THE BROKEN HILL PROPRIETARY CO. LTD.

EXPLORATION DEPARTMENT

SOUTH-WEST TASMANIA EL 13/65. GEOLOGICAL REPORT 1966-67.

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Melbourne. March, 1969.

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Location and Tenure

Exploration Licence 1/64 (E.L. 1/64) was granted to the Broken Hill Proprietary Company Limited on August 6th 1964, for a period of six months over an area of approximately 6,000 square miles in the south-west portion of Tasmania. The area was bounded to the north by Tasmanian State Grid Line 810,000 yards north, to the east by Grid Line 470,000 yards east, and to the south and west by the coastline. The northern boundary extended approximately from Strahan to Waddamana, and the eastern boundary extended from Waddamana to South Cape Bay.

In February 1965, E.L. 1/64 was extended for a further six months, and was amended so as to exclude an area half a mile wide on either side of the Gordon River Road between Maydena and the Gordon River.

Exploration Licence 13/65 (E.L. 13/65), subject to the same conditions as E.L. 1/64 and replacing it, was granted on June 11th, 1965. The coastal boundaries were amended to include the inland waters of Port Davey and Bathurst Harbour enclosed between Hilliard Head and North Head. The amendment pertaining to the Gordon River Road did not apply to E.L. 13/65. This Licence was extended bi-annually from December 1965 until June 1967.

In June 1967 the Licence area was reduced to 3,1000 square miles, and extended until December 1967. The areas surrendered were in the north-east, east and south-east of the original E.L. 13/65 where results of geological and aeromagnetic investigations were not encouraging.

The areas surrendered consist largely of flat lying Permian and Triassic sediments intruded by dolerite.

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Access

The south-west of Tasmania is a rugged and isolated region. Although a number of walking tracks exist the only roads into the area are the Lyell Highway which crosses the north-east and skirts the north of the area, and the Gordon River Road which extends across the centre from Maydena to near the junction of the Gordon and Serpentine Rivers.

Light aircraft are able to land at Melaleuca inlet in the south-west and at Lake Pedder in the centre. The only regular service is to Strahan in the north-west. Small fishing boats from Hobart, Southport and Strahan frequent the west and south coasts except during the spring.

Topography and Vegetation

This central and western portions of the area consist of long, narrow mountain ranges which rise 1,500 feet to 2,500 feet above the surrounding country, and are separated by broad, swampy valleys. The highest peaks are Frenchman's Cap (4,739 feet) in the north-east, and Federation Peak (4,010 feet) towards the south-east. The valleys are generally covered with thick peat which supports a cover of button grass and heath, but stands of eucalypts and thick scrub grow along the banks of the rivers and streams. The mountain tops are commonly bare, but the slopes are clothed with thick myrtle forest.

The eastern portion of the area consists of steep sided, plateau like ranges, with jutting pyramid and battlement shaped dolerite peaks rising to over 4,000 feet and draped with a mantle of coarse talus. The plateau surfaces are usually bare or have a light scrub cover. Some are covered by extensive swampy areas. Thick forest with giant eucalypts covers the mountain slopes and valleys.

Climate

South-west Tasmania is an area of relatively high rainfall, with cool weather, and strong westerly winds during much of the year. The most settled weather is during the late summer and autumn, but periods of cold, wet weather can occur at any time of the year.

The average annual rainfall varies from 60 inches along the west coast to 80 inches along the south coast, and rises rapidly inland to 120 inches near the junction of the Gordon and Serpentine Rivers, but falls off to between 30 and 40 inches along the eastern margin of the area. The heaviest falls are during the late winter.

Snow falls on the highlands intermittently throughout the year, but only lies for more than a few days during the winter. The monthly average temperatures are in the mid fifties and low sixties, but temperatures of just below 100° have been recorded on days of strong, hot northerly winds.

Less than 1,750 hours of sunshine are recorded annually in the western highlands.

REVIEW OF PREVIOUS WORK IN SOUTH-WEST TASMANIA

1. Prospectors and Surveyors

An unrecorded number of prospectors and Government surveyors have explored South-west Tasmania since the 1850's. Apart from topographic mapping their investigations were largely biased towards the search for gold. Small, profitable mineral deposits discovered by them include alluvial tin at Bathurst Harbour (1881), alluvial osmiridium at Adamsfield (1925), and alluvial gold in the Jane River (1935).

2. University of Tasmania

Investigations carried out by staff and students of the University of Tasmania consist of geological mapping in small areas around the margins of the E.L. 13/65. The reports of this work are found mainly in the Papers and Proceedings of the Royal Society of Tasmania, and in unpublished theses held at the University. Among the most useful work is that of Bradley (1954), Corbett (1964), Jago (1966), Jennings (1955), McIntyre (1964), Reid (1964), Solomon (1957b and 1960), Spry (1963) and Spry and Gee (1964).

3. Hydro-Electric Commission

Investigations carried out by the H.E.C. have been primarily concerned with regional investigations of hydro-electric potential and damsite investigations. Regional studies include those of Corbett (1965), Mather (1955), McLeod (1955 and 1956), Spry (1957), Spry and Zimmerman (1959?, and Wells (1955), and have been invaluable in the compilation of regional maps.

4. Tasmanian Department of Mines

The work of the Tasmanian Department of Mines in South-west Tasmania has been of two types; reports on specific mineral areas, and reports on regional work in various parts of the area.

Reports on specific mineral areas include those on Adamsfield (Nye 1929, Reid 1925), Asbestos (Blake 1929b, Taylor 1955), Cox Bight and Bathurst Harbour (Nye 1927a, Reid 1928, Stephanski 1958b, Twelvetrees 1906), Humboldt Mine (Henderson 1939), Jane River (Blake 1935b), Jukes-Darwin (Hills 1914a, Twelvetrees 1900, Waller 1903), Limestone (Hughes 1957), Macquarie Harbour (Blake 1939), Nicholls Range (Blake 1938b), and Point Hibbs (Waller 1902).

Reports on regional work within the boundaries of E.L. 13/65 include those in the north-central (Blake 1936b and 1937, Finucane and Blake 1933, Gee 1963, Gulline 1965), central and east-central (Blake 1935a), west coast (Hills 1914b, Nye 1926), south-west (Jennings 1961, Nye 1928 and 1930, Stephanski 1958b and 1960 and Taylor 1960), and south-east (Blake 1938a, Twelvetrees 1915) portions of the area.

Much of this information is as yet unpublished.

5. Lyell-Electrolytic Zinc Exploration

In 1956 the Mt. Lyell Mining and Railway Co. Ltd., and the Electrolytic Zinc Co. of Australasia combined to form Lyell-E.Z. Explorations (L.E.E.) in order to carry out mineral exploration in south-west Tasmania.

Two Special Prospectors Licences were granted in 1956 but were surrendered in 1959 and replaced by Exploration Licence 3/59, (the Gordon Concession). In 1957 a further three Special Prospectors Licences were granted, and were in turn surrendered and replaced by Exploration Licence 1/59, (the Arthur Concession). About 4,400 square miles were held under the two Licences.

Aerial photographs were produced at a scale 1:23,760 in the Arthur Concession. Photo mosaics and field sheets were prepared at a scale of 1:23,760.

The Gordon Concession and three small areas of the Arthur Concession were covered by aeromagnetic surveys and more restricted aero-electromagnetic surveys.

Most of the ground work consisted of extensive ground geophysical investigations of selected aeromagnetic anomalies, and minor geological and geochemical investigations.

Geological reconnaissance in areas of Precambrian rocks gave little indication of mineralisation and most of the detailed investigations were concentrated on the west coast area between Macquarie Harbour and Elliott Bay. Emphasis was placed on the supposed structural and lithological similarities of the Queenstown and Moores Valley areas, and a large amount of detailed ground geophysical work (magnetometer, gravimeter, A.F. mag., and I.P.) was carried out in the vicinity of Moores Valley. Geological investigations in the area were handicapped by the thick cover of Tertiary sediments, and the geophysical interpretations were largely inconclusive.

One diamond drill hole was put down at Moores Valley to determine the cause of an I.P. anomaly. The cause of the anomaly was not established, and the hole was abandoned at a depth of 673 feet after passing through 587 feet of semi-consolidated Tertiary gravels, sands and minor clay and lignite bands, and 86 feet of Ordovician Owen Conglomerate.

Six shallow diamond drill holes (maximum depth of 122 feet) were drilled at Pelias Cove immediately east of Double Cove on the south coast of Macquarie Harbour, where hematite with minor sulphides was exposed over a width of 39 feet on the beach. The drilling indicated six to ten feet of hematite overlying friable greywacke. Two samples of hematite averaged 40.2% Fe, 0.12% Cu, 0.75% Pb, and 1.0% Zn. The prospect was abandoned after the drilling and a ground electro-magnetic survey failed to indicate persistence of the mineralisation along strike.

At Lake Jukes, eight miles south of Queenstown, two further diamond drill holes were put down to depths of 650 feet and 491 feet respectively. Neither hole intersected ore of economic interest and the prospect was abandoned.

Very little work was carried out after the failure of the single drill hole at Moores Valley, and Exploration Licences 1/59 and 3/59 were allowed to expire in 1961 and 1962 respectively.

6. The Broken Hill Proprietary Co. Ltd.

An Exploration Licence covering an area of 6,000 square miles in South-west Tasmania was granted to the B.H.P. Co. Ltd. in August 1964. Before field work commenced a report entitled "Summary of Investigations, South-west Tasmania" was prepared by Whitehead (1964).X Not received This comprehensive report summarized the results of literature research and information received from State and Commonwealth Government Departments and Mining Companies. It dealt with such aspects as access, communications, organisation of camps and field parties, and weather. The report reviewed previous work in the area and summarized the known geology and mineral occurrences.

Whitehead concluded that geochemistry offered the best approach for detecting mineral deposits, and recommended that consultants be engaged to supervise a programme of stream sediment sampling. It was also recommended that an aeromagnetic survey be conducted over that portion of the area not already covered.

Geological field work commenced in March 1965, from a base camp at Melaleuca Inlet, Bathurst Harbour and during the next three months approximately 150 square miles in the extreme south-west portion of the Licence area was mapped. Geochemical stream sediment sampling commenced at the same time under the supervision of consultants from Barringer Research Ltd. Toronto, Canada, and an aeromagnetic survey of the eastern portion of the area was begun by Aero Service Ltd., Sydney.

The results of this first season's field work were described by Hall (1965).X Not received

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The 1965-66 field season occupied six months between November 1965 and May 1966, and the results of the work were described by Gebert (1966), Hall (1966), and Walker (1966). The area covered by geological mapping was extended east along the south coast to South Cape Bay, north to the Cracroft River and Lake Pedder, and along the Olga and Hardwood Valleys, and along the west coast to Mt. Osmund. Geochemical sampling was mainly confined to the area along the west coast.

This field work was an extension of the previous season's, using larger field parties and making more extensive use of helicopters. The camp at Melaleuca Inlet was used again, and a second base camp was established at Moores Valley during the final three months of the season.

The aeromagnetic survey of the eastern part of the licence area was completed in 1966.

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B.H.P. FIELD WORK 1966-67

The purpose of the 1966-67 field work was to continue the search for evidence of mineralisation by completing the reconnaissance geological mapping of the area, and commencing detailed ground work in the areas covered by significant aeromagnetic and aeroelectromagnetic anomalies.

Field work commenced in mid October, 1966, when a five man party (two geologists, field assistant, helicopter pilot and an engineer) occupied a small caravan camp on the Gordon River Road, 100 miles from Hobart. A detailed ground traverse was carried out through the Ordovician, Cambrian and Precambrian rocks exposed along the road, and helicopter reconnaissance extended the regional mapping throughout the Precambrian rocks of the Central area, and the Palaeozoic rocks of the east and southwest portions of the Licence area.

