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ANNUAL REPORT OF THE GOVERNMENT GEOLOGIST FOR 1945

GENERAL

Staff

No changes of staff occurred during the year. Mr. F. Blake was absent throughout the year on War Service leave. Mr. T. Hughes who had also been on active service resumed duty on December 12th. For the remainder of the year the effective staff consisted of Dr. S. Warren Carey, Government Geologist, Mr. Q.J. Henderson, A.M. (Aust.) I.M.M., and Mr. H.G.W. Keid, M. Sc., Field Geologists, and Mr. K. Kendall, Field assistant, (temporary).

Field Work

The following field investigations were carried out :-

(1) Examination of the Mt. Cleveland Tin Mine :- undergfound work by Mr. Henderson, surface and structual work by Dr. Carey.

(2) Extension of regional mapping in the Mt. Farrell district:- control survey and systematic mapping by Mr. Henderson, reconaissance to the east by Dr. Carey.

(3) Survey of the Cradle Mountain district by Mr. Keid as part of the plan for the systematic examination of the Mackintosh quadrangle.

(4) Sampling of diatomaceous earth at Andover, by Mr. Henderson.

(5) Brief examination of Tasmanian Asbestos Company's Mine at Renison Bell, by Dr. Carey.

(6) Examination of so-called "Ammonia deposit" at Trial Harbour, by Dr. Carey and Mr. Henderson.

(7) Sampling of Rhodochrosite in the Read-Rosebery Mines, by Mr. Henderson.

(8) Regional survey of the alluvial tin areas in the north-eastern corner of the State by Mr. Keid.

(9) Selection of suitable source of high grade silica in the Ulverstone district, by Dr. Carey.

(10) Progress examination of the Clarke Dam foundations at Butlers Gorge, by Mr. Henderson (Dr. Carey accompanied Mr. Henderson on a visit of inspection.

(11) Investigation of petroleum possibilities on Flinders Island, by Dr. Carey.

(12) Investigation of possibility of utilising the Killiecrankie topaz deposit on Flinders Island as a calcium free source of fluorine, by Dr. Carey.

(13) Preliminary examination of Brown Coal and Peat possibilities on King Island, by Dr. Carey.

(14) Survey of the Risdon-Bellerive district to determine possibility of obtaining underground water supplies for town reticulation, by Dr. Carey and Mr. Henderson.

Reports were submitted on all the above subjects except the regional surveys (items 2 and 3) which were incomplete at the end of the year.

Office and Laboratory Work

Several months were spent by Mr. Henderson on survey computations for the Mt. Farrell district control survey, and on the preparation of a full report on the Mt. Farrell Mine with details of a recommended diamond drilling programme in that area. Microscopic examination was carried out by Dr. Carey on a series of actinolite asbestos samples from the Pieman River submitted by Mr. W.B. Dallwitz; also a particle count analysis was made under the microscope of some beach sand concentrate from the Frazer River, King Island. Several parcels of osmiridium were certified, and numerous minor determination of samples were made for callers and correspondents.

Recommendations were prepared for the reorganisation of the library, laboratory, and storage facilities of the Geological Survey. The implementation of these recommendations is held up pending the appointment of a librarian.

A systematic reorganisation of the filing and index system throughout the geological survey was initiated using the map-sheet quadrangle system introduced by the Australian Military Forces, and adopted by the Department of Lands and Surveys for its regional mapping, and aerial survey programme. Rock samples, petrological slides, mineral prospects data, plans, localities, and geological literature will be systematically filed and cross-indexed under this scheme so that the vast wealth of data accumulated during the past century is automatically accessible as required irrespective of the memory of individuals.

A revised geological map of Tasmania and a revised map showing the distribution of mineral resources in Tasmania have been prepared, and accompany this report. Although as far as possible all existing information has been used in making these compilations, it should be realised that at least half of Tasmania has not been examined geologically, and much of the remainder has only been covered sketchily. Hence no finality can be claimed for the geological map, but it is hoped that it approximates nearer to the truth than earlier compilations. A compilation has also been prepared showing all important overland trakcs and routes formerly in existence, their present condition with recommendations for reconditioning, and for new tracks considered desirable for the future prospecting of the mineral resources of the State. This map shows all known mines and prospects, and those areas of Tasmania so far geologically unexplored.

MT. CLEVELAND TIN MINE

Structure of the Ore Bodies.

The tin and copper bearing pyritic ore bodies of the Mt. Cleveland Mine occur as replacement deposits in a series of slates, tuffs and cherts probably of Cambrian age, which are strongly folded along axes trending NNE to NE with a prevailing dip to the NW. Much faulting of a minor character is present, and it is possible that large strike faults are also present. These strata are intruded by large bodies of basic and ultrabasic rocks which outcrop extensively in the Whyte River Valley, their boundary approaching within 25 chains of the lodes. Granite is known to outcrop three miles away to the south-east and three and a half miles away to the south-west, and there may be nearer outcrops of granite in the geologically unexplored country to the south-east. "Small protrusions of porphyry" have been mentioned by Reid (1923) in the vicinity of the lodes but the existence of these has not been confirmed.

The lodes are all of replacement type and conform to the folded structures of the sedimentary rocks, not to fractures or fissures, though a good deal of minor dislocation of the ore bodies has occurred subsequent to their emplacement. Tuffs are selectively replaced in preference to slates, and the latter have suffered intense local silicification. There is a marked tendency for the replacement to occur in the syncline. The lodes of Henry's Cut, Hall's Cut, No. 12 workings and all the Luck's Lodes (No. 8, 10 and 16 workings) are all developed on the troughs and adjacent limbs of synclines. It is also possible that the Battery and Smithy Lodes are opposing limbs of a slightly recumbent syncline.

Correlation of the Lodes.

As a result of structual interpretation the following correlations are made.:-

Luck's Lode which is exposed in Luck's No. 3 level and the Mt. Bischoff Company's No. 4 crosscut is probably the same lode as that worked in No. 16 workings, No. 10 workings and the Kaki open cut. The ore in No. 8 and No. 10 workings may be expected to meet in depth on about the 210 ft. level. If the Mt. Bischoff Company's No. 4 crosscut is extended a further 100 ft. it should cut through the same ore body again with the opposite underlay.

Luck's upper lode exposed on No. 2 level is probably the same ore body as the south dipping lodes in the No. 3 south-east drive of Luck's No. 1 level. The two limbs may be expected to meet at approximately the 330 ft. level.

Hall's lode is a trough shaped ore body lying in the bottom of a syncline. It is not connected with either the Luck's Lodes, or Henry's Lode, or the Battery or Smithy Lodes as has been suggested. It was probably originally the same ore body as that worked in the open cut of No. 12 workings although the physical connection of the two has probably been removed by erosion. The Mt. Bischoff Company's No. 1 crosscut on the 260 foot level only just caught the edge of this ore body. If 20 feet lower or 20 feet further to the north-east, the crosscut would have passed beneath the lode. At its centre this ore body may be expected to cut out on about the 200 foot level.

