exploration campaign has been successful in this respect as has already been outlined in this paper.

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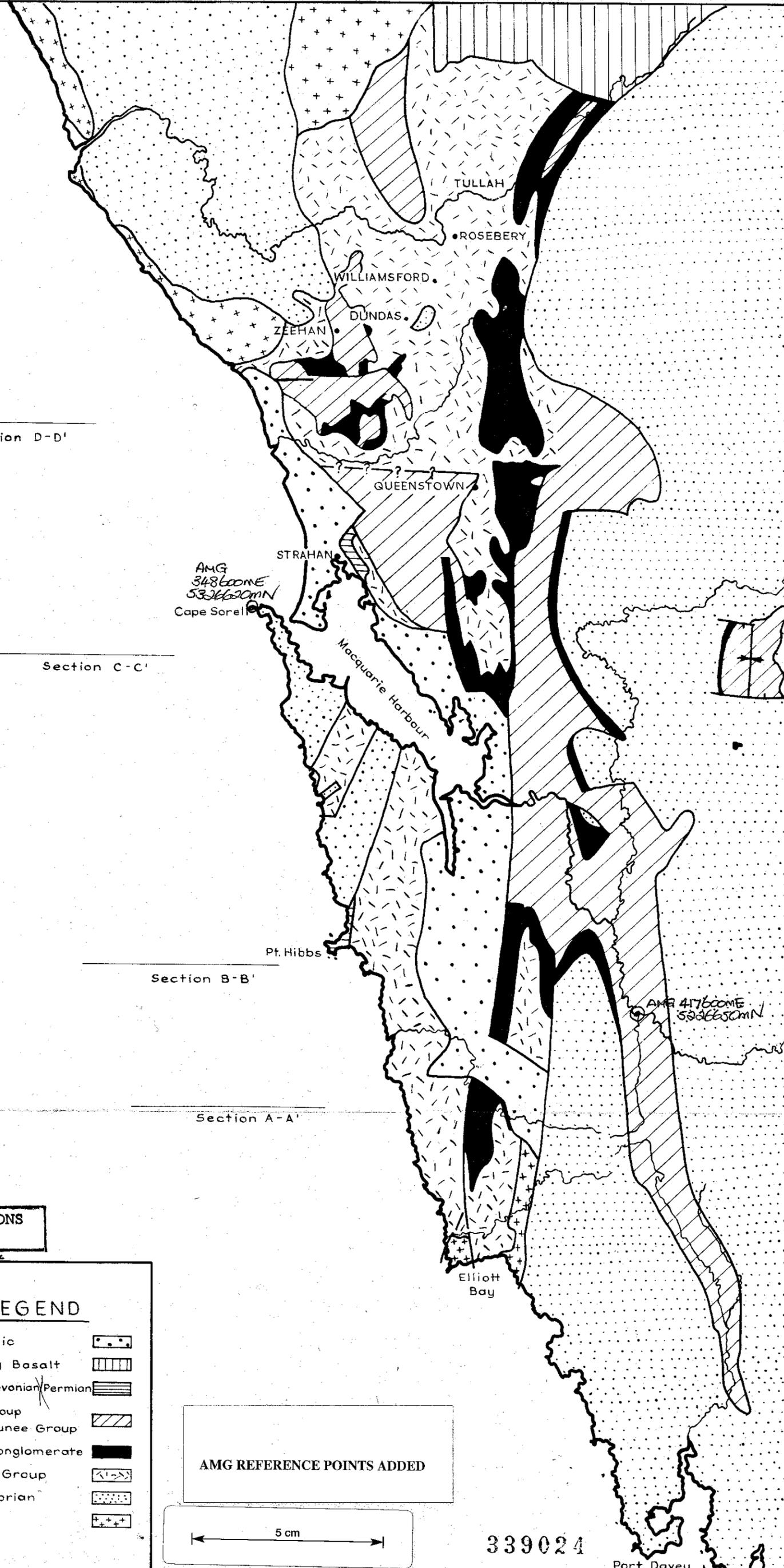
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Section D-D'

Section C-C'

Section B-B'

Section A-A'