The work was interrupted by a helicopter crash in late October, but was completed in early December. The party then transferred to the west coast area. About 2,000 square miles were covered during this work, and the causes of the majority of the aeromagnetic anomalies were fairly well established. Ultrabasic rocks were located in the Boyes River valley, and pyrite with possible chalcopyrite was discovered in pelitic schist three miles east of the junction of the Gordon and Serpentine Rivers.

Field information was plotted on one inch to two thousand feet photomosaics, and compiled on one inch to one mile topographic maps.

Field work continued between mid December 1966 and late April 1967 in the west coast portion of the Licence area, from a base camp at Birch Inlet at the southern end of Macquarie Harbour.

From this camp a geologist and a field assistant made extensive use of helicopter support to extend reconnaissance geological mapping over the areas of

Precambrian rocks between the Giblin River and King Billy Range, and between Macquarie Harbour and the west coast. This work combined with geochemical stream sediment sampling of the areas covered by significant aeromagnetic and aero-electromagnetic anomalies.

The geologist acted as navigator and plotted the sample locations and geological data, while the field assistant collected the samples. Up to 80 samples a day were collected in this manner, and an area of up to 20 square miles was mapped in fair detail at the same time.

Apart from a very minor occurrence of specular haematite and pyrite at the south end of Birthday Bay, no evidence of mineralisation was located in the Precambrian rocks. The results of the geochemical samples were unfavourable, and the magnetic and electromagnetic anomalies appear to be related to areas of garnet grade, pelitic and graphitic schist.

Reconnaissance mapping and geochemical stream sediment sampling were also carried out over the area of Cambrian sedimentary and igneous rocks between Elliott Bay and the south-east corner of Macquarie Harbour, and in the upper Sprent and Conder River valleys. Small parties comprising one geologist with one or two field assistants made boat traverses around the coast of Birch Inlet and Macquarie Harbour to Big Gravelly Beach, and along the lower reaches of the Spero, Wanderer and Mainwaring Rivers. Ground traverses were made along a number of streams draining into Birch Inlet and Macquarie Harbour, and along the Urquhart River and upper reaches of the Spero and Mainwaring Rivers, and along Cypress, Abo and Copper Creeks.

As this country is all covered by heavy timber and thick scrub, sampling of the stream sediments offered the best approach and resulted in the discovery of an area of anomalous copper and zinc values between the Mainwaring and Urquhart Rivers.

A boat traverse was also made along the lower Gordon River adjacent to Butlers Island, where an aeromagnetic anomaly covered an area of Ordovician limestone and sandstone. Short ground traverses were also made along some of the side streams, from which stream sediment samples were collected.

About the same time a party of two geologists undertook an examination of the north-east portion of the Licence area, mainly to determine the causes of the numerous aeromagnetic anomalies, and to check for the presence of bauxite.

Detailed ground work was carried out in the area of Cambrian rocks immediately west of Birch Inlet. Between November 1966 and May 1967 twenty six miles of tracks were bulldozed in this bush covered area for access and geophysical purposes. A further six miles of access tracks were bulldozed across the buttongrass country immediately to the west.

Work was concentrated along a zone of linear aeromagnetic anomalies with peaks up to 8,183 gammas, which occur along the western edge of the Cambrian rocks. The magnetic anomalies were found to be associated with two narrow belts of ultrabasic rocks, and these were closely delineated by geological mapping at one inch to four hundred feet (later compiled on field sheets at a scale of one inch to two thousand feet), and by ground magnetometer and electromagnetic traverses with readings taken at 100 foot intervals.

The geophysical work resulted in the discovery of a significant electromagnetic anomaly along the western margin of the eastern belt of ultrabasic rocks. Three costeans were bulldozed across this zone, and located a sharp contact between ultrabasics and graphitic siltstone with common pyrite.

Chip samples were collected over ten feet intervals along the costeans, and indicated values of up to 0.8% Cu. and 0.15% Ni.

Work in this area was assisted by Nodwell track carrier and helicopter support. Temporary camps were set up at various points as the work progressed. A number of areas were cleared for helicopter landings.

Field work was suspended at the beginning of May 1967, when poor weather and short daylight hours made further work impractical.

At the completion of the 1966-67 field season the reconnaissance geological mapping was complete except for an examination of the north-central and north-west portions of the Licence area, and the Double Cove Belt.

The area of Cambrian rocks along the west coast had emerged as the most prospective area, and the results of the geochemical stream sediment sampling, particularly in the southern part of this area were encouraging. Asbestos had been discovered in ultra-basic rocks at the northern end of the belt, and it had become increasingly obvious that the entire belt was worthy of closer and continued investigation.

SUMMARY OF REGIONAL GEOLOGY

Older Precambrian rocks are the most widespread in the Exploration Licence area, and are divided into two distinct lithological and metamorphic groups - dominantly pelitic schists of garnet grade and dominantly quartzites and quartz schits of chlorite grade. The metamorphic isograd boundaries coincide closely with the lithological boundaries between the groups.

Fine grained and knotted garnet grade and biotite grade schists, small bodies of eclogite and amphibolite occur in the Frenchman's Cap area in the north-central portion, and in the south-west portion of the Licence area at Port Davey, Bathurst Harbour and along the south coast. They are also found along the west coast between Port Davey and Elliott Bay, and in the headwaters of the Giblin River.

The most common garnet and biotite grade rocks are dark, fine to medium grained garnet schists and pale, coarse grained schists with knots of garnet and/or albite wrapped by coarse white mica. Essential minerals in both types are quartz, albite, muscovite, garnet, and in some cases biotite. Mineral abundances depend largely on the compositions of the original sediments. Chlorite is a common product of retrograde metamorphism.

The chlorite grade rocks are dominantly massive quartzites and quartz schists containing a little sericite. There are minor bands of fine grained quartz-chlorite schist, graphitic schist and phyllite. At Port Davey and Bathurst Harbour these rocks overlie the garnet grade rocks, but the sequence may be locally inverted (e.g. Giblin River area) or interleaved (e.g. Frenchman's Cap area).

Original bedding is seen in some massive quartzites where ripple marks and cross bedding may be destroyed. However, in the schists So has been destroyed by recrystallisation, although microscopic remnants occur as trails of inclusions in albite porphyroblasts.

Metamorphism during F_1 produced Upper Greenschist Facies assemblages (i.e. garnet and biotite grades) and the surface S_1, which is parallel to S_0 in some cases. Tectonism was probably limited during F_1, and there is evidence only of minor, small scale deformation.

The F_2 foliation is very pronounced, and developed as a highly penetrative cleavage parallel to the axial planes of F_2 folds. The cleavage is due to parallelism of recrystallised or rotated micaceous minerals. F_2 recrystallisation was in part retrograde.

S_1 and S_2 may be parallel except at fold crests, and remnants of S_1 often occur as hook and tear shaped bodies deformed during F_2. F_2 folds are similar and generally isoclinal, with rounded, thickened crests and attenuated limbs. Recumbent F_2 folds have wave lengths up to several miles, and some form detached, nappe like structures.

The recumbent structures probably formed before the deposition of Younger Precambrian rocks, and have been considerably modified by Devonian (Tabberabberan Orogeny) folding.

S_3 is a very minor fracture cleavage formed along the axial planes of F_3 kink folds, and is not related geometrically to the major F_3 structures. S_3 rarely maintains consistent orientations over areas of more than a few square yards, and the only mineral growth associated with it is slight recrystallisation of chlorite.

Lineations are generally parallel to fold axes. L_2, the most common, is a mineral elongation and L_3 is a mica crinkle lineation.

<u>Younger Precambrian</u> rocks are also divided into two distinct groups. In the Bathurst Harbour area, and extending north to the Upper Davey River and south-east to the Ironbound Range, a basal breccia rests unconformably on Older Precambrian rocks, and is overlain by at least

10,000 feet of conglomerate and quartzose turbidites. These rocks have been strongly deformed at Bathurst Harbour and are often schistose or phyllitic, and have a strong axial plane cleavage.

Younger Precambrian rocks of a markedly differing facies occur in the Upper Maxwell and Jane River Valleys, in the Mt. Anne area and Upper Weld River valley, and along the middle reaches of the Huon River. In the Jane River area they are dolomites with a thin, impersistent basal conglomerate. Dolomite is also dominant in the Weld and Huon River areas, and is interbedded with thick sequences of quartzite and phyllite, and thin beds of conglomerate and breccia.

The turbidites of the Bathurst Harbour area were probably deposited in a trough formed along the margin of a more stable area of dominantly dolomitic sedimentation.

Precambrian rocks of chlorite grade and uncertain correlation occur in the Solly River area east of Bathurst Harbour and south of Federation Peak, and in two belts on the Cape Sorell Peninsula.

The rocks in the Solly River area consist of a massive quartzite overlain by phyllite and pelitic quartz-chlorite schist with thin bands of green schist and stretched conglomerate, and dark graphitic schists. These rocks have a simple structure and dip moderately steeply NW.

In the Cape Sorell Peninsula the Precambrian rocks are quartzite and foliated quartz-chlorite schist with common graphitic schist and rare conglomerate bands. They are isoclinally folded into north plunging structures with a prominent axial plane cleavage.

Cambrian rocks are exposed along the west coast from Elliott Bay to the King River (Western Basin), along the south coast from the mouth of the New River to Pretty's

Point and in the upper Cracroft River (Southern Basin), and along the Gordon River Road, and in the Boyes, Wedge, Boyd and upper Florentine River valleys (Eastern Basin).

The Cambrian rocks in the Southern Basin are at least 6,000 feet thick. They rest unconformably on Younger Precambrian dolomite and are unconformably overlain by Ordovician rocks. Massive conglomerate and breccia at the base passes up into cyclic sediments consisting of conglomerate, sandstone and laminated dolomitic siltstone. These are overlain by laminated siltstone, chaotic unsorted conglomerate, and thick sequence of argillaceous turbidites with thin bands of sandstone, grit and muddy conglomerate.

In the Eastern Basin the Cambrian rocks are divided into two distinct groups - an older group of geosynclinal greywacke, argillite and chert overlapped by a younger group of shallow water conglomerate, sandstone and siltstone which passes conformably up into Ordovician rocks.

The older group is about 20,000 feet thick. Interbedded conglomerate and sandstone at the base rests unconformably on Precambrian rocks and is overlain by a thick sequence of sandy turbidites. Above the turbidites are maroon, locally green grey, argillites with bands of massive chert. Interbedded with the argillite and chert are sequences of massive, unbedded, poorly sorted greywacke with large irregular argillite inclusions which were probably derived from large, submarine slumps.

The rocks in the upper part of the Older Cambrian Group are intruded by ultrabasics at Boyes River, Adamsfield and in the Upper Florentine River valley. Dolerite and trachyte are associated with the sediments immediately south-west of The Needles.

The Upper Cambrian group is about 4,000 feet thick. The basal conglomerate is locally rich in serpentine fragments and chromite grains, and passes up into interbedded laminated siltstone, fine sandstone, and conglomerate which contains an Upper Cambrian trilobite fauna.

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These rocks are overlain by a transitional facies of interbedded sandstone and siltstone, and a terrestrial facies of strongly cross-bedded conglomerate sandstone and fine conglomerate.

In the Western Basin sheared acid volcanics (quartz and quartzfeldspar porphyries derived from rhyolites and dacites) at the base of the Cambrian succession are exposed between Elliott Bay and the Wanderer River, in the headwaters of the Sprent and Conder Rivers, between Innes Peak and the D'Aguilar Range, and in the Clark River and southern tributaries of the King River in the Jukes-Darwin area. They are intruded by Upper Cambrian granite at Low Rocky Point and Mt. Darwin, and by quartz porphyry between the north-east corner of Elliott Bay and the Wanderer River.