Henry's Lode is another trough-shaped ore body on a synclinal axis. The Mt. Bischoff Company's No. 2 crosscut passed completely beneath it. A raise of 20 feet from this crosscut should find this ore body.

The Smithy Lode is the same ore body as that worked in the No. 4 workings. The ore body followed by the drive at the end of the No. 3 crosscut off the end of the No.2

workings is the Battery Lode cut at a lower level than the old Battery workings (No. 3 workings). These two lodes are parallel and both dip to the north-west, the Smithy Lode very steeply and the Battery Lode at more moderate angles. It is possible that these two lodes are opposing limbs of an overturned syncline, and that they meet in depth at somewhere about the minus 60 level in which case they would cut out at that level or not far below.

Character of the Ore

The lodes consist of fine grained sulphide ore with pyrrhotite as the principal mineral together with chalcopyrite, pyrite, quartz and cassiterite. A composite sample from six samples taken across the back at 100 foot intervals along the drive below Hall's Cut yielded : Tin 0.95%, copper 0.39%, sulphur 12.9%, lead, antimony, bismuth, arsenic all nil, acid insoluble 39.8%. These analyses made by the Chief Chemist of the Mines Department, and a number of samples recorded by Reid from other workings indicate that the average grade of the sulphide lode material runs a little under one per cent of tin. Vanning assays gave little better than eighty per cent recovery.

Ore Reserves

Oxidized ore with secondary enrichment occurred irregularly in the upper levels of all the lodes but has been for the most part removed. A limited quantity of oxidized ore said to be of good grade is still left in Luck's workings. Hall's Lode has been proved to the 260' level and 4,000 tons of ore can be regarded as proved. Estimates of probable ore are as follows :-

Hall's Lode	100,000	tons
Henry's Lode	7,000	"
Luck's Lodes	80,000	"
Battery & Smithy Lodes	10,000	"
	197,000	

The total ore so far removed from the mine in past operations is 36,311 tons.

Conclusions

As a result of this work it is concluded that the Mt. Cleveland ore bodies, being replacements on fold axes, do not persist to great depths. Also that further ore bodies are likely to occur, and would best be looked for by a magnetometer survey followed by local detailed structual examination of the areas which show magnetic anomalies.

The plans and sections relevant to the foregoing remarks are on plans No. 972A and 972B in the Geological Survey files.

REVIEW OF THE TASMANIAN "PORPHYROIDS"

In any regional analysis of the mineral prospects of the Mt. Farrell district, it is of economic fundamental importance to determine the relative age and relationships of the abundant igneous rocks of the district; and as these all fall into that varied group of sheared acid and sub-acid porpyries which have gone under the name of "porphyroids", which are of such wide occurrence in the mining fields of the West Coast, the solution of the problem is of general interest and application.

Early workers, particularly Twelvetrees and Ward, recognised extrusive, pyroclastic, and intrusive phases among these schistose rocks, and considered that they all belonged to the early Palaeozoic age. Much more recently Finucane, followed by Nye and others, recognised intrusive contacts against fossiliferous Silurian rocks and adopted the view that all or nearly all the so-called "porphyroids" were intrusions of Devonian age, and that the alleged tuffaceous and pyroclastic characters were the result of intrusion brecciation and/or dynamic crushing.

The decision as to which of these views is correct has a direct bearing on the search for new ore bodies, because if the whole of the porphyroid rocks are intrusions more or less contemporaneous with the emplacement of the ore, a very different field for search results from what would be the case if the whole of the porphyroid suite intrusive and extrusive alike are early Palaeozoic and pre-ore, the mineralising solutions being derived from deeper igneous rocks not visible in the immediate vicinity.

A critical re-examination of the relationships of the porphyroids was therefore considered essential. As a result of this analysis the writer has concluded that each of the foregoing views contained a part truth and a part error; that the porphyroids are largely lavas, breccias and tuffs of early Palaeozoic age (pre-ore), and that they intruded by later porphyries which were more or less contemporaneous with and intimately related to the ore; and that the shearing and hydrothermal alteration of the older effusives and the younger intrusives was contemporaneous with the injection of the younger porphyries.

Evidence of Pyroclastic Phases

The first definite record of pyroclastic rocks among the porphyroids was made by Ward (1908, p.17) who found tuffaceous rocks at a number of places in the Mt. Farrell district :

On the western flank of the Mt. Farrell near the south-western corner of mining lease 2409/93M near the top of the porphyroid series, in immediate contact with an amygdaloidal felspar porphyry, he describes a deep green rock with grey and reddish blotches irregularly distributed. "The varying splashes of colour are due to angular fragments, which are of different composition, some chalcedonic, others apparently fragments of pink-coloured uncrushed porphyries." Similar rocks occur near the junction of the Mackintosh and Murchison Rivers and in the nearby tramway cuttings. Under the microscope "it is still more apparent that these tocks are certainly fragmental and yet possess many features in common with the other porphyroids" One slide contained an angular fragment of an igneous rock with a number of clear microlites with straight extinction in a perlitic glass.

In the North Dundas area Ward (1909, p.17) describes a similar tuff on a lower stratigraphic horizon. The rock looks like a porphyry but under the microscope the rock is seen to consist of numerous rounded fragments of glass containing microlites, together with fragments of quartz and oligoclase all embedded in a sericite-chlorite aggregate.

Twelvetrees (1909, p11) has described a series of soft bedded tuffs which are interbedded with the porphyroids in the Gunn's Plains district. "Under the microscope the base appears as a pellucid glass, with numerous vesicular steam cavities. In this base is a confused mass of particles of ash and felspar microlites with occasional grains and nests of quartz." In the same area are other volcanic breccias, often gossanous and enclosing irregular tuffaceous patches with an occasional sprinkling of pyrite in a partically vitreous and felsitic base with much quartz, some of it secondary.

Twelvetrees and Ward (1910, p.18) described fragmental rocks of pyroclastic origin interbedded with the Dundas Series of the Zeehan district. Under the microscope the tuffs consist of shattered fragments of an acid igneous rock. Some fragments consisting of partly devitrified glass containing felspar laths, represent the ground mass of the parent rock. Other fragments are broken crystals of quartz and plagioclase which represent the original phenocrysts.

Along the Lorinna road in the Moina district, Twelvetrees (1913, p.26) reports that fragmental rocks containing felsitic and siliceous inclusions.

Loftus Hills (1914, p.37) reports that fragmental pyroclastic types are abundantly developed in the porphyroid belt in the Jukes-Darwin area, varying from coarse volcanic breccias to fine tuffs. Coarse breccias may be "seen on the Lake Jukes track, west of Hanlon's Creek and Snake Peak, and on the Prince Darwin Section."