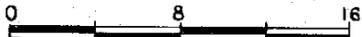
FIGURE II

LYELL-EZ-EXPLORATIONS
Queenstown

59-304

SOUTH WEST
TASMANIA

SCALE IN MILES



INDEX



LEGEND

- Cainozoic
- Tertiary Basalt
- Upper Devonian/Permian
- Eldon Group
- Upper Junee Group
- Owen Conglomerate
- Dundas Group
- Precambrian
- Granite

AMG REFERENCE POINTS ADDED

5 cm

Q47a

2345

339024

Port Davey

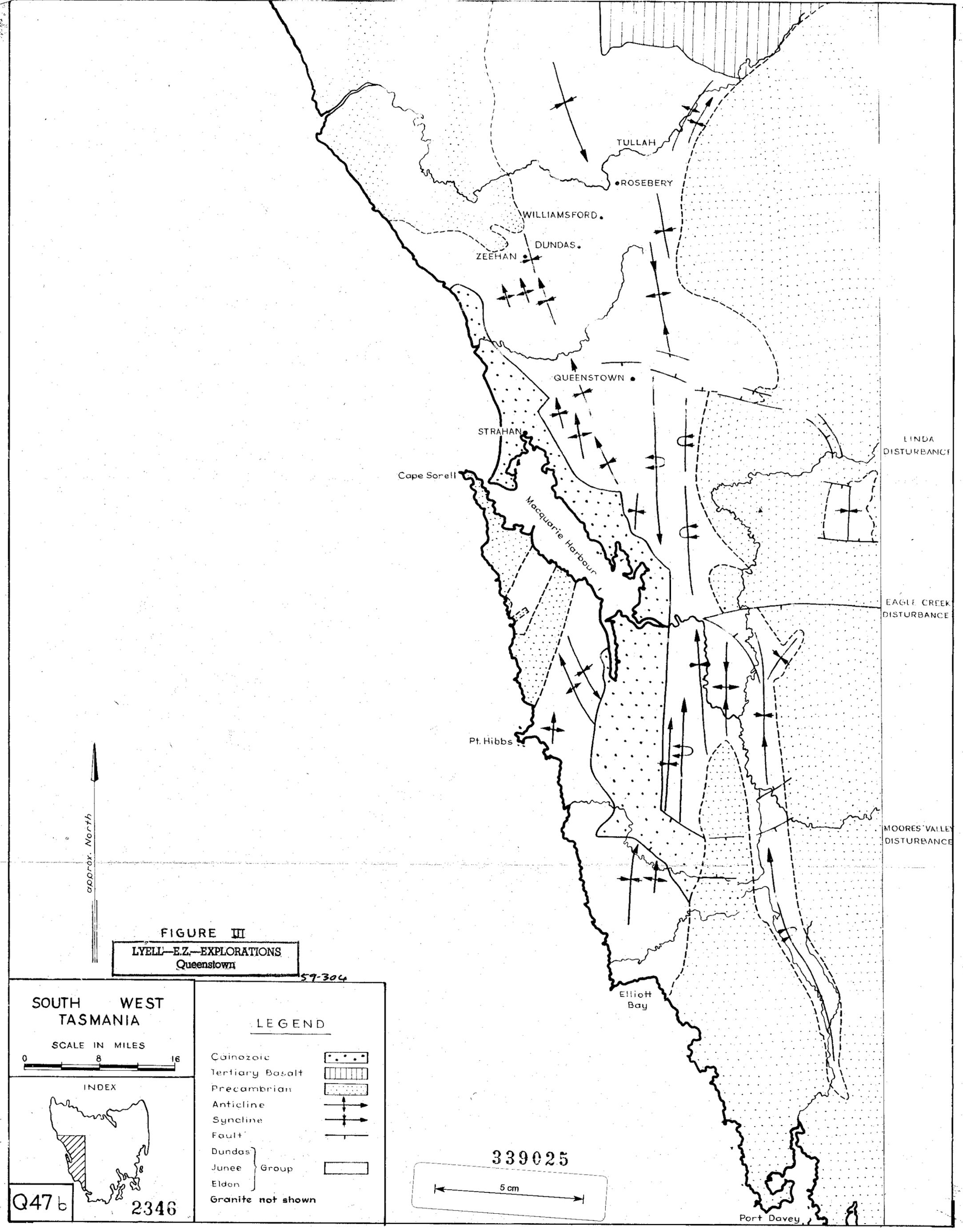


FIGURE III
 LYELL-E.Z.-EXPLORATIONS
 Queenstown

59-304

SOUTH WEST TASMANIA

SCALE IN MILES
 0 8 16

INDEX

Q47b 2346

LEGEND

Cainozoic	
Tertiary Basalt	
Precambrian	
Anticline	
Syncline	
Fault	
Dundas } Group	
June }	
Eldon }	
Granite not shown	