The volcanics are interbedded with greywacke and fine conglomerate in the Jukes-Darwin area, and are unconformably overlain by a massive breccia (Jukes Breccia).

North of the Lewis River the volcanics are conformably overlain by phyllite with thick bands of schistose green tuff. These are followed by a geosynclinal sequence, at least 23,000 feet thick, consisting of thick horizons of laminated argillite and graded bedded greywacke with thin conglomerate bands. Thin andesite and basalt sills and bands of crystal tuff are interbedded with these rocks. The argillite contains an Upper Cambrian trilobite fauna west of Birch Inlet.

North of Endeavour Bay the greywacke and argillite are intruded by long, narrow concordant sheets of ultrabasics. The ultrabasics are largely serpentinized, but are locally banded and include pyroxenite and gabbro. Considerable shearing has taken place within the ultrabasics and along their margins.

Immediately west of Birch Inlet andesite, keratophyre, basalt and spilite are interbedded with sediments, and intruded by a small body of fine grained quartz diorite.

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Ordovician rocks are fairly widespread and generally occur in the following sequence:

At top Gordon Limestone
Caroline Creek Sandstone, and its more restricted lateral equivalent, Florentine Valley Mudstone.
Owen Conglomerate

The thickness of the various formations varies considerably, and the Owen Conglomerate is not always present.

In the Southern Basin Caroline Creek Sandstone with scattered pebbles at its base rests unconformably on both Cambrian and Precambrian rocks. It passes up into Gordon Limestone which is unconformably overlain by basal Permian tillite.

In the Eastern Basin Owen Conglomerate occurs as a series of thick (up to 5,000') lenses of pebble conglomerate and conglomeratic sandstone, probably terrestrial fanglomerates. It is locally conformable with the Cambrian but overlaps on to Precambrian rocks. The conglomerate is overlain by cross-bedded conglomeratic sandstone of flood plain origin.

Along the Denison Range this is overlain by massive Caroline Creek Sandstone (Florentine Valley Mudstone along the Gordon River Road) and Gordon Limestone.

In the Western Basin Owen Conglomerate is up to 6,000 feet thick at the Wanderer River. It was deposited in a narrow, north trending trough extending from Mt. Osmund to the Jukes-Darwin area, and rests unconformably on Cambrian volcanics. It thins rapidly into Caroline Creek Sandstone, which transgresses onto Cambrian rocks to the west and Cambrian rocks to the east, and is overlain by Gordon Limestone.

Silurian and Devonian rocks overlie the Gordon Limestone in the eastern and western basins, where they are preserved in synclinal cores. They are up to 12,000 feet thick in the north-west corner of the Licence area, and consist of alternating formations of quartzite and shale.

Devonian rocks of shallow water facies are exposed at Point Hibbs on the west coast, and include conglomerate, sandstone and reef limestone.

Permian rocks rest unconformably on all other rocks along the north-east and eastern portions of the Licence area. They include a basal tillite, and are dominantly mudstone and sandstone with minor limestone and coal measures, and are overlain by shallow water Triassic sandstone and minor shale and coal measures. These rocks have been extensively intruded by dolerite.

Tertiary lacustrine clay, ferruginous sandstone and poorly sorted conglomerate occur in the Derwent Graben in the north-east, and are overlain by thick flows of olivine basalt which locally contain pyroclastics. Lacustrine clay, silt and sand with common conglomerate and minor lignite also occur in the Macquarie Harbour Graben in the north west.

Pleistocene rocks are represented by outwash gravels, moraine and raised beaches, and Recent rocks by terrace and river gravels, silt and extensive valley peat.

GEOLOGY OF THE WEST COAST AREA

by

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SUMMARY

Precambrian rocks occur in two belts west of Birch Inlet, and in one belt east of the Lewis and Thirkell Hill Faults. They are chlorite grade quartzite and quartz schist with minor conglomerate and limestone, and minor pelitic and knotted garnet schist. Hematite and pyrite mineralisation is associated with a small syenite body intruding these rocks on the coast south of Birthday Bay.

Geochemical stream sediment sampling of aeromagnetic and aero-electromagnetic anomalies over the Precambrian rocks did not produce any anomalous results.

Lower Cambrian rhyolite with thin tuff bands occurs west of the Lewis and Thirkell Hill Faults, and south of the Moores Valley Fault, and is intruded by granite and quartz-feldspar porphyry at Elliott Bay. Small localized pockets of copper, lead and pyrite mineralisation were located, but extensive geochemical sampling did not give any anomalous results.

At least 23,000 feet of Middle and Upper Cambrian tuff, greywacke and argillite overlie the rhyolite, and are intruded by ultrabasic sills in the northern portion of the area. Geochemical copper anomalies were located in the area of tuffs between the Urquhart and Mainwaring Rivers, and significant electromagnetic anomalies were located along the margins of the ultrabasic bodies in the area west of Birch Inlet. Drilling of the most favourable e.m. anomalies, and follow up work on the area of geochemical anomalies is recommended.

An igneous complex of basalt, andesite and diorite sills and flows is intruded by diorite and granite plugs in the Timbertops area.

Thick Ordovician Owen Conglomerate occurs in a graben trending north from Mt. Osmund, and is overlain by Caroline Creek Sandstone which overlaps on the Cambrian rocks to the west and Precambrian rocks to the east.

The Deep Creek iron body is located at a faulted Cambrian-Precambrian contact. It is recommended that the area be opened up to enable a more detailed examination.

INTRODUCTION

Locality

The area described in this section of the report is bounded on the west by the coast from Cape Sorell to Low Rocky Point. The eastern boundary is taken at the Albert Creek Fault, a major structural bounday separating the deformed Older Precambrian rocks of the "Tyennan Geanticline" from the Precambrian and dominantly Lower Paleozoic rocks of the "West Coast Province".

The southern boundary is taken east from Low Rocky Point to the Albert Creek Fault, and the northern boundary extends along the coast of Macquarie Harbour to the mouth of the Gordon River, and along the Gordon River to Eagle Creek, and thence to the Albert Creek fault.

Topography and Vegetation

West of a line from Birch Inlet to Elliott Bay the remnants of a Pleistocene surface slope gently down at 1 in 50 to the west coast. The larger streams have cut deeply into this surface. The softer Cambrian rocks have been mostly heavily eroded and the surface is best preserved on the areas of Precambrian rocks.

The areas of Cambrian rocks carry a thick forest and dense scrub cover, and are very difficult to penetrate. The Precambrian areas are covered by peat which supports

button grass and heath.

Remnants of the old surface, 1,200 feet above sea level, occur along the western side of the ridge stretching from Thirkell Hill to Mt. Discovery.

A series of younger surfaces have been superimposed on this old surface, and extend from either side of Birch Inlet to Moores Valley, and slope gently down towards the north. The area is covered by thick peat and button grass, with a few patches of eucalypts, mainly along the streams.

South of Moores Valley the area is generally open and slightly undulating. The Lewis and Hudson Rivers have cut steep sided valleys up to 100 feet deep which have borders of forest.

East of the Thirkell Hill and Lewis Faults the area is more elevated and rugged, and rises to 2,600 feet at Mt. Lewis. It has a cover of button grass with thick forest belts along the streams.

The Olga-Hardwood Valley has a broad flat floor with a cover of button grass. Along the eastern side of the valley rugged strike ridges of Silurian rocks have a thick rain forest cover, and are difficult to penetrate.

Field Work

Most of the field work in the area was carried out between early January and late April, 1967. The areas of Precambrian rocks were examined by helicopter reconnaissance in conjunction with geochemical sampling of aeromagnetic and electromagnetic anomalies. The areas of Cambrian Volcanics were also examined in this manner.

Boat traverses were made for 30 miles along the Gordon River between the mouth and the junction with the Franklin River, and around the coast of Birch Inlet and Macquarie Harbour and along the lower Wanderer River.

Foot traverses were made along the

Foot traverses were made along the rivers and larger streams in the area of Cambrian rocks from Copper Creek to Macquarie Harbour, and along the 22 miles of track bulldozed in the area between the Hibbs River and Macquarie Harbour.

STRATIGRAPHY AND STRUCTURE

PRECAMBRIAN

Precambrian rocks west of the Albert Creek Fault occur in three belts, named the Western, Central and Eastern Precambrian Belts. The Western and Central Belts occur west and north-west of Birch Inlet, and the Eastern Belt is exposed between the west limb of the Olga Syncline and the fault along the east side of the Cambrian volcanics and intrusives.

Western Precambrian Belt

The Western Precambrian Belt extends south from Cape Sorell to a north-east striking fault extending from Lagoon Creek to the south coast of Macquarie Harbour. Cambrian rocks of the Double Cove Belt occur south-east of this fault.

The Precambrian rocks are dominantly white to grey massive quartzite with minor conglomerate, sandstone and graphitic phyllite. They strike north to north-east, and are isoclinally folded.

Central Precambrian Belt

The Central Precambrian Belt is bounded to the west by a fault, extending from Birthday Bay north-east to Macquarie Harbour, and to the east by the Modder Fault which extends from the mouth of the Hibbs River to Big Gravelly Beach on the south coast of Macquarie Harbour. The belt is a horst between Cambrian rocks to the west and east.

The rocks are mainly interbedded quartz-chlorite schist and graphitic phyllite with minor quartzite. They are isoclinally folded along N to NNE striking axes, and have prominent axial plane cleavage.

A small syenite body, a quarter of a mile across, intrudes these rocks on the coast between Birthday Bay and the Modder River. Thin veins of hematite and pyrite crystals up to one inch across occur in the country rocks close to the contacts.

The Cambrian rocks of the Double Cove Belt do not extend to the West Coast. Precambrian rocks occupy the entire coastline. They are similar to the rocks of the Western and Central Precambrian Belts, and at Big Creek include a band of limestone 1,500 feet thick.

Eastern Precambrian Belt

Precambrian rocks of the Eastern Precambrian Belt are divided into garnet and biotite grade, and chlorite grade regionally metamorphosed schists and quartzites.

The garnet and biotite grade schists occur in the View Hill area and in the headwaters of the northern tributaries of the Giblin River, and include the following members:

At top Knotted quartz-muscovite schist....2,100 ft.
Coarsely foliated, psammitic quartz-muscovite-biotite schist....6,300 ft.
Finely foliated, graphitic garnet schist.....1,000 ft.

South of View Hill the garnet schist appears to overlie quartzite and quartz schist, but the succession may be inverted.

Thin, faulted strips of these rocks occur west of the Giblin Syncline and west of Mt. Lewis.

The chlorite grade rocks are dominantly light coloured quartzite, quartz schist, and quartz-chlorite-muscovite schist, with minor black chlorite phyllite. They have been folded into a large anticline, the axis of which extends from the Sprent River to Frederick Hill, and to the south of Mt. Jean.

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CAMBRIAN

A succession of Cambrian geosynclinal sediments, at least 23,000 feet thick, but probably up to 40,000 feet thick, extends along the West Coast from the mouth of Sassafras Creek to Macquarie Harbour. North of the mouth of the Hibbs River the Cambrian rocks are faulted against Precambrian rocks to the west. Along much of their eastern boundary the Cambrian sediments are obscured beneath Tertiary and Quaternary gravels. Well exposed sections were examined in Copper and Sassafras Creeks, and the Mainwaring, Urquhart, Wanderer, Spero and Modder Rivers, and in a number of creeks along the west coast of Birch Inlet.