Reid (1918, p.29) considers that a considerable proportion of the lower part of the porphyroid series in the north Pieman-Huskinson area is made up of pyroclastic rocks and that further tuffs occur higher in the series as intercalated beds between lava flows. The "lower beds of tuff and larger volcanic ejectamenta are usually mixed with much sedimentary material, and merge by imperceptible gradation into true sedimentary rocks."

The present writer has found abundant evidence of pyroclastic and extrusive phases widely distributed through the porphyroids. A clear exposure of the contact of two flows separated by a thin tuffaceous sandstone can be seen in the Farrell tramway cutting about half a chain west of the water tank about 17 chains west of the Mackintosh River bridge. Samples from this locality are now stored in the Geological Survey collection and may be inspected. The upper part of the lower flow contains numerous fragments of pyroclastic material which become increasingly abundant in the upper layers of the flow. Sample 44C38 which comes from the very top of this flow is a tuffaceous lava with fragments of felsite which showered on to its surface. This is followed by two feet of friable bedded sandy tuff, which is a water redistributed rock (Sample 44C36). The next flow has a very fine-grained chilled base (Sample 44C37) which passes up into a normal porphyry (Sample 44C35) at the tank. About 8 chains west of this water tank there is another outcrop of a similar tuffaceous sandstone parting (Sample 44C43) between the igneous rocks, but the actual contacts are not visible in this case. Sample 44C44 which occurs near top of the flow underlying this sandy tuff contains pyroclastic inclusions and is in part tuffaceous. In a cutting still further west (about 30 chains west of the Mackintosh bridge) is another tuffaceous lava represented by Sample 44C48. These exposures leave no doubt that this part at least of the porphyroid belt is made up of lava flows accompanied by pyroclastic showers.

In the vicinity of the 2-mile peg on the Farrell tramway are excellent exposures of coarse volcanic breccias. These are best seen if one leaves the tramline at the 2-mile peg and walks up the hill. Weathering attacks the fragments differentially so that they show up in sharp relief. For example in Sample 44C72 angular fragments of felspar porphyry up to 6 inches long are etched differentially to a depth of half an inch below the surrounding matrix which is itself made up of smaller fragments. Some of the breccias have very coarse fragments and in other beds the fragments are only half an inch or so long. In freshly broken faces it is often difficult to recognise the fragmental character of these rocks for they break uniformly across fragments and matrix alike. Hence it is always desirable to examine the weathered outcrops on the hillside as well as the fresh exposures in the cuttings. This has also been pointed out by Hills (1914, p.37) and Reid (1918, p.29).

Between the 2-mile peg and Farrell Siding the greater part of the porphyroids are either wholly pyroclastic or are lavas containing pyroclastic material which showered on to them. Samples 44C102 to 44C113 inclusive collected at intervals across this section are available for inspection. Many of these are not visibly pyroclastic in the fresh hand specimen. However, Sample 44C106, collected beside the tramline 15 chains north-west of the water tank, which is etched by weathering is made up of fragments of felsite up to two inches in length in a tuffaceous matrix. Sample 44C110 which is a quite fresh spawl flake collected beside the tramline about 25 chains east-south-east of Farrell/junction contains angular fragments of different varieties of acid lava varying from over two inches in diameter down to chips of crystals in a hard felsitic ground mass.

Many exposures of undoubted pyroclastic rocks are visible in the cuttings of the Emu Bay Railway. The most striking is Sample 44C123 which was collected beside the railway line about midway between the railway signal and watering tank on the Boco Hill two and three quarter miles from Farrell junction (23 miles 62 chains from Guilford on Sheet 24 of the Emu Bay Railway Company's Survey). This is a coarse volcanic breccia with fragments two to four inches long in vesicular almost pumiceous lava, in a ground mass of dark blue tuff. The largest vesicles are nearly half an inch long. The rock is interesting in being much more basic than the general run of porphyroids. It recalls the diabase breccia with vesicular inclusions described and figured by Reid (1918, p.33), which he found in a large boulder beside the Farrell tramway near the Boco Creek bridge. This is on the same general horizon but about 2 miles along the strike from where sample 44C123 was collected.

Further good exposures of pyroclastic rocks may be seen in the cuttings further up the Emu Bay Railway. In many cases the tuffaceous character is not apparent without the closest scrutiny. In some places however the pyroclastic nature of the rock is evident immediately it is broken. This is true for example in Samples 44C115 to 44C119 inclusive which were collected exactly a mile up the line from 44C123 (along the three chain straight bearing 208°39' between 22 miles 62 chains and 22 miles 65 chains on Sheet No. 23 of the Emu Bay Railway Survey). Of these samples, 44C115 is a fine grained blue tuff (probably water sorted) interbedded with the more common acid varieties. 44C116 is a fine volcanic breccia consisting of angular fragments of reddish felsite of various sizes ranging from one inch to small chips in a dark blue tuffaceous ground mass. 44C117 and 44C118 are also felsite breccias, the fragments of which are not tightly packed so that angular spaces and cavities occur between many of the fragments. 44C119 is a coarse tuff.

Numerous exposures of pyroclastic rocks may be seen between the Boco water tank and Farrell junction. For example 44C125, a rhyolite breccia with flow structure in the fragments, was collected 61 chains down the line from the tank (in the centre of the 5 chain curve 8 chains below the present 62 mile peg). Sample 44C127, a tuff with half inch pyroclastic inclusions was collected 106 chains up the grade from the Farrell Station building. 44C128 is a tuffaceous flow breccia from a point 88 chains north of Farrell Station.

Further evidence of the extrusive and pyroclastic nature of the porphyroids may be seen in the railway cuttings in the vicinity of Bulgobac. At the northern end of the long button grass plain south of Bulgobac, the first outcrop consist of a highly spherulitic quartz porphyry, which continue to outcrop northwards for 34 chains (Samples 44C132 and 44C133). In the long curve immediately south of Bulgobac Siding, a pyroclastic phase of the same rock is exposed, with angular blocks of the spherulitic quartz porphyry up to three inches across set in a pyroclastic matrix. This is the top of the quartz porphyry flow, which strikes roughly meridionally and dips steeply to the east, with the railway line swinging roughly along the strike. At the northern end of Bulgobac Siding and at the water tanks the quartz porphyry again outcrops because the line veers to the west to a lower stratigraphic horizon. At the Bulgobac signal, however, where the line has veered to the east again, the pyroclastic phase again appears. The best exposures of the volcanic breccias here are found by climbing to the top of the cutting on the west side of the line at the signal, where weathering has etched the breccias differentially. In the foregoing descriptions precise details of specimen numbers and field localities have been given so that the pyroclastic character of these rocks may be confirmed by any worker who may wish to do so.

For if it is admitted that a considerable part of the porphyroid series consists of lavas, tuffs and breccias, and it seems to the writer impossible to escape this conclusion, then the current view of Finucane, Nye and Blake that the whole of the porphroid series is intrusive and of post-Silurian age is untenable.