339025

5 cm

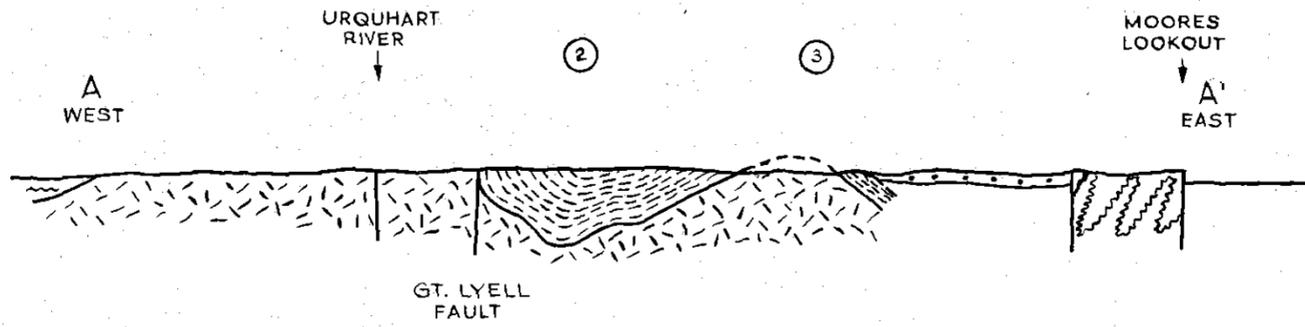
LINDA DISTURBANCE

EAGLE CREEK DISTURBANCE

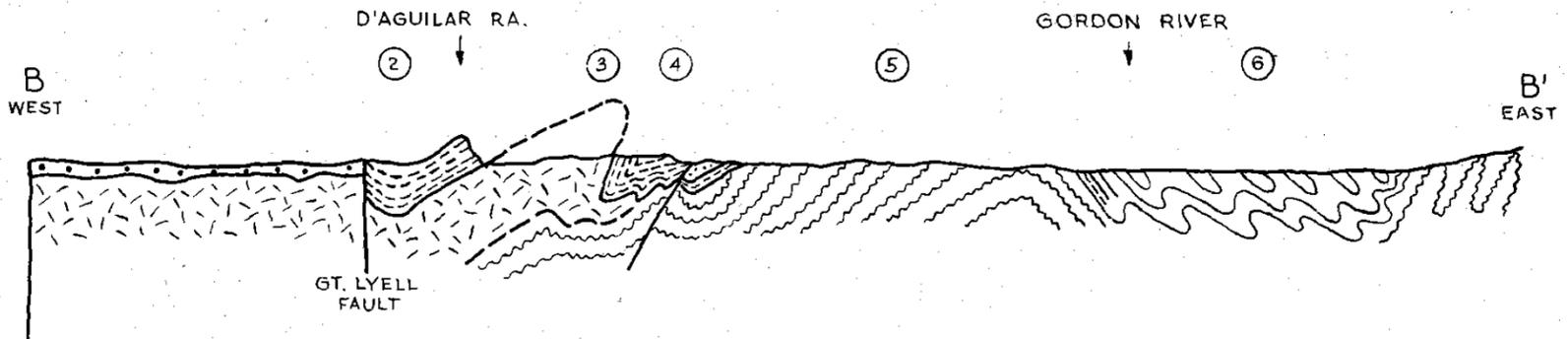
MOORES VALLEY DISTURBANCE

FIGURE IV

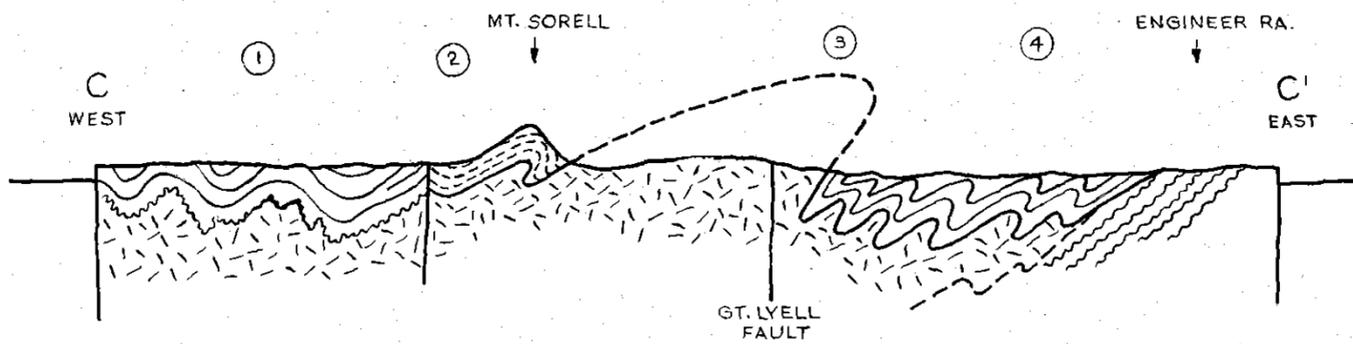
SECTION A-A'



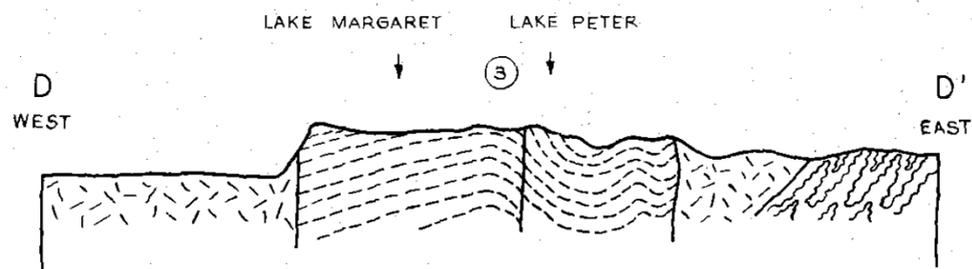
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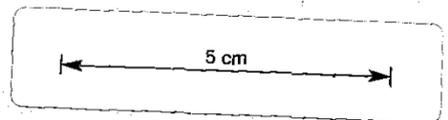
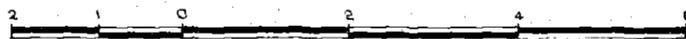
SECTION C-C'



SECTION D-D'



Scale in miles



LEGEND

Cainozoic		Dundas Group		Precambrian
Eldon Group		Upper Junee Group		Unconformity
Owen Conglomerate		Fault		

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LYELL-E.Z.-EXPLORATIONS
Queenstown

339026 2347

Q 48

FIGURE V

SOUTH

NORTH

SECTION A-A'

SECTION B-B'

SECTION C-C'

SECTION D-D'

ELLIOTT BAY

MT OSMUND

MOORES VALLEY

D'AGUILAR RA

GORDON RIVER

MT. DARWIN

MT JUKES

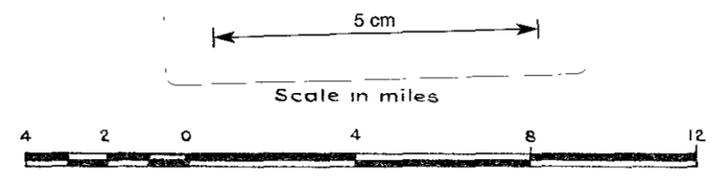
MT OWEN

MT LYELL

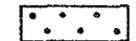
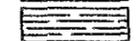
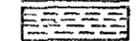
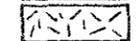
MT. SEDGEWICK

MT TYNDALL

MT MURCHISON



LEGEND

- Cainozoic 
- Eldon Group, Upper Junee Group 
- Owen Conglomerate 
- Dundas Group 

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 LYELL-E.Z.-EXPLORATIONS
 Queenstown