The base of the sequence is exposed in the upper Mainwaring River, in Copper Creek and at the mouth of Sassafras Creek. In the upper Mainwaring River the Lower Cambrian rhyolitic volcanics are overlain by 5,000 feet of medium green-grey, finely laminated, schistose tuffs with rare quartz phenocrysts. These tuffs extend north to the middle reaches of the Wanderer River, but appear to thin rapidly to the south and are absent from Copper Creek where dark phyllite overlies the rhyolites.

The phyllites are grey to black, very finely foliated, and locally banded dark grey and rusty orange. They are about 3,500 feet thick at Copper and Sassafras Creeks, and contain thin bands of light green-grey, very finely foliated tuffs up to 20 feet thick. These rocks thin to about 2,600 feet in the Mainwaring River, where they lose their phyllitic appearance, and are interbedded with a band of tuff 1,200 feet thick. To the north, in the Wanderer River, the sequence appears to pass laterally into the turbidites.

A further band of tuff 5,000 feet thick extends from Diorite Point to the Wanderer River. It is medium green but locally purple and maroon, and is finely foliated and has occasional quartz phenocrysts.

At Diorite Point individual bands become coarser, and contain shard-like inclusions of purple and green igneous rocks. Three hundred feet below the top of the formation in the Urquhart River is a band of conglomerate 100 feet thick containing angular pebbles up to one foot across, possibly derived from the immediately underlying rocks.

This tuff is overlain by a succession of argillites and greywacke sandstones, commonly showing graded bedding, which is at least 10,000 feet thick at the Urquhart River, at least 17,000 feet thick at the Wanderer River, and at least 15,000 feet thick at the Spero River. The total thickness of the sediments above the tuff is in the order of 23,000 feet.

Of the 17,000 feet at the Wanderer River 11,500 feet are greywacke, while at the Urquhart River they comprise 2,000 feet, and at the Spero River 4,500 feet. The greywackes are thus dominant adjacent to the Wanderer River, and individual horizons appear to thin both to the north and south. At the Spero River and north to Macquarie Harbour argillite dominates the succession and only minor bands of greywackes have been mapped along the west coast of Birch Inlet.

The argillites are finely laminated and green-grey to black with thin, laminated green and maroon bands. In the headwaters of the Modder River they contain a trilobite fauna dated as Upper Middle Cambrian.

The greywackes occur in both massive and graded bedded sequences, and may locally be crystal tuffs. At the Spero River massive, gritty greywacke occurs in ungraded bands six feet thick, and contains pebbles up to two inches across.

Graded bedding sequences are clearly exposed at the Wanderer, Urquhart and Mainwaring Rivers, and Cypress Creek.

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They grade from gritty, micaceous sandstone to very thin argillites in two to twelve inch cycles. Argillite bands are locally up to 10 feet thick.

At the east end of Endeavour Bay cycles grading from conglomerate to sandstone and argillite are set up to five feet thick. A number of conglomerate bands up to six feet thick contain angular quartz and chert fragments. Poorly preserved scour casts from the base of a sandstone bed are orientated 335° - 155°.

The Cambrian sediments show a marked increase in rank southward. The fine grained rocks would be best described as siltstones west of Birch Inled, argillites between the Spero and Mainwaring Rivers, and phyllites south of the Mainwaring River. Slatey cleavage is poorly developed north of the Wanderer River, but becomes pronounced south from the Urquhart River, and at Copper Creek is often difficult to distinguish from bedding.

The greywackes and tuffs become schistose south of the Wanderer River, and quartz veins become prominent.

Mesoscopic folding of the sediments is common south of the Urquhart River.

North from Sandy Point the strike of the cleavage varies from N 10°W to N50°W and generally dips steeply to the west. South of Copper Creek the cleavage strikes N20°W to N40°W and dips steeply south-westerly.

The strike of the bedding is close to north-south throughout the entire belt.

A number of thin andesitic flows and intrusions are interbedded with the sediments in the Mainwaring, Urquhart, and Wanderer Rivers.

CAMBRIAN IGNEOUS ROCKS

Volcanics

Cambrian volcanic rocks occur in a belt extending from the coast at Elliott Bay to just north of the Wanderer River, and are intruded by granitic rocks along their eastern margin and at Low Rocky Point. They are conformably overlain by Cambrian tuff and phyllite between the upper Mainwaring River and the mouth of Sassafras Creek, and are unconformably overlain by Ordovician conglomerate between the Wanderer River and Mt. Osmund.

The most common rock types in the belt are green-grey to pink "quartz porphyries" and "quartz-feldspar porphyries" which were originally acid lavas. It is difficult to distinguish continuous horizons over a large area, but local divisions can be made on phenocryst content and size.

In the upper Mainwaring River, immediately below the tuff at the base of the Cambrian sedimentary sequence, the following section of volcanic rocks is exposed:

At top	Quartz-feldspar porphyry Fine grained feldspar porphyry Quartz-feldspar porphyry	700 ft.
	Fine chloritic tuff	100 ft.
	Quartz-feldspar porphyry	300 ft.
	Chloritic tuff	100 ft.
	Quartz-feldspar porphyry Quartz porphyry	
At base	Quartz-feldspar porphyry	1,300 ft.

East of the Ordovician conglomerate at Mt. Osmund about 7,000 feet of volcanic rocks are exposed, and are divided into the following members:

At top	Tuff with rounded to sub-angular quartz and feldspar in a fine feldspathic matrix	200 ft.
	Quartz porphyry Quartz-feldspar porphyry Fine grained quartz-feldspar porphyry Quartz porphyry Quartz feldspar porphyry	5,200 ft.

Tuff with rounded quartz
and feldspar grains.....400 ft.

At base:

Quartz feldspar porphyry.....1,200 ft.

These rocks are cut by a prominent cleavage striking NE to NNE and dipping steeply to the west. The original layering is locally well preserved, particularly on the coast adjacent to the Lewis River, where it strikes N - S and dips west at 60°.

In thin section the lavas generally contain quartz and feldspar phenocrysts in a microcrystalline matrix composed of quartz and feldspar. The dominant feldspar is orthoclase (? sanidine). Plagioclase is uncommon, although oligoclase is the dominant feldspar in one thin section. These rocks are dominantly alkali rhyolites with minor dacites and rhyodacites (or toscanites).

Similar acid lavas with minor tuff bands are exposed in the core of an anticline in the headwaters of the Sprent and Condor Rivers, between the D'Aguilar Range and Innes Peak. These rocks are cut by a strong NNW striking schistosity which dips steeply west, and are unconformably overlain by Ordovician conglomerate.

Acid Intrusives

Two small bodies of biotite granite intrude the Cambrian acid lavas at Low Rocky Point and at the north-east corner of Elliott Bay, and cover five square miles and one square mile respectively.

The granite is dominantly coarse grained with crystals up to two inches long, but minor aplitic and porphyritic varieties were observed. It becomes schistose and fine grained at its margins.

Schistose quart-feldspar porphyry is exposed east of the granite at the north-east corner of Elliott Bay, and extends north for 12 miles as a belt up to two miles wide.

It intrudes the acid lavas to the west, and is faulted against Older Precambrian schists to the east. It has been intruded by the granite at the north-east corner of Elliott Bay.

The porphyry contains rounded, glassy quartz phenocrysts up to three quarters of an inch across and perthitic feldspar phenocrysts up to one inch long, in a fine grained quartz-chlorite matrix which wraps around the phenocrysts.

The granite has been dated (I. McDougall, A.N.U. pers. comm.) as pre-Devonian (405 million years minimum), and is probably Uppermost Cambrian

Ultrabasics

Long sill-like bodies of ultrabasic rocks are exposed in the Fern Creek and Noddy Creek areas, immediately north of Hibbs Lagoon, and at the mouth of the Spero River and Endeavour Bay. The rock types include pyroxenite, gabbro, serpentinite, talc and minor granodiorite.

The pyroxenite is green and composed dominantly of augite with individual crystals up to four inches long, but usually less than half an inch long. The gabbro and granodiorite are medium to coarse grained rocks, mottled green and white. Serpentinite occurs as both dark green and apple green varieties, and is usally highly sheared.

Between Hibbs Lagoon and Fern Creek a single body of ultrabasic rocks, 2,000 feet across, consists of medium and coarse grained pyroxenite with an enclosing sheath of dark green, sheared serpentinite.

South of Hibbs Lagoon the ultrabasics extend to Endeavour Bay, and the belt is 4,000 feet across at the mouth of the Spero River. At Hibbs Lagoon the ultrabasics enclose a narrow strip of hornfels. The country rocks at

the margin of the ultrabasics at the Spero River and Endeavour Bay are baked for only a short distance away from the contact.

North of Fern Creek the ultrabasics occur in two belts, and in the Noddy Creek area are separated by up to 2,500 feet of siltstone.

The western belt consists almost entirely of dark green serpentine, with thin margins of talc. The eastern belt is more variable and contains a large portion of gabbro. Talc occurs along the eastern margin of the belt.

A thin belt of serpentinite with margins of talc extends from Asbestos Point to Noddy Creek, where it is faulted against the eastern belt of the ultrabasics. Gabbro exposed at the head of Fern Creek is inferred to lie on the continuation of this belt.

The ultrabasics are interpreted as sills intruded into the enclosing sediments when they were substantially horizontal. They have been tilted vertically and a considerable amount of movement has taken place along their margins.

Low lying swampy areas underlain by ultrabasic rocks are commonly covered by a thin, cemented crust of angular limonite fragments.

Timbertops Igneous Complex

An area of lavas and intrusive rocks occurs around the nose and along the east side of the Timbertops Syncline, immediately west of Birch Inlet. The rocks in this complex range from basic to acid.

Lavas

Basalt is exposed in a number of streams flowing into Birch Inlet east of the syncline. It is a dense, black, finely crystalline rock.

The area mapped as basalt also includes thin bands of basaltic tuff, volcanic greywacke, and serpentinite, but boundaries are difficult to distinguish and correlation between different streams is impossible.

Andesite is interfingered with a sheared chloritic rock, sediments and diorite around the nose of the syncline. It is a dense, medium grey, porphyritic rock, distinguished in the field from basalt by its lighter colour and common phenocrysts.

Intrusives

Extremely sheared chloritic and granular talc occurs as narrow bands, and appears to form envelopes around the intrusive bodies.

Diorite occurs as sill-like and irregular lensoid shaped bodies around the nose of the syncline. The finer grained sill-like bodies are microdiorites, and the coarser grained, lensoid bodies include diorite and quartz-syenite. These coarser grained rocks are commonly partly chloritized and talcose.

Diorite also occurs in small, plug-like intrusions which form three hills immediately north-east of the nose of the Timbertops Syncline. The largest is elliptically shaped and 5,500 feet long and 2,000 feet across. Medium to fine grained, pinkish diorite and minor granite form the major part of the intrusions, which appear to have margins of fine grained quartz diorite.

These are the least altered of the igneous rocks in the Timbertops area, and are probably the youngest in the igneous complex, as they intrude all the other igneous groups. They probably acted as stable blocks during folding, and the sill-like bodies and lavas were "smeared" around them.

ORDOVICIAN

Owen Conglomerate

Owen Conglomerate is exposed in the Osmund Syncline,

and in the D'Aguilar Range, and in a belt from Mt. Discovery to Thirkell Hill where it forms the limbs of an anticline.

The thickest section is exposed along the Wanderer River on the east limb of the Osmund Syncline, where the formation is at least 5,900 feet thick. In this section the conglomerate includes the following members:

At top:

Pink conglomerate with occasional hematite pebbles	500 ft.
Thick bedded quartz pebble conglomerate	700 ft.
Thick bedded quartz sandstone	250 ft.
White quartz pebble conglomerate	250 ft.
Alternating bands of quartz sandstone and quartz pebble conglomerate	300 ft.
Thick bedded quartz pebble conglomerate	800 ft.
Micaceous quartz sandstone	250 ft.
Thin bedded quartz pebble conglomerate	50 ft.
Micaceous quartz sandstone	950 ft.
Light grey shale	50 ft.
Thin bedded quartz sandstone and thick bedded quartz pebble conglomerate	900 ft.
Thick bedded conglomerate with quartz, quartzite and chert pebbles up to six inches across	900 ft.