Evidence of Intrusive Phases

The existence of intrusive members among the porphyroids has been recognised by many of the workers who have investigated these rocks. Waller (1904, p.2) mentioned "quartz porphyry dykes in the Lower Silurian slates and grits at North Dundas and at the King River and Queenstown" (Waller's term "Lower Silurian" is synonymous with the modern term "Ordovician"). Referring to the Mount Farrell field he stated that "in some cases they are undoubtedly intrusive." Later Ward (1908, p.2) confirmed Waller's view and reported that "On section 3263 at least the igneous rock was clearly intrusive into the slate, for tongues of igneous rock can be seen protruding into the Slate." The large body of felsite and porphyry with its coarser variants of granite porphyry, granite and syenite, which outcrops on the Murchison River between Mount Farrell and Little Farrell was also regarded as intrusive.

At Gunn's Plains, Twelvetrees (1909, p.12) reported a reddish hornblendic porphyroid intrusive into slates at the Waterworks building on the Forth River.

In the North Dundas district, Ward (1909, p.16) recognised that "there are both intrusive and effusive types present." He also stated that "it is important to distinguish clearly between the older poprhyroids and the later intrusions of a more acid type - the quartz porphyry dykes, which are genetically connected with the occurrences of tin ore in the field."

In the Moina district, Twelvetrees (1913, p.23) correlated with the porphyroids the granite porphyry of the Dove River, and the granite at Reardon's Mine. These rocks are certainly intrusive.

Hills (1914, p.34) considered the granite of Mt. Darwin, which he correlated with the Dove River granite to be related to the porphyroids. This granite is intrusive into the felsites.

Although it is thus evident that it was clearly recognised that some members of the porphyroid group were intrusive, up until 1930 the concensus of opinion was that these intrusive members were pre-Silurian with the exception of the acid, tin-bearing dykes of the North Dundas areas which were correlated with the tin-bearing Devonian granites. An important advance was made by Finucane (1932, p.55) who pointed out that the intrusive relations were more widespread than had hitherto been recognised and that fossiliferous Silurian strata were intruded by rocks regarded as an integral part of the porphyroids. Unfortunately Finucane's report has not been published so I will quote in full the evidence of intrusion assembled by him :-

" The evidence outlined above shows that the porphyries are principally intrusive rocks and that they are younger than the Dundas series, i.e. they are at least post-Lower-Ordovician. This indicates a very strong probability that they belong to the Devonian period of igneous activity. However, the only place in the vicinity of Rosebery and Mt. Read in which the porphyries are in juxtaposition to Silurian rocks is on the north-western and western slopes of Mt. Murchison. Unfortunately no clean contacts were observed in this locality, but during and since the completion of the Rosebery survey reconnaissance trips have been made to various localities with the object of obtaining any evidence pertinent to the age of this important series of igneous rocks. A brief resume of the total evidence now is given below.

(a) During a reconnaissance trip to Mt. Tyndall, in June, 1932, the writer observed that the main belt of porphyries extended to within two or three chains of the foot of Mt. Tyndall, which is composed entirely of West Coast Range Conglomerate. Working along the line of contact south of Newton Creek it was noted that in many places the porphyries contained xenolithic pebbles and blocks of conglomerate up to two feet in diameter which had been derived from the adjacent conglomerates. The porphyries were quite massive and there can be no doubt that the pebbles etc., are present as true xenoliths. Therefore, they must have been caught up during the intrusion of the porphyries.

(b) At the entrance to the gorge in the West Branch of the Queen River, the contact between the porphyries and the Silurian slates may be seen quite clearly, and is quite clean cut and well defined. The slates are often baked and toughened along the margin and there are small protrusions of porphyry into the slates. Moreover the porphyries contain small xenoliths of black slate. There can be no doubt that the contact is an intrusive one.

(c) In McCusicks Creek, a small tributary of the west branch of the Queen River, at a point about four chains up the left hand branch, the creek has been washed clean by sluicing. Here the contact between the Queen River porphyries and the Silurian slates may be seen quite clearly. It is quite clean cut and well defined, though the actual line is rather irregular, there being several small protrusions of porphyry into the slates. The rocks are brecciated along the contact and the porphyries contain innumerable fragments of slate. This occurrence has been described by Gregory as a fault breccia, but, when considered along with the occurrences in Lynch Creek, the weight of the evidence favours contact-brecciation. Moreover, the porphyries are quite massive a few feet from the margin and there are no minor fault planes such as one would expect to see along a fault of any magnitude.

(d) In Lynch Creek, Lynchford, at a point about forty chains above the King River Mine, a large xenolith like block of slates and indurated sandstones occurs wholly within massive porphyries. This block is ten to fifteen chains wide and about half a mile long. The slates and sandstones are generally similar to those of the Silurian rocks occurring to the west and have probably been derived from intruded Silurian strata. In addition to the one large block innumberable smaller fragments may be observed in the porphyries at various points along the creek. The observations in McCusicks and Lynch Creeks and in the West branch of the Queen River were made in November, 1932 and June, 1933.

(e) In June, 1931, while examining the upper reaches of the Henty River south of Mt. Dundas, Mr. F. Blake found Silurian rocks occurring on both sides of the southern extension of the porphyries from Mt. Read. The field relationships indicated that the porphyries were intrusive into and younger than the Silurian rocks.

(f) On Madam Howard Plains, west of Queenstown, Blake had obtained similar evidence in 1928, though its importance was not then realised. In that locality, syenites, similar to some of the Queen River porphyries, are intrusive into fossiliferous Silurian slates and sandstones.

(g) On the north-western slopes of Mt. Murchison, about six miles south-east of Rosebery, pieces of sheared porphyry were found to contain fragments of West Coast Range Conglomerate. The occurrence is generally similar to that at Mt. Tyndall but on a smaller scale. The specimens were obtained close to the porphyry-conglomerate contact.

(h) In the Mt. Claude district, there is a quartz porphyry dyke on Thomas' Road which is quite definitely intrusive into Tubicolar sandstones (Silurian). This occurrence is again referred to below."

The foregoing statement establishes beyond doubt the fact that intrusive members are present in the porphyroid group and that fossiliferous Silurian strata are also intruded.

Evidence of Pre-Ordovician Erosion of the Porphyroids

Professor Gregory (1905, p.80) considered that the porphyroids were older than the West Coast Conglomerate because of the frequent occurrence of pebbles of the Lyell Schists (porphyroids) in the conglomerates. Finucane (1932, p.56) questioned Gregory's statement on the grounds that there had been confusion in Gregory's references between the schists of the porphyroids and older mica schists and quartz in the Pre-Cambrian.