Facies variations are common in the Osmund Syncline, but the conglomerate members predominate, and the pebble size (average one inch) remains constant through the entire section.

The Osmund Syncline is an asymmetric structure plunging 20° north. The rocks on the west limb dip at 70°, and on the east limb dip at 40°. To the east the conglomerate rests unconformably on the Cambrian volcanics, and to the west is faulted against both the Cambrian volcanics and sediments.

Owen Conglomerate is 1,100 feet thick in the belt extending from Mt. Discovery to Thirkell Hill, and dips 30° to 80° west. It is composed of 850 feet of siliceous pebble conglomerate in bands one to two feet thick, overlying 250 feet of fine pebble conglomerate with poorly sorted basal beds, containing sub-angular fragments of schist and slate up to one foot across. This basal member rests unconformably on Cambrian volcanics. The pebble size decreases upwards through the conglomerate, which is overlain by coarse quartz sandstone with thin pebble bands.

Similar conglomerate is exposed on the D'Aguilar Range south-east of Mt. Discovery, but appears to thin to the south-east and pass laterally into quartz sandstone.

Interpretation of measured and estimated sections of Owen Conglomerate shows that the formation occurs in an elongate trough, probably a graben, extending from south of Mt. Osmund to the Queenstown area. East and west of the trough Caroline Creek Sandstone with minor pebble bands rests unconformably on the underlying rocks.

Caroline Creek Sandstone

Caroline Creek Sandstone is exposed in the Timbertops Syncline and headwaters of the Modder River, in the Mt. Discovery area, on the Elliott and King Billy Ranges, along the west side of the Olga Valley, and at the head of the northern tributaries of the Giblin River.

In the upper Modder River the formation is about 500 feet thick, and consists of laminated, white to cream quartz sandstone with thin bands of white and pink fine grained conglomerate. There is no evidence of a break beneath the formation and it has been mapped as resting unconformably on the underlying siltstone.

In the Timbertops Syncline the Caroline Creek Sandstone is about 2,100 feet thick, and includes three members, each about 700 feet thick. The lower and upper members are white quartz sandstones, and the middle member is a grey, micaceous siltstone. Lower Ordovician fossils have been collected from the lower and middle members of the formation.

The lower sandstone also occurs as a faulted outlier east of the Timbertops Syncline.

At both the Timbertops Syncline and the locality to the east, the Caroline Creek Sandstone rests unconformably on the underlying Cambrian Rocks.

South of Mt. Discovery the formation overlies the Owen Conglomerate, and is 1,200 feet thick. It comprises the following members:

At top:

Beds of grey micaceous sandstone and green grey shale six to twelve inches thick.....450 ft.

Soft green-grey micaceous shale.....70 ft.

Alternating bands of sandstone and shale with thin pebble bands six inches thick.....280 ft.

Green, micaceous quartz sandstone with thin shale and pebble bands.....400 ft.

Similar rocks are exposed in the King Billy and Elliott Ranges and along the Gordon River. They are up to 1,200 feet thick at the King Billy Range, and unconformably overlie Older Precambrian rocks.

Along the west side of the Olga and Hardwood Valleys 400 feet of Caroline Creek sandstone rests on Older Precambrian rocks. The sandstone is friable, light grey in colour, well bedded, and contains scattered pebbles and thin bands.

The sandstone is exposed on both limbs of the Olga Syncline south of the junction of the Davey and Hardwood Rivers, and has been strongly drag folded. Between the Crossing River and the lower Spring River it occurs as a series of isolated outliers.

About 600 feet of the Caroline Creek Sandstone is exposed around the nose of the south plunging Giblin Syncline. Here it is a grey to white quartz sandstone in bands of one foot thick.

Gordon Limestone

Gordon Limestone conformably overlies Caroline Creek Sandstone in the Timbertops, Olga and Giblin Synclines, in the upper Modder River, and along the Gordon River between Eagle and Kinghorne Creeks. It is at least 3,000 feet thick, and consists of a fine grained, light grey to black, crystalline limestone.

In the upper Modder River 770 feet of Gordon Limestone is exposed, and is divided into the following members:

At top (faulted)

Fine crystalline limestone.....200 ft.
Purple shale.....10 ft.
White quartz sandstone.....60 ft.
Grey limestone.....500 ft.

To the south the sandstone member thickens to 650 feet and is locally a maroon quartzite, and the lower limestone thins to 200 feet.

SILURIAN

Silurian rocks are exposed along the lower Gordon River, and along the eastern side of the Olga Syncline. They include shale and quartzite, but were not examined in detail.

DEVONIAN, PERMIAN, JURASSIC

Middle Devonian marine sediments and basal Permian tillite which is intruded by dolerite are exposed at Point Hibbs, and have been described by Banks (1957).

TERTIARY

Tertiary rocks occupy the Macquarie Harbour Graben which extends north from the Moores Valley area to the south-east corner of Macquarie Harbour, and then north-west along Macquarie Harbour. The Tertiary rocks are 600 feet thick at Moores Valley, and thicken to at least 5,000 feet near Strahan. (D. Johnson, pers. comm.). They consist of semi-consolidated gravel and sand beds, and contain a number of thin lignite beds.

QUATERNARY

Quaternary gravels form a number of well developed surfaces west of the D'Aguilar Range. An outwash surface (Henty Surface) slopes gently towards the west coast from the foot of the D'Aguilar Range, but along the Macquarie Harbour Graben it has a flight of younger terraces superimposed on it. The gravels are well rounded, and consist almost entirely of quartz and quartzite pebbles.

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THE GEOLOGY OF THE CENTRAL AND SOUTH-EAST AREAS

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BY

W.D.M. HALL and M.H. McINTYRE

S U M M A R Y

Older Precambrian quartzite and quartz and pelitic schists form the core of the Tyennan Geanticline, and are folded into isoclinal structures dipping towards the east. Pelitic garnet schist just east of the junction of the Gordon and Serpentine Rivers is covered by a weak aeromagnetic anomaly and contains pyrite and possible chalcopyrite, and should be covered by geochemical stream sediment sampling.

Younger Precambrian rocks include dolomite, quartzite and phyllite and are gently folded into NW trending structures. Reports that Cambrian rocks occur in the area thought to be occupied by Younger Precambrian rocks, should be followed up as Cambrian ultrabasics are known from the Weld Valley.

Lower and Middle Cambrian geosynclinal sediments including turbidites, argillite and chert are intruded by ultrabasics along the Boyes River Valley and at Adamsfield. The Boyes River area should be examined in more geological detail and by geochemical stream sediment sampling, and ground geophysics.

Upper Cambrian and Lower Ordovician breccia, conglomerate and sandstone, and Upper Ordovician and Silurian limestone, argillite and quartzite overlap on to Precambrian rocks. The conglomerate members are 12,000 feet thick and partly of freshwater origin. An airborne radiometric survey is recommended to cover the conglomerate.

Flat lying Permian and Triassic sediments intruded by a thick dolerite sill unconformably overlie the Precambrian and Lower Palaeozoic rocks in the south-east area, and are of little economic interest.

INTRODUCTION

The Central and South-east areas were examined by helicopter reconnaissance during October and November 1966, and by a ground traverse along the Gordon River Road.

The area is rugged and mountainous. In the Central area long, parallel ranges strike generally north-south, but swing to the east south of Lake Pedder. Broad areas of alluvium occupy the larger valleys. The south-east area is dominated by rugged dolerite peaks, and broad, flat-topped ridges formed on the horizontal Permian and Triassic rocks.

STRATIGRAPHY AND STRUCTURE

OLDER PRECAMBRIAN

Strongly deformed Older Precambrian rocks of the "Tyennan Geanticline" outcrop in the central portion of the Licence area. They are bounded on the west and south by the Albert Creek Fault, and to the north and east are locally faulted against, and unconformably overlain by, Younger Precambrian and Palaeozoic sediments.

The Older Precambrian rocks consist of quartzite and quartz schist with minor green schist and graphitic schist, all of chlorite grade, and pelitic schist of garnet grade.

These rocks are folded into a series of isoclinal folds with steep easterly dipping axial planes, but along the eastern edge of the belt, north of the Gordon River the fold axes become flatter and the majority of the folds are recumbent. North of the Gordon River Road the fold axes generally strike north-south, but swing to the north-east between the upper Denison and Gordon Valleys. South of the Gordon River Road the fold axes swing to the east and abut against the Lake edgar Fault.

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The Older Precambrian rocks are interpreted as regionally metamorphosed schists which were originally folded along north-south striking axes, and were locally thrust towards the west. Where the garnet grade rocks are exposed they usually occupy elongate anticlinal cores. A significant outcrop of garnet grade rocks occupies the core of an apparent syncline about two miles east of the junction of the Gordon and Serpentine Rivers. This structure is probably bounded by a thrust along its western margin.

Older Precambrian rocks east of the Lake Edgar Fault are exposed on the Jubilee Range, east and west of Mount Anne, on Schnells Ridge, and between the Huon and Lower Cracroft Rivers. Apart from the outcrops between the Huon and Cracroft Rivers the rocks are dominantly well-bedded, ripple marked and locally cross-bedded white and pink quartzites, and are at least 10,000 feet thick. They are folded into broad NNW to NW trending structures.

Along the Huon and Cracroft Rivers grey-black and white quartzite is interbedded with black phyllite and quartz-chlorite schist. These rocks are also folded into a NNW trending anticline, but to the west they are apparantly overlain by finely-foliated pelitic, quartz-chlorite-garnet schist with a well developed axial plane cleavage cutting the foliation at an angle of 80°.

YOUNGER PRECAMBRIAN

Younger Precambrian rocks occur in three localities:

1. North of Upper Weld River.
2. Mt. Anne Area
3. Along the Huon River between Mt. Picton and Schells Ridge.

They are dominantly dolomitic but phyllite, conglomerate, breccia and sandstone also occur.

In the Upper Weld River, immediately west of the Jubilee Range, fine grained, pale brown to maroon siltstone contains occasional bands of coarser, more siliceous and micaceous material.

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The rocks strike N 60° W and dip 75° N.

Quartzite pebble and cobble breccia occurs on the north-east slopes of Mt. Bowes and between Mt. Bowes and Mt. Mueller. The pebbles consist of sub-rounded to sub-angular white, pink, and smokey grey quartzite in a silicified sandy matrix. Bedding is indistinct but one outcrop strikes NW and dips fairly steeply NE. These rocks appear to be faulted against the siltstone extending from the Jubilee Range.

Poorly outcropping white quartzite south-west of Mt. Mueller is folded into a northerly trending and gently plunging anticline.

At Mt. Anne at least 250 feet of pale brown to pale green dolomite siltstone underlies thin Permian sediments and Jurassic dolerite. The bedding strikes N 30° E and dips 45°NW and is cut by a well developed cleavage which strikes N 65°W and dips 75° SW.

About 3,500 feet of light grey siliceous dolomite occurs on the ridge running north from Mt. Anne. It strikes N 45°W and dips 45° SW and is overlain conformably by about 200 feet of maroon sandstone and fine breccia. Large sink holes, to a depth of at least 150 feet, have developed in the dolomite.

In the Huon River north of Mt. Picton, dolomite is associated with coarsely foliated, silver-white phyllite striking N 20°W and dipping 55° NE. It is overlain unconformably to the south by Permian sediments and to the east by Younger Precambrian grey quartzite and blue-grey mudstone striking N 45°W and dipping 70°NE.

Slightly stretched pebble conglomerate and sandstone between Schnells Ridge and the Huon River is faulted against the Schnells Ridge Quartzite. The conglomerate consists of red-brown, green and white quartz pebbles and is interbedded with medium to coarse grained, slightly schistose sandstone. The bedding strikes N40°E and dips 70°NW, while an indistinct cleavage strikes N70°W and dips 45 °N.

The Younger Precambrian dolomitic rocks are correlated with the Jane Dolomite.

CAMBRIAN, ORDOVICIAN, SILURIAN

Cambrian geosynclinal sediments unconformably overlie Older Precambrian rocks west of the Lake Edgar Fault. They extend from the Boyes Valley to the Sentinel Range, and east to Mt. Bowes. The most complete section is exposed along the Gordon River Road, and includes the following rock types:

At top:

Maroon argillite with chert bands.....2,000ft.
Greywacke sandstone.....2,000 ft.
Grey argillite.....300 ft.
Greywacke sandstone.....700 ft.
Maroon argillite with chert bands.....3,500 ft.
Sandy turbidites.....6,500 ft.

At base:

Conglomerate and grit with thin sandstone and siltstone bands.....6,500 ft.

These Cambrian rocks have been intruded by ultrabasics along the Boyes River Valley, and in a belt stretching from Adamsfield to the Upper Florentine River Valley.

The geosynclinal sequence is unconformably overlain by up to 12,000 feet of Upper Cambrian and Lower Ordovician breccia, conglomerate and sandstone, and at least 5,000 feet of Middle and Upper Ordovician limestone and Silurian argillite and quartzite.

The basal conglomerate overlaps the Cambrian rocks north of the Boyes River and extends on to the Older Precambrian metamorphics. East of the Upper Florentine River it extends on to Younger Precambrian rocks. Abundant serpentinite fragments and grains of chromite in the conglomerate indicate that the ultrabasic bodies were originally emplaced during the Middle Cambrian. The ultrabasics of the Adamsfield-Florentine River area appear to have been re-intruded along a major fault zone (i.e. the northern extension of the Lake Edgar Fault).

PERMIAN

Permian rocks are widespread in the south-east area. They consist of conglomerate, sandstone, mudstone and tillite and are flat-lying, or dip gently east to south-east.

Up to 250 feet of fine grained, well-bedded, grey-green sandstone and fine, grey, quartzite conglomerate underlie the dolerite caps of Mt. Anne and Mt. Sarah Jane. They overlie Older Precambrian quartzite at Mt. Sarah Jane, and Younger Precambrian dolomitic siltstone at Mt. Anne.

Well-bedded, medium to coarse grained, grey-brown quartz sandstone up to 1,500 feet thick underlies Triassic sandstone and Jurassic dolerite at Mt. Weld.

Wynyard Tillite (Basal Permian?) has been reported from the Weld River north of Mt. Weld (Lewis, 1924) and during the present survey was observed in the Huon River south of Mt. Weld. The presence of fossils in the tillite from the Huon River Suggests re-working or marine deposition.

At Mt. Picton up to 1,400 feet of quartzite pebble and cobble conglomerate and grey to green-brown sandstone underlies rocks of Jurassic and Triassic age.

Up to 1,200 feet of Permian sandstone, mudstone, conglomerate and tillite underlie the dolerite cap of Mt. Mueller.

A complex Permian sequence occurs in the Styx Range (Jago, 1965) north of the Snowy Range. At least part of this sequence extends to the Snowy Range where it is overlain by Jurassic and Triassic rocks.

TRIASSIC

Triassic rocks are widespread towards the eastern boundary of E.L. 13/65. They are flat or dip gently (less than 10 degrees) east to south-east, and consist

of coarse grained, white, cross-bedded sandstone, fine grained brown sandstone, and well-sorted medium grained, green-brown to white sandstone.

At Mt. Bobs about 800 feet of grey and green-brown sandstone containing occasional pebbles of quartzite and siltstone, quartzite pebble conglomerate with dark sandy matrix and well-bedded (up to 3 inches), pale green to white, fossiliferous sandstone overlies dolerite. The sediments dip up to 25°E adjacent to the dolerite sediment contact, but otherwise are flat or dip gently east.

JURASSIC

Remnants of Jurassic dolerite up to 1,500 feet thick form the peaks of the higher mountains including Mts. Anne, Picton, Weld, Sarah Jane, Mueller and the Snowy Range. It was intruded slightly discordantly into sub-horizontal Permian and Triassic sediments, although at Mt. Anne and Mt. Sarah Jane it also overlies Precambrian rocks. In one small area (800 x 400 yards) on the Mt. Anne Plateau the dolerite is overlain by Precambrian quartzite.

QUATERNARY

Most of the higher mountains in the area have been significantly modified by Pleistocene glaciation and evidence remains in the form of cirques, weathered lateral and terminal moraines, and moraine-dammed glacial lakes.

THE GEOLOGY OF THE NORTH-EAST AREA

By K. Hall

SUMMARY

In the north-east portion of E.L. 13/65, flat lying Permian mudstone and Triassic sandstone are intruded by two substantially concordant dolerite sills. These rocks have been dislocated by a series of north-west trending normal faults along the Derwent Graben.

Bauxite developed on the dolerite surface has largely been eroded, and is locally covered by lacustrine sediments and basalt.

The area was covered by the 1965-66 aeromagnetic survey, but correlation with geology indicates the anomalies are not significant economically. Most of the anomalies recorded can be explained by the presence of dolerite. No prospective occurrences of economic mineralisation were detected.

INTRODUCTION

During January and February 1967, four weeks were spent mapping 195 square miles in the Ouse and Ellendale 1 inch to 1 miles sheet areas in the north-east portion of E.L. 13/65.

The purpose of the investigation was to complete reconnaissance geological work in the north-eastern portion of E.L. 13/65, and in particular to examine the dolerite surfaces for bauxite development, and to examine the airborne geophysical anomalies.

One inch to 20 chains aerial photographs were used for field plotting in the area covered by the Ouse sheet, and 1 inch to 40 chain photos were used for the Ellendale sheet.

Photo plotting was transferred to field sheets at the same scale as the aerial photos.

PHYSIOGRAPHY

The physiography is largely controlled by the structure and the occurrence of large dolerite sheets.

The western part of the area is dominated by an extensive high level dolerite plateau, and is bounded to the east by a system of NW trending faults. To the east small dolerite plateaux rise above more gently undulating country. Basalt remnants of a formerly extensive sheet form characteristic steep rounded hills.

Generally the sandstone weathers fairly uniformly to give gently undulating topography, but in places steep river valleys have been formed.

The main streams draining the area are the Derwent, Dee and Ouse Rivers. They have meandering courses and extensive river terraces and alluvium deposits along their banks.

On the dolerite plateau in the west drainage is largely controlled by large joints and faults. It is poorly developed and swamps are common.

STRATIGRAPHY

Stratigraphic Table

Sedimentary Rocks

AGE	FORMATION	LITHOLOGY
Quaternary		Alluvium
Tertiary		Limonitic lacustrine sandstone and clays. Bauxite
Triassic	Feldspathic Sandstone	Feldspathic sandstone with interbedded shale
	Langloh Coal Measures	Carbonaceous sandstone and shales
	Knockloty Sandstones	Sandstone and shale
	Ross Sandstone	Quartz sandstone with conglomerate
Permian	Ferntree Mudstone	Mudstone

Igneous Rocks

AGE	FORMATION	LITHOLOGY
Tertiary		Fine grained olivine basalt.
Jurassic		Dolerite and granophyre.

SEDIMENTARY ROCKS

PERMIAN

The Ferntree Mudstone, uppermost formation of the Permian in Tasmania, is named from the type section of Ferntree, west of Hobart. In the Ellendale area it consists of a well-bedded, medium grey gritty mudstone and underlies Triassic sandstone. The outcrops are confined to two faulted areas in the Ellendale Sheet district west of the Derwent River.

TRIASSIC

The Triassic rocks are divided into four formations:

At top: Feldspathic Sandstone
Langloh Coal Measures
Knocklofty Sandstone
Ross Sandstone

The formations are often difficult to distinguish and pass laterally into one another. During the present survey the Triassic was mapped as a single unit, but distinct outcrops of the various members were noted.

No type section of the Ross Sandstone has been described, but the term applies to the medium grained micaceous quartz sandstone which occurs at the base of the Triassic sequence. The colour of the sandstone varies from white to yellow-brown, and is red on weathered surfaces.

The soil formed on the sandstone is fine and sandy, and supports a bracken and heath vegetation.

The Ross Sandstone occurs extensively throughout the area. It is well exposed along the Strickland Road where it outcrops showing cross-bedding and well developed slump structures.

The sandstone disconformably overlies the Ferntree Mudstone in the Ellendale area, and is locally intruded by dolerite and overlain by basalt.

The Knocklofty Sandstone is named from the type section in the Knocklofty-Cascades area of Hobart where the formation is at least 800 feet thick and consists of bedded sandstones with minor, friable shales. In the north-east area of E.L. 13/65 it consists of at least 500 feet of alternating sandstones, shales, and claystones. The sandstones vary from fine grained sandstone to a coarse grit. They are micaceous and often show cross-bedding and ripple marks. The argillaceous members are usually grey and interfinger with sandstones. A dark grey loamy sand soil is formed on these rocks.

The Knocklofty sandstone generally forms poor outcrops, but is well exposed along the Ouse River north of Ouse and in the road cutting at the south end of the Dunrobin Bridge.

The Langloh Coal Measures occur immediately south of Norley Trig. on the eastern edge of the area mapped.

The Feldspathic Sandstone is named from rocks overlying coal measures near Triabunna, but no type section has been assigned. The rocks consist of medium to fine grained feldspathic sandstone with shale bands. The sandstone is a light coloured rock consisting of quartz, feldspar, mica and rock fragments set in an argillaceous matrix, and has a "salt and pepper" appearance. The fine grained shale members vary in colour from white to dark grey, and are fissile and micaceous.

The formation formspoor outcrops but is exposed along the road to the Wayatinah Power Station, and along the Tarraleah Highway just east of the Liapootah Power Station.

TERTIARY

Tertiary lacustrine sediments occur on the east bank of the Derwent River near Dunrobin Bridge, at Thistle Hill west of Ouse, and to the north of the Tarraleah Highway between the Dee and Kenmere Rivers. They cover an area of approximately 20 square miles, and consist of poorly sorted ferruginous sandstones and claystones, with coarse bedding and slump structures. They weather to a white or grey sandy soil with some limonite staining and limonitic nodules.

The Tertiary sediments unconformably overlie older rocks and are locally covered by Tertiary basalt.

QUATERNARY

The Quaternary deposits consist of alluvium, scree, talus, and river gravels, mainly developed along the valleys of the Derwent, Ouse and Dee Rivers. On the western dolerite plateau alluvium deposits occur at the Father of Marshes and Newton's Marsh west of the Dee River, and cover an area of 3 square miles.

IGNEOUS ROCKS

Dolerite

Dolerite occurs extensively in the area. It is intruded into Triassic sediments as both concordant and discordant sheets. An upper and lower sill are exposed. The lower sill was observed only in the bed of Kenmere Rivulet south of Victoria Valley, along the Dee River and in Duck Creek. Sixty to 100 feet of Ross Sandstone occurs between the two dolerite sills at these localities.

The dolerite is predominantly coarse to medium grained, and grey in colour. Granophyric variations have been observed beside the Strickland Road near its junction with the Lyell Highway.

At the edges of the sills the dolerite is fine grained with slightly chilled margins. The effect of contact metamorphism is very slight, and shales adjacent to the contact are slightly baked but there are no effects ten feet from the contact.