However, Loftus Hills (1914, p.41) advanced strong and convincing evidence of a period of erosion of the porphyroids before the West Coast Conglomerates were deposited. In the Jukes-Darwin district a breccia-conglomerate (called by Hills "brecciated conglomerate" though it is clear from the text that breccia-conglomerate is meant) is almost invariably found at the base of the West Coast Conglomerate series. This breccia-conglomerate "consists of a varying thickness of beds composed of angular, sub-angular to partially rounded fragments of those members of the porphyroid series which are developed in this field, including, inter alia, fragments of the Darwin granite. Some fragments of quartz and quartzite are also present, but only in subordinate amount, the predominant constituents being the porphyroids. These fragments are cemented together by a paste of the finer particles of the same rocks. The size of the constituent fragments varies from masses approximately 4 feet in diameter down to the finest material forming the cementing paste." At the northern end of Mt. Jukes they rest "unconformably on the upturned edges of the porphyroids and show a distinctly stratified arrangement en masse." The breccias pass laterally and upwards into normal West Coast Conglomerates and in the transition zone there is interbedding and interdigitation of the two types.

Finucane discussing this evidence (1932, p.57) says: "This would constitute indisputable evidence of the pre-Silurian age of the porphyroid series if it did not clash as it does, with the evidence which places the porphyroids as post-Silurian." Finucane had a thin section cut of one of the pebbles in a specimen of conglomerate collected by Hills and concluded that it was "probably a highly sheared quartz porphyry."

Nye, Blake and Henderson (1934, p.48) who encountered what is undoubtedly the same formation in three localities at the base of the West Coast Conglomerates in the Mount Lyell district, were of the opinion that these breccia-conglomerates occurring as they do "between the quartz felspar porphyries and the coarse members of the West Coast Range Series, are the result of the intrusion of the former into the latter..... The quartz felspar porphyry magma was of such a composition and nature that it could intrude conglomerates, partly assimilating and replacingthem, thus giving pebbles of quartz porphyry in a ground mass of similar character." It is also suggested that the breccia-conglomerates described by Hills had a similar origin, and Hill's description of the transition from the breccias to normal conglomerates by the gradual elimination of the porphyroid pebbles in favour of quartz and quartz schist pebbles, is interpreted as further evidence of selective hydrothermal replacement of the former pebbles by quartz porphyry and quartz felspar porphyry. Nye and his co-authors added that they realised that it was an unusual occurrence and put forth their views with some hesitation.

It is fairly evident that this interpretation of the breccia-conglomerate was forced on these authors not because the outcrops do not look like true conglomerates, for their own description makes it clear that they do, but because of their initial conclusion, following Finucane, that the whole of the porphyroids are of Devonian age and intrusive into the Silurian. Hence a basal conglomerate or breccia at the bottom of the West Coast Conglomerates containing pebbles of the porphyroids had to be explained away or the main conclusion abandoned. The explanation offered is inherently unsound. For although it is quite possible for a quartz porphyry to invade a conglomerate and assimilate it, or bodily replace it by quartz porphyry, or selectively replace the original pebbles by hydrothermal minerals, it is manifestly impossible for it to replace the pebbles alone by quartz felspar porphyry. The latter can only be produced by high temperature crystallisation of the phenocrysts and lower temperature solidification of the groundmass, and could not be produced by selective replacement processes.

Dr. W.R. Browne who later examined some of the exposures in the Mt. Lyell district wrote (1939) in a letter to the then Acting Government Geologist: "I had sections cut of the matrix and pebbles of the sheared conglomerates at King River Bridge, and the former appeared to be tuffaceous, or at all events fragmental, while the latter are definitely acid and intermediate volcanic rocks - rhyolites and andesites. I can't help thinking on this evidence, such as it is, that the conglomerate is a tuffaceous one, and that, whatever its age, there were andesites and rhyolites in existence before it was formed."

Reid (1919, p.25) reported the presence of boulders of porphyroids in the West Coast Conglomerate towards the summit of Mt. Claude. This evidence is disputed by Finucane (1932, p.57) on the grounds that though the "large reddish pebbles and boulders closely resemble some of the reddish quartz felspar porphyries which occur in the vicinity" they are really felspathic grits and not felspar porphyries. Since the porphyroids contain abundant breccias, tuffs and fragmental rocks it would still seem probable that the pebbles were derived from the porphyroids.

The present writer has seen scarce but nevertheless positive pebbles of quartz porphyry in the basal bed of the West Coast Conglomerate at Mt. Farrell. It would seem, however, that except in special localities such as the Jukes-Darwin-Lyell district where local islands of porphyroid must have been subjected to erosion, the porphyroids were for the most part submerged during the deposition of the West Coast Conglomerate and hence protected from erosion.

However, there is fairly widespread evidence that the porphyroids were also subjected to erosion in an earlier interval before the deposition of the West Coast Conglomerates. In the upper part of the Farrell slates formation which separates the porphyroids from the West Coast Conglomerates, Ward described (1908, p.20) a series of sheared conglomerates. These are well exposed in the Murchison Gorge at the northern end of Mt. Farrell and have been examined by the writer. They contain pebbles of acid and intermediate lavas and of quartz in a sheared sericitic and chloritic matrix, which makes up the greater part of the rock, and which as Ward mentions, is difficult to distinguish from some of the sheared porphyroids (Samples 44C78 to 44C80). Similar sheared conglomerates have been examined by the writer in the Nietta district, half a mile south-west of the Loongana road bridge across Jeanbrook Creek. The pebbles are waterworn and consist largely of acid lavas and vary in size up to three inches. Smaller pebbles of quartz are also present. The matrix is either tuffaceous or has accumulated from the redistribution of tuffaceous material. The beds are well stratified, some bands being free from pebbles. Over one thousand feet thickness of these beds was seen by the writer but this did not include either the bottom or the top. (Samples 37C2 to 37C6 inclusive.)

Reviewing the foregoing evidence it seems impossible to escape the conclusion that the porphyroids or part of them were subjected to erosion during the time of deposition of the Farrell slate series, and again in certain restricted localities at the beginning of the deposition of the West Coast Conglomerates.

Summary of Evidence on the Age of the Porphyroids

In the preceding review the following facts have been established :-

(1) The porphyroids contain lava flow.

(2) A considerable proportion of the porphyroids especially in the lower half consist of pyroclastic breccias and tuffs.

(3) The porphyroids suffered erosion and contributed to conglomerates at the top of the Farrell Series and at the base of the West Coast Conglomerate Series.

(4) Intrusive members are present, some of which intrude also fossiliferous Silurian sediments.

It is therefore apparent that neither the old school which considered the whole of the porphyroids to be of early Palaeozoic age nor the newer school which considered the whole of the porphyroids to be Devonian intrusions can be completely supported. Both schools were wrong in assuming, for it is merely an assumption, that the whole of the porphyroids were but a single series. It is now quite evident that two groups of rocks are present, the porphyroids proper which include all the lavas and tuffs and breccias, which make up the greater part of the series, and the Devonian intrusive porphyries, which are prominent at Queenstown, Rosebery and at the northern end of Mt. Farrell, and again in the Moina district, So far as the writer is aware there is no recorded factual observation concerning these rocks which is in conflict with this conclusion.