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The dolerite locally shows columnar jointing and spheroidal weathering. The steep slopes of the dolerite plateau to the west of Ellendale are mantled with dolerite talus. The soil formed on the dolerite is a thin reddish-brown clay loam and is well exposed along the road between Liapootah Power Station and Wayatinah.

Laterisation during the early Tertiary formed bauxite depostis (see section on Economic Geology).

Basalt

Black to dark grey olivine basalt occurs on the Ouse sheet area between Ouse and Wayatinah Lagoon, and along the Strickland Road and south-east of Ouse. Basalt also occurs south of the Derwent River in the Ellendale sheet area.

The outcrops are remnants of a formerly extensive flow along the Derwent Valley and consist of olivine and plagioclase phenocrysts in a glassy ground mass. Olivine crystals are larger and more common at the base of the flow. Scoriaceous basalt agglomerate occurs near James Lookout and on the Tarraleah Highway two miles east of the Liapootah Power Station.

A dark chocolate brown soil is developed on the basalt. Areas of sandstone covered by this soil south of the Derwent River indicate that the basalt originally covered a much larger area.

STRUCTURE

The Permian and Triassic sediments are generally flat lying but dip locally 15° in a north-east direction. They are intruded by dolerite sills which generally appear to be sconcordant with the sediments.

The area is cut by a number of north-west trending Tertiary faults.

These are normal faults with the downthrown side generally to the north-east. The fault south of Mt. Shawfield (Ouse sheet) shows a lateral displacement of about half a mile in a clockwise sense.

These faults form part of the complex fault system along the Derwent Graben. The Tertiary sediments formed in lakes along the grabens and were covered by extrusions of basalt.

GEOPHYSICS

No further geophysical work has been carried out in this area since the Aeromagnetic survey of Aero Services Ltd. in December 1966.

The geology of the areas over which anomalies occurred was examined during this field exercise and the following notes made:

Anomaly 20 occurs over the alluvial deposits of the Father of Marshes, deposited on basalt and adjacent to a faulted contact with dolerite.

Anomaly 21 occurs at 461,000E 786,000N over Triassic Sandstones.

Anomaly 23 occurs on dolerite beside Gulf Creek south of Wayatinah Power Station.

Anomaly 24 occurs over basalt over dolerite adjacent to a fault at co-ordinates 454,000E 777,000N.

Anomaly 26 occurs over the contact between a sandstone raft and dolerite, on the Derwent River at 456,000E and 768,000N.

Anomaly 32 occurs on dolerite at 458,000E 755,000N.

Anomaly 34 occurs over a small dolerite outcrop about one mile long and a quarter mile wide abutting Triassic Sandstone, south of Dunrobin Bridge.

ECONOMIC GEOLOGY

Lateritic bauxite is developed on the dolerite surface in the Ouse area and is described by Owen (1954). The deposits probably developed during the early Tertiary before faulting, and are the result of the leaching of the dolerite.

Locally the bauxite is covered by Tertiary sediments and basalt.

The bauxite outcrops are reddish-brown, and pisolitic or nodular. No outcrops of bauxite were found other than those already delineated and tested by the Tasmania Mines Department and the Bureau of Mineral Resources.

In the Ouse area there are two main deposits, one about two and a half miles north-north-west of Ouse near the Lanes Tier Road, with 425,000 long tons proved, and the other one and a half miles south-south-west of Ouse on the western flank of Thistle Hill, containing 202,000 long tons. At Thistle Hill the bodies dip east into the hill. These deposits are probably remnants of a former gently continuous and widespread sheet. There is a small lenticular body about 1190 feet by 80 feet exposed in a creek just west of the Dee River, north of where it is crossed by the Tarraleah Highway. Several smaller deposits also occur in the Ouse area, but none is of economic grade.

PROSPECTIVE AREAS

Evidence of mineralisation has been discovered in the following areas of E.L. 13/65.

1. Asbestos Point, Macquarie Harbour.
2. Birthday Bay, West Coast.
3. Pelias Cove, Macquarie Harbour.
4. Jukes-Darwin Area, West Coast Range.
5. Nicholls Range, near junction of Gordon and Maxwell Rivers.
6. Jane River, north-central portion of area.
7. Deep Creek, West Coast.
8. Humboldt Mine, east-central portion of area.
9. Penders Prospect, Lewis River, West Coast.
10. Hazell Hill, Wanderers River, West Coast.
11. Kelly Basin, Port Davey.
12. Elliott Bay, West Coast.
13. Gordon River, near junction with Holley River.
14. Gordon-Serpentine River Area.
15. Cypress Creek, West Coast.
16. Hibbs River Belt, Macquarie Harbour and West Coast.

1. Asbestos Point

Asbestos Point is situated at the northern end of the Hibbs Belt on the southern shore of Macquarie Harbour. The asbestos occurrences in this area have been the subject of four Mines Department reports (Hills, 1914; Nye, 1929; Rae, 1941; and Taylor, 1955).

An asbestos reward was granted over the area in 1900 but very little work was done during the five year currency of the lease. The deposit was worked during 1914, and at least 6.8 tons of hand-picked, long-length fibre were mined from small opencuts and trenches (Nye, 1929).

Two men prospected the area in 1941, and concluded that further prospecting was not warranted more than six chains inland.

Rae (1941) measured 5% asbestos veins in a small quarry three chains south of Asbestos Point, and considered the deposit to be on the borderline of profitable exploitation.

Taylor (1955) described the deposit, including the old trenches, in detail. He concluded that the old prospectors had worked out the few rich patches of fibre, and the area did not warrant further exploration.

The work carried out on this deposit has consisted of geological examination, and prospecting and mining of the rich surface patches of fibre. Nothing is known of the deposit at depth, and no attempt has been made to estimate or measure reserves.

Most of the ore mined consisted of long, hand-picked fibre, and it is possible that the deposit contains economic amounts of short fibre that is amenable to modern extraction techniques.

Future exploration in the area should include geological mapping, and measurement of asbestos vein lengths, widths and areal concentration. This would best be done by costeaning with a bulldozer along the southern extension of the ultrabasics.

2. Birthday Bay

Birthday Bay is situated on the West Coast 18 miles south of Cape Sorell. The copper occurrences in the area have been described by Waller (1902).

Chalcopyrite, bornite and copper carbonates have been very briefly worked in the Birthday Bay area between Big Creek and Birthday Creek. Trenches and prospect holes were sunk along the beach, but only a few tons of ore were mined. The copper occurrences are evidently only a surface feature and diminish rapidly with depth. One trench yielded about two tons of 40% Cu ore from a chalcocite rich gossan.

Specular hematite and pyrite in calcite veins up to

three inches thick occur on the southern margins of a small syenite body on the coast three miles south of the copper prospect. Analysis of the hematite and pyrite indicated only trace quantities of copper, lead and zinc.

No further work is recommended in this area.

3. Pelias Cove.

Pelias Cove is situated immediately east of Double Cove on the southern shore of Macquarie Harbour.

Hematite with minor sulphides is exposed over a width of 39 feet on the beach at Pelias Cove. Six shallow holes (maximum depth 122 feet) drilled by L.E.E. during 1957 (Scott, 1960) indicated six to ten feet of hematite overlying friable greywacke. Two samples of the hematite averaged 0.12% Cu, 0.75% Pb, 1.0% Zn and 40.2% Fe.

The prospect was abandoned after the drilling and a ground electromagnetic survey indicated that the mineralisation did not persist along the strike.

The area is in the Double Cove Belt, and should be examined by stream sediment sampling and geological mapping.

4. Jukes-Darwin Area

The Jukes-Darwin area lies 16 miles south-east of Strahan. It is rugged and isolated with Mt. Darwin and Mt. Jukes rising 3,383 and 3,833 feet respectively.

Four main mineral prospect areas are known. These are Jukes Pty., Findons, Lake Jukes and Prince Darwin. Ground access to all prospects is limited to foot tracks.

The area has been fairly well examined by prospectors during the past 70 years, and although the structural and stratigraphic setting is favourable and minor sulphide mineralisation is known, no economic ore bodies have beenoutlined.

Evidence of copper mineralization was found at Mt. Jukes in 1897 and in the Darwin area the following year. These areas were actively explored during the next few years, but most exploration ceased when the North Lyell Company closed down its smelter at Crotty.

Various Government geologist and geologist of the Mt. Lyell Mining and Railway Company examined the area during the next 50 years, but all concluded that the area was too isolated to justify further work.

In the 1950's the Mt. Lyell Company again examined the Jukes-Darwin area, and regional mapping was carried out and a ground geophysical survey recommended.

Parts of the area were briefly examined by L.E.E. during the period 1957-60, and two diamond drill holes were sunk at Lake Jukes without success.

The United States Metals Refining Company carried out a detailed literature research and ground geophysical and geological survey in part of the area in 1964 (Gilfillan, 1964). They concluded that although the area appeared favourable for copper accumulation, the known mineralization was not of sufficient intensity to justify drilling.

Geophysical surveys in the area have been carried out by L.E.E., the B.M.R. and the U.S. Metals Refining Company but did not result in any drilling programs, except for two holes at Lake Jukes.

<u>The Prince Darwin Prospect</u> has sulphide mineralization associated with a zone of hematite and magnetite 500 feet long, 150 feet wide and at least 250 feet deep. Surface and adit sampling indicate 0.5% Cu, and 2.5 dwts/tonAg and traces of Au. Leaching appears to have removed the copper from the iron rich outcrop, and there is no indication of secondary enrichment and no evidence to indicate greater concentrations of copper at depth or along the strike.

Findons Prospect has been tested with pits, adits and trenches. A zone of disseminated pyrite and chalcopyrite 20 feet wide is exposed in the trenches, but could not be traced along the strike. A self potential survey of the area did not indicate any anomalies.

The Jukes Pty. Prospect is a sheared zone, 200 feet wide, containing disseminated pyrite and chalcopyrite with some hematite and magnetite, and has been tested with adits and trenches. Early assay information indicates that high grade copper ore, probably from minor ore shoots, has been extracted but that no large ore-body exists.

The Lake Jukes Prospect was tested with adits and two diamond drill holes. Copper mineralization consists of rich bornite veins and disseminated chalcopyrite, but all the veins investigated during the early mining did not persist in length or depth. The diamond drill holes did not intersect ore of economic interest (L.E.E. Annual Report, 1957).

The Jukes-Darwin area has been examined several times in the last 70 years without any orebody being located. Known copper mineralization occurs mainly as disseminated chalcopyrite in uneconomic quantities. Before any further work is undertaken in the area, a thorough examination and compilation should be made of any anomalous areas (both geological and geophysical) that have not been tested, or have been insufficiently tested.

The obviously mineralised areas appear to have been discovered and prospected, but the most efficient and effective method of undertaking an overall assessment of the area appears to be a stream sampling program of the area of Cambrian rocks. This is recommended.

5. Nicholls Range

The Nicholls Range copper prospects occur on the eastern side of the Nicholls Range about four miles north of the junction of the Gordon and Maxwell Rivers.

The prospect was examined and sampled by Blake (1938) who considered that a limited amount of developmental work was warranted to test the deposit for possible enrichments. The mineralization occurs as small blebs and veinlets of chalcopyrite and pyrite along the schistosity planes of mica, quartz-mica and chloritic schists. Chip samples of the most conspicuous leached zone of the deposit averaged 1.96% Cu over a width of 11 feet.

The prospect was examined by L.E.E. (Wade, 1956) and a tape and compass survey was made of the area. Two separate mineralized horizons were located, each about 12 feet wide and separated by 20 feet of barren rock. One horizon was 40 feet long. Seven samples from the mineralised zones averaged 1.05% Cu. Copper minerals observed included chalcopyrite, covellite, chalcanthite, azurite, native copper and malachite.