Thus is vindicated a view expressed over thirty years ago by the late Professor David :

> "If the porphyroids are largely contemporaneous tuffs, one fails again to see how they can intrude anything; and if they include an intrusively behaving member........ in their series, is not that member an intruder in the porphyroid series itself, and therefore probably later than the porphyroids in age" (from a letter to Twelvetrees, quoted by Twelvetrees, 1913, p.15).

With regard to the age of the porphyroids proper, it is now clear that they overlie the Dundas Series with apparent conformity and underlie the Farrell Series and the West Coast Conglomerates. The Dundas Series contain fossil dendroids, which are regarded by Thomas and Henderson (1944) to be of Middle Cambrian age, as well as the worm Tasmanadia twelvetreesi, and the phyllocarid Hurdia davidi also of Cambrian (probably Middle Cambrian) age. There are no other authenticated fossils. The porphyroids are therefore probably not older than Upper Cambrian. The West Coast Conglomerates are not fossiliferous but lower Ordovician (Tremadocian) trilobites and Piloceroid cephalopods occur near Railton and Adamsfield in the beds immediately overlying the conglomerates, hence the West Coast Conglomerates are not newer than Tremadocian and are themselves probably basal Ordovician (See also later). Hence the porphyroid series the Farrell Series, and the diastem represented by the unconformity between the Farrell Series, and the West Coast Conglomerates together make up the Upper Cambrian.

GEOLOGICAL SUMMARY TO ACCOMPANY NEW GEOLOGICAL MAP OF TASMANIA

Pre-Cambrian Cycle of Sedimentation (Davey System)

The oldest rocks known in Tasmania are a thick series of quartz schists, mica schists and quartzites with some stretched pebble conglomerates. Zoisite amphibolites on the Rocky River, Collingwood River and elsewhere are grouped with this series. No outcrops have been found of the basement on which these old sediments rest or the rocks from which they were shed. This Pre-Cambrian system which is coloured brown on the map, has been strongly folded and recrystallised under regional metamorphism but shows little contemporaneous or subsequent igneous activity or thermal metamorphism. On the evidence of their metamorphic grade it has been accepted that this system is separated from all subsequent systems by a major unconformity, although no unconformity against the succeeding Cambrian strata has been observed in the field. Apart from undeveloped iron ores these old rocks have not proved fertile (the Jane River Goldfield and the Cox's Bight Tinfield) do occur in these rocks.

Cambrian Cycle of Sedimentation : Pieman System

The second cycle of sedimentation (shown in purple on the geological map) probably started in the late Pre-Cambrian but extends well into the Cambrian. A thick series of dolomites (shown in barred blue about Smithon) also belongs to this cycle, and dolomites are recorded from the Arthur Valley and south of Macquarie Harbour. Tillite occurs on the east coast of King Island in the vicinity of City of Melbourne Bay, where it is overlain by laminated dolomite thought to be dolomitised varves which is followed in turn by a thick suite of volcanic rocks. The Dundas Series consists of purple slates, dark slates, and quartzites and contains also a peculiar breccia horizon. Cambrian dendroids and hydroids (Thomas and Henderson 1944) and the worm _Tasmanadia_ (Chapman 1928) and the phyllocarid Hurdia (Chapman 1925) have been described from this series, but earlier records of graptolites have now been discredited (Thomas 1944). Volcanic phases with spilites, tuffs and breccias are present within the Dundas Series, which passes conformably upwards into a thick volcanic suite of sheared keratophyric lavas, tuffs and breccias, which have been referred to as "porphyroids". This series is complicated in some areas by subsequent injection of Devonian porphyries along shear zones. Conformably overlying the porphyroids are the Farrell slates which pass upwards into schistose conglomerates containing pebbles of volcanic rocks, probably derived from earlier Cambrian lavas. The strata of this long cycle are strongly folded, crumpled and faulted, but regional metamorphism is of a distinctly lower grade than in the underlying Pre-Cambrian rocks. Contact metamorphism has occurred around intruding batholiths and silicification around some of the basic intrusions, and intense shearing and hydrothermal metamorphism has occurred particularly in the volcanic rocks adjacent to later porphyry injections. The strata of this cycle are the principal host rocks for ore bodies in western Tasmania.

Ordovician Cycle of Sedimentation : Junee System

The third cycle of sedimentation of Ordovician age (all the blue colouring except the Smithon dolomites) commences with the West Coast Range Conglomerate, a coarse hard boulder formation now silicified and stained pink with haematite. This Ordovician cycle is unconformable on the Cambrian. A basal breccia with blocks derived from the Cambrian sequence is developed locally in the vicinity of Mt. Darwin. Included in this breccia are boulders of the Darwin granite which is intrusive into the Cambrian. However, the evidence generally does not suggest a major diastrophism between the Cambrian and the Ordovician. The West Coast Range Conglomerate passes up into white or pink quartzites which are followed conformably by sandstones and shales with Tremadocian Dikelocephalid trilobites (Adamsfield, Junee and Caroline Creek). At Adamsfield not far from this horizon occurs also a rich cephalopod fauna with more than one species of Piloceroid. Overlying the trilobite beds are dark blue limestones containing a varied fauna of cephalopods, gasteropods, brachiopods (particularly Orthids), and corals (including Tetradium). There is some evidence that this limestone which certainly commences in the Ordovician persists through with no great thickness more or less continuously into the Silurian as indicated by the presence of such forms as Hercophyllum shearsbyi but it is not certain that only one limestone is involved. A difference of opinion also exists in respect to the conglomerates, some workers (e.g. Thomas, 1944a) holding the view that the conglomerates east and north of the Pre-Cambrian core are Tremadocian (Adamsfield, Junee, Railton) while the conglomerates west of the core are Silurian. The writer's view is that the conglomerates are all basal Tremadocian and represent a gravel girdle surrounding the Pre-Cambrian core then emergent, from which the pebbles are certainly derived. The fossil evidence establishes the age of the eastern and northern conglomerates as underlying the fossiliferous Tremadoc, and overlying unconformably beds lithologically correlated with the fossiliferous Cambrian. The western conglomerates overlie with unconformity fossiliferous middle (?) Cambrian and are follwed by fossiliferous Silurian. These conglomerates are all similar in their lithology which is distinctive, and they recur at intervals throughout the belt between Railton, where they underlie Tremadocian fossils, and Queenstown.

Siluro-Devonian Cycle of Sedimentation

The middle Palaeozoic cycle of sedimentation (neutral tint) is represented in two distinct provinces, the Eldon Series in the west and the Mathinna Series in the north-east. The Eldon Series (more widely known as the Queen River Series, which term however should lapse on grounds of priority as pointed out by Thomas) is transgressive over the western region, sometimes resting with apparent conformity on the West Coast Conglomerates or Gordon River limestones, but elsewhere transgressing unconformably on to the Cambrian or Pre-Cambrian. The series consists of sandstones and shales with richly fossiliferous zones. The fauna has been regarded as of Silurian age, but recent workers (e.g. Thomas 1944a and Gill, personal communication) have independently claimed a Devonian age on the evidence of Pleurodictyum and certain Chonetid brachiopods. No strong folding or igneous injection occurred between the Ordovician and this Siluro-Devonian sedimentation, but a violent epoch of strong diastrophism, igneous intrusion, shearing, and metallogenesis followed this sedimentation.

Meanwhile the Mathinna Series which consists of a thick succession of slates, tuffs and quartzites, all of geolsynclinal facies, was accumulating in the north-east. These rocks differed from the Eldon Series, in that whereas the floor of Ordovician, Cambrian, and Pre-Cambrian rocks on which the Eldon Series was deposited is everywhere appatent, the Mathinna Series was a true geosynclinal facies, and no floor of older rocks has anywhere been seen. This thick series seems to be devoid of marine fossils but a few plant remains of the Hostimella type have been found, and suggest a Siluro-Devonian age. Like the Eldon Series, the Mathinna Series sedimentation was closed by violent diastrophism, bathylithic injection and metallogenesis.

Carboniferous Peneplanation

Next ensued a prolonged period of erosion lasting about until the close of the Carboniferous, during which time a general peneplain was developed. But although this erosion interval was long enough to reduce existing mountains, it was not long enough to destroy the capacity of the mountains for isostatic regeneration. Accordingly although most parts of the State were submerged in the transgression that followed, the capacity of the sea floor to subside was very unequal, with the result that the thickness of sediments varied considerably in different regions.

Permo-Triassic Cycle of Sedimentation

This fifth cycle of sedimentation commenced in the lower Permian (possibly late Carboniferous) and continued with diastems to the end of the Triassic. Owing to the widespread violence of the Devonian orogeny and the ensuing period of erosion, the Permo-Triassic strata everywhere rest with violent unconformity on the older rocks. The cycle begins with tillite resting on a glacially striated pavement at Wynyard. This gives place to marine mudstones, limestons and shales with a Permian fauna, which are interrupted by a coal and oil shale interlude, and are followed by further coal measures with Glossopteris. Triassic quartz sandstones succeed the Permian with disconformity, and are followed by shales with Thinnfeldia and Phyllotheca then more quartz sandstones, then productive coal measures associted with a rich Rhaetic flora with Cladophlebis, Cycads and Ginkgloales. The coal measures are followed by thick arkosic sandstones which closely resemble and may be coeval with the felspathic sandstones of Gippsland, Victoria which contain a Jurassic flora. This cycle of sedimentation was terminated in the Juriassic by stupendous injections of dolerite which warped and dislocated the Permo-Triassic rocks and resulted in a land surface of considerable relief.

The Late Mesozoic Peneplanation

The next ninety or so million years, from the Jurassic into the lower Tertiary saw stable conditions with prolonged erosion and the development of a great late Mesozoic peneplain, on the surface of which a lateritic and in places bauxite crust was formed during desiccating epochs of the lower Tertiary climate.

Tertiary Origin of Present Topography

The late Mesozoic peneplain was broken up in the Miocene by a great series of fractures with a north-north-westerly trend along which some blocks were uplifted forming escarpments and others were tilted forming structual valleys. This trend is reflected in the prevailing topographic grain of Tasmania as expressed by the Derwent Valley, the Western Tiers, the Tamar, South Esk and Maquarie Valleys, Maquarie Harbour and the lower Gordon and the west coast and western continental shelf. This trend is oblique to the tectonic grain of Tasmania, which tends to be more nearly meridional. Following the faulting, the depressed areas without exterior drainage became freshwater lakes. As such a line of lakes overflowing from one to the other down a structual valley the Derwent River was born. The Launceston Tertiary Basin now drained by the South Esk, Macquarie and Meander Rivers had a similar origin and so did Macquarie Harbour. The freshwater lakes rapidly filled up with sands and clays in which the sub-tropical flora of the times contributed its leaves and fruits. Overlying these lakes sediments are widespread Pliocene(?)

basalts. There are also earlier basalts which may have been contemporaneous with the initial break up of the peneplain.

Pleistocene Landscape Sculpture

The Pleistocene glaciation saw about a third of Tasmania under ice, and cirques, glacially formed lakes and tarns are common feature of the highlands. The poorly drained button grass plains which are so conspicuous a feature of the south-western half of Tasmania are largely on glacial debris. Eustatic changes of sea level during the last million years have had a profound effect on the coast line, and have been responsible for the drowning of all the major estuaries, the flooding of Bass Strait and dune development on shores exposed to the westerly gales.

Intrusive Rocks

A small body of granite thought to be of late Cambrian age occurs at Mt. Darwin. Certain other granitic rocks in Tasmania may belong to this epoch. The extensive granite of western Tasmania are Devonian, and the granites of the north-east and the Furneaux Group are probably Devonian also. Some evidence suggests that two Devonian granite epochs are developed in Tasmania, one of early and the other late Devonian or lower Carboniferous age. This question is referred to again below in connection with the mineral deposits. Most of the ore bodies of Tasmania were introduced during these Devonian eruptions. Pre-granite pyroxenites and serpentine are widely distributed usually in Cambrian country into which they introduced osmiridium and some gold. They have been regarded as of Devonian age but some evidence suggests they may be older. Widespread stratiform and trangressive sheets of dolerite invaded the Permian and Triassic probably during the Jurassic. Alkaline syenite with many cognate variants intrudes the Permian and the Jurassic sills at Cygnet. It is of late Mesozoic or early Tertiary age, and has introduced a little gold.

Structual Features

The most fundamental feature of Tasmania is the Pre-Cambrian core trending from Port Davey northwards to Cradle Mountain. This was folded during the late Proterozoic and has not suffered strong folding since, although it is flanked on east and west by strongly folded belts of lower Palaeozoic sediments. This core has been generally emergent ever since the Cambrian. It supplied gravels to form the West Coast Conglomerate during the lower Ordovician, and was an area of minimum subsidence during the Permian and Mesozoic transgressions. It suffered maximum uplift during the lower Tertiary movements and at present contains some of the highest and most dissected country of Tasmania.

The dominating structural feature of the State is the great composite intrusion of dolerite which extends through the greater part of the island. The dolerite burst through the basement in the Midlands and spread out laternally through the Permian and Triassic strata, sometimes concordantly often discordantly, sometimes at the basal unconformity of the Permian, more often higher up, often on more than one horizon, preserving a general sill-like character in spite of many transgressive contacts. Remnant outliers show that the sheet extended originally to the West Coast Range and north-east to Banks Strait. Towards the margin the intrusion was generally concordant.