This is a low grade copper deposit of unknown, but probably small extent, and occurs in an extremely isolated area of west-central Tasmania. Examination of the prospect has been limited to surface sampling and brief geological mapping. The full extent of the mineralized zone is obscured by heavy soil and vegetation cover.

No further work is recommended in this area.

6. Jane River Area.

The Jane River rises in the Lightning Plains south of Frenchman's Cap and flows into the Franklin River east of the Elliott Range.

Alluvial gold was discovered in 1935 in a small creek on the western foothills of the Algonkian Mountain, one and a half miles east of the Jane River. Small quantities of alluvial cinnabar were found associated with the gold, but the source of the gold and cinnabar have not been located. An outcrop of limonite with traces of manganese occurs on the banks of the upper reaches of the Jane River (Blake 1937), and a sample of the limonite showed traces of gold and silver, but no mention was made of other minerals.

The limonite may be the gossanous capping of a sulphide deposit, and it is recommended that the limonite be examined for evidence of sulphide mineralization.

7. Deep Creek

The Deep Creek iron body is situated one mile east of Birthday Bay on the west coast 17 miles south of Cape Sorell.

The iron body is associated with L.E.E. aeromagnetic anomaly 10/8 (B.H.P. anomaly 129), and was investigated by L.E.E. using geological, geophysical and geochemical techniques along hand cut lines. The deposit consists of hematite and hematite-magnetite of apparently high grade. Four samples assayed from 64.8% Fe to 69.2% Fe. No sulphide mineralization was observed although copper staining was noted in one exposure. Copper and zinc averaged 0.04% and 0.25% respectively.

L.E.E. estimated that the body was 1,475 feet long with a maximum width of 170 feet, and that it contained 4,700,000 ton of iron oxides to a depth of 300 feet.

Ground geophysical investigations included magnetic, electromagnetic and gravimetric surveys, and the results indicated a massive north-east striking iron body, flanked on the eastern side by a shear zone.

No drilling was carried out.

The presence of pyrite indicates the possibility of sulphides at depth.

It is recommended that the deposit be opened up for further ground investigation, and be drilled to check the possibility of sulphide mineralization at depth.

8. Humboldt Mine

The Humboldt Copper Mine is situated at the foot of the eastern spur on The Needles, nine miles west of Maydena.

A mineralized zone of black slate 30 inches wide contains veins of quartz and siderite with minor amounts of pyrite, chalcopyrite, galena and sphalerite. No assay results are available.

The mineralized areas were described by Twelvetrees (1908), Henderson (1939) and Hughes (1952), all of whom considered the mineralization to be uneconomic.

No further work is recommended in this area.

9. Penders Prospect

Penders Prospect is situated on the west coast about three quarters of a mile south of the Lewis River.

Pyrite and a very small amount of chalcopyrite occur in sheared chloritic Cambrian rhyolites. The prospect has been tested by the sinking of two pits, but no ore has been mined. L.E.E. (Gilfillan 1957) estimated 2% Cu in hand picked specimens and did not consider the area worthy of further investigation.

Recent geochemical sampling in the area did not give encouraging results, and no further work is recommended.

10. Hazell Hill

The Hazell Hill area described by Elms (1959) is

situated two and a half miles south of the junction of the Wanderer and Hales Rivers, but the Hazell Hill area proper lies four miles to the east.

Elms noted two mineral occurrences in Cambrian rocks adjacent to the faulted Cambrian-Ordovician contact in the Wanderer River. A pyrite-sphalerite band three inches wide assayed 5.25% Zn, and quartz veins in a fine grained dyke rock contained a small amount of fine grained galena.

No further work is recommended in this area.

11. Kelly Basin, Port Davey.

Kelly Basin is an inlet on the west coast of Port Davey.

Minor copper mineralization occurs in graphitic and knotted schists at Kelly Basin and on the west coast immediately north-west of Kelly Basin, where one sample assayed 1.5% Cu. The mineralization on the west coast was limited to one small outcrop, and the geochemical results showed no indication of the mineralization extending inland.

No further work is recommended in this area.

12. Elliott Bay Area

Elliott Bay is situated on the west coast midway between Cape Sorell and South-west Cape.

Along the Elliott Bay coastline numerous small veins of quartz in Cambrian volcanics contain minor amounts of galena, pyrite, hematite, chalcopyrite and sphalerite. The mineral occurrences are not considered to be of economic value because of their small size and low grade (Nye, 1926).

Chalcopyrite, pyrite, siderite and manganese oxides occur close to a shallow prospecting pit near the Lewis River about two and a half miles north of the eastern end of Elliott Bay. The mineralization is associated with a ferruginous gossan covering an area of about 300 square yards. A chip sample of unweathered mineralised rock assayed 0.65% Cu, 0.24% Mn, and 32.7% Fe.

A number of streams along the lower reaches of the Lewis River contain slightly anomalous zinc values, and a number of aeromagnetic anomalies occur in the same area close to the contact between the Low Rocky Point granite and the Cambrian volcanics.

It is recommended that the area associated with the aeromagnetic anomalies be covered by a ground geophysical survey and geochemically sampled.

13. Gordon River

A north-south trending aeromagnetic anomaly (peak 5,815 gammas) occurs over an area of pyritic green schist and quartz-chlorite schist near the junction of the Gordon and Holley Rivers. The anomaly is eight miles long and appears to reflect an important and unique feature of the geology (Daly, 1967). The cause of the anomaly is not known.

The area is covered by a recently proclaimed Scenic Reserve, and is now excluded from the Licence area. Official permission to work in the area may be difficult to obtain, but if granted it is recommended that the anomaly be examined initially by more detailed geological traverses and geochemical sampling.

The rugged, bush-covered terrain prohibits the easy application of ground geophysical methods.

14. Gordon-Serpentine River Area

Pyrite and suspected chalcopyrite in pelitic garnet schist is associated with a weak aeromagnetic anomaly (peak 4,879 gammas) about two and a half miles east of the

junction of the Gordon and Serpentine Rivers.

No exploratory work has yet been carried out, but a sampling program of geological examination and stream sediment sampling is recommended.

15. Cypress Creek

Cypress Creek is a small stream on the west coast between the Urquhart and Mainwaring Rivers.

L.E.E. aeromagnetic anomaly 20/6 is situated in the general area, and was the subject of ground geophysical (E.M., S.P., AFMag, magnetometer and gravimetric) surveys and geological investigations along hand cut lines. The anomaly is centred over an area of Cambrian chert and black shale both of which are pyritic. L.E.E. concluded that the anomaly was caused by graphitic shales and that no economic mineralization was present.

The results of stream sediment samples recently collected from the area gave strongly anomalous copper and zinc values, making the area one of the most promising so far examined. Copper staining was observed in tuffs in the Urquhart River at the northern end of the anomalous area.

It is recommended that this area be examined in more detail and be opened up to enable a soil sampling program to follow up the promising stream sediment results.

16. Hibbs River Belt

The Hibbs River Belt extends from the south-east portion of Macquarie Harbour south-west to the west coast at Endeavour Bay. The geological and geophysical investigations in this area are described elsewhere in this report, and by Pollard and Taylor (1967).

The following mineralization has been observed:

(a) Pyritic, graphitic bands on the contact between ultrabasics and dark siltstone were exposed in a

costean excavated across an electromagnetic anomaly in the Noddy Creek area.

(b) Asbestos veins are common in the eastern belt of ultrabasics in the Noddy Creek area.

(c) Fibrous and massive magnetite is associated with the asbestos-bearing ultrabasics.

(d) Cambrian chert from one mile west of Timbertops assayed 2.6% P_2O_5.

(e) Geochemical stream sediment sampling detected anomalous zinc values in the same area as the significant electromagnetic anomaly in the Noddy Creek area.

The Hibbs River Belt is one of the areas in which major investigations are recommended for the 1967-68 field season. The main targets in the area are the asbestos deposits and the area of coincident electromagnetic anomalies and geochemical zinc anomalies. The discovery of the phosphate occurrence in Cambrian chert in the Timbertops area is encouraging, and further investigation is recommended.

The following work is recommended:

(a) Geological mapping and testing of the asbestos by costeaning.

(b) Soil sampling and detailed ground geophysics, including E.M., I.P. and magnetometer over the area of coincident E.M. anomalies and geochemical anomalies. Diamond drilling of targets selected on the results of the geochemical and geophysical work.

(c) Testing of the Cambrian sediments for phosphate.

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SUMMARY OF RECOMMENDATIONS FOR FIELD WORK DURING 1967-68 SUMMER

The following summary is intended as a guide for future exploration in South-west Tasmania.

A number of prospective areas have emerged and required more detailed work, while large portions of the Exploration Licence Area appear unprospective, and should be excluded from future consideration.

WEST COAST AREA

1. Double Cove Belt

Complete coverage of geological mapping at 1 inch to 2,000 feet, and geochemical stream sediment sampling.

Open up anomalies 127, 128, and 129, along eastern margin of the belt, by bulldozer, to enable detailed geophysical and geological surveys to be carried out.

Drill one initial diamond hole into the Deep Creek iron body (anomaly 129) to test it at depth.

2. Hibbs Belt

Continue detailed geological investigation of asbestos bearing rocks at Noddy Creek by costeaning, measuring fibre length and quantity, and mapping at 1 inch to 400 feet.

Complete coverage of reconnaissance stream sediment sampling and geological mapping at 1 inch to 2,000 feet, to give overall picture of geology and metal distribution.

Complete detailed geophysical examination of electromagnetic anomaly along western margin of eastern ultrabasic belt at Noddy Creek, and carry out soil sampling over same area. Drill coincident geophysical and gechemical anomalies.

Commence detailed geophysical and geological examination of area of high intensity aeromagnetics three miles south-west of the head of Birch Inlet.

3. Mainwaring Belt

Extend geochemical stream sediment sampling in area between the Urquhart and Mainwaring Rivers in order to more clearly and closely define the source area of the anomalous copper and zinc values. If such an area can be defined relatively easily it should be opened up for a program of soil sampling.

A closer geological examination should also be made of the area for obvious indications of mineralization.

Ground geophysical examination of the aeromagnetic anomalies along the lower reaches of the Lewis River, and soil sampling along the same grid lines.

4. Jukes-Darwin (including Crotty Road) Area.

Compilation of all available data, and geochemical stream sediment sampling of the area of Cambrian rocks.

CENTRAL AREA.

1. Jane-Franklin River Area

Completion of reconnaissance geological mapping with closer investigation of limonite occurrences near Warnes Lookout and aeromagnetic anomalies along the Franklin River, followed by geochemical sampling of favourable areas.

EASTERN AREA

1. Boyes River

Initial geochemical reconnaissance, followed by ground geophysical survey of this area of Cambrian sediments and ultrabasics.

2. Holley River

Ground geological and geochemical survey of long, narrow aeromagnetic anomaly.

3. Gordon-Serpentine River Area

Geological examination and geochemical sampling of the area covered by the weak aeromagnetic anomaly.

4. Gordon Road-Weld River Area

Closer geological examination of the area of Cambrian sediments, ultrabasics, and recently discovered volcanics, including a traverse of the upper Weld River to investigate the presence of Cambrian volcanics reported from the area.

Geochemical sampling of streams crossing the Gordon Road, and the upper Weld River and its tributaries.

Sampling of cherts in the Cambrian sequence to determine phosphate content.

MISCELLANEOUS

Airborne scintillometer survey as recommended by the Chief Research Geologist, to cover areas of basal conglomerates of Ordovician and Younger Precambrian age. Areas where the conglomerates are best developed are the Sorell-Jukes-Darwin area, D'Aguilar Range, Mt. Osmund, Reed's Peak-Tim Shea area, and the Bathurst Harbour area.