NOTES ON DISTRIBUTION OF ECONOMIC MINERALS IN TASMANIA

New Mineral Map

Accompanying this report is a new map showing the distribution of the principal economic minerals known in Tasmania. So far as the scale will allow, every mineral prospect on record in the Geological Survey is indicated by the appropriate symbol. In some of the more richly metalliferous areas it has not been possible to show every known prospect. Where-ever a productive mine has developed this is indicated by ringing the prospect with a circle. Where the mine has been subsequently abandoned, or is not at present operating, ticks are added to this mine symbol. Over a considerable part of the State the surface rocks belong to formations younger than the metallogenetic epochs which introduced the ores. These areas in which the chances of finding lodes at or near the surface are remote, are shown on the map by a green tint which may serve as a guide to prospectors and help to narrow search to the more favourable areas. It should however be clearly understood that stratified deposits such as coal, oil shale and limestone, and residual deposits such as bauxite may and do occur in the areas so tinted; also that alluvial deposits may occur on the tinted areas where detritus is shed from a favourable area on to a barren area.

Within the metalliferous areas lines have been drawn in the appropriate colours grouping together similar mineral occurrences which are genetically related. Within these boundaries the prospects of discovering new lodes of similar type are high. A photographic reduction of the State four mile to the inch map is overprinted in a neutral tint in order that mineral localities can be identified on the larger scale map. Many non-metallic products such as clays of several commercial types, ochres, sands and silica, and building and monumental stones, have been omitted from the map even though some of them are of considerable potential value. Minor metals such as antimony, beryllium, bismuth, cadmium, cerium, cobalt, magnesium, manganese, mercury and thorium, some of which occur as valuable by-products in the recovery of other minerals and some of which would be developed on their own account, have also been omitted.

Mineral Belts of North-East

The mineral prospects in the north-east are distributed in two clearly defined zones which suggest that there are two independent epochs of metallogenesis in this region. The red line shown on the map defines the tin belt, which takes in all the granite areas on Flinders Island, Cape Barren Island, the Ringarooma Valley, Mt. Cameron and Blue Tier. Outliers of this tin granite occur at Storey's Creek and Roy's Hill and southward extensions are covered by younger rocks but reappear on the Freycinet Peninsula. The granites of this area are commonly coarsely porphyritic with felspar phenocrysts up to three inches long; but fine grained granites and greisens also occur and it is these that carry the tin (See Thomas 1943b). Quartz reefs in the contact aureole carry cassiterite and wolfram, as at Storey's Creek and Aberfoyle, and the Fly-by-Night Mine at Gladstone.

Sharply contrasting with the tin granites, is the granitic mass about Scottsdale, of which Mt. Stronach is the best known peak. This granite, subsidiary bosses of which extend northwards to Mt. Horror and towards Waterhouse Point and eastwards to Lisle and Lilydale, is a granodiorite rather than a true granite, and is conspicuously free from tin and tungsten; from the extensive granitic area itself no lode matter has been reported except a molybdenite prospect at Mt. Stronach. But the country rocks in a broad girdling belt round the granodiorite contain auriferous quartz reefs. This gold belt which includes the Waterhouse, Warrentinna, Mangana, Mathinna, Burns Creek, Lisle, Lefroy and Beaconsfield goldfields contains free milling quartz lodes in the upper few hundred feet with primary sulphides such as pyrite, arsenopyrite and chalcopyrite and to a lesser extent galena, stibnite, and sphalerite present at depth as lower grade ore. There is no doubt that a considerable area of this auriferous province is considerable area of this auriferous province is concealed beneath the Permo-Triassic sheet of sediments and dolerites east of the Tamar and the South Esk.

There is perhaps reason to look for local placer streaks of aruiferous conglomerate in the basal beds of the Permian in this region. Likewise it is not impossible that tin in payable quantities may occur locally in similar situations in the basal Permian grits around Aberfoyle, Roy's Hill and the Freycinet Peninsula.

In separating the tin and the gold provinces of the north-east and their parent igneous rocks, the question arises of the position and relationships of the Eddystone-Mt. William granitic mass in the extreme north-east (see geological map) and of the line of small gold mines running from the Grand Flaneur through the Blue Bell and the Portland to McGowan's shaft. So far no tin has been recorded in association with this granite, and the adjacent gold prospects are free milling quartz reefs with primary sulphides at depths similar to the auriferous reefs of the other provinces. Hence there is a temptation to correlate the Mt. William granite with the Mt. Stronach intrusion rather than the Mt. Cameron intrusion. But on the other hand this granite is said to resemble lithologically the coarse porphyritic granite of the tin province.

Another island zone is the group of copper prospects near Scamander. These are associated with small intrusions of granodiorite which has border phases of hypersthene-bearing granodiorite (Twelvetrees 1911). These masses are outlying bosses from larger granodiorite mass in the St. Marys district, which also has pyroxenic phases. The lodes are quartz reefs with arsenopyrite, chalcopyrite, and galena and at the Scamander Silver Mine carry silver and gold with secondary enrichment in the oxidized zone. The whole set up of the group of lodes and the character of their parent igneous rocks links them with the Mt. Stronarch gold province as distinct from the Mt. Cameron-Blue Tier tin province. The two provinces come very near one another at the Great Pyramid Tin Mine, but there is no confusion or overlapping of the lodes.

The foregoing discussion suggests that there were distinct epochs of granitic intrusion and metallogenesis in the morth-east of Tasmania, one bearing gold and some copper, zinc, silver, lead and molybdenum and the other introducing tin and tungsten. The geographic evidence suggests that this differentiation is not merely one of thermal zoning. In the past it has been generally accepted that all Tasmanian orebodies were the result of a period of intense granitic and ultra basic intrusion of Devonian age, but critical review makes it clear that this view involves much unwarranted assumption. So far as the north-east is concerned, the ore bodies are probably all Post-Silurian and were emplaced sufficiently long before the beginning of the Permian to permit extensive peneplanation. However there still remains a considerable interval of time within these limits. Dr. W.R. Browne in private correspondence with the writer has suggested that the granodiorite intrusions with their associated arsenical gold quartz veins and copper etc., and their tendency to carry hypersthene may be of late

Middle Devonian age and referable to the epi-Yeringian magmatic epoch of Eastern Australia, and that the tin granites may be of late Lower Carboniferous age and referable to the Drummond epoch of Eastern Australia. There is a good deal to be said for such a view and I find nothing in the Tasmanian evidence to gainsay it. A systematic petrological study of the plutonic rocks of north-eastern Tasmania might yield much information of economic as well as academic value.

Western Mineral Belts.

A conspicuous feature of the West Coast region is the zinc-lead sulphide belt extending from the Pinnacles southwards for 30 miles through Rosebery and the Hercules to the old Queensbury Mine. This belt is associated with sheet like intrusions of Devonian felsite and porphyry into Cambrian keratophyric lavas, breccias and tuffs; the intrusion was accompanied by strong shearing, which effected the intruding rock even more than its host, and by hydro-thermal alteration. In the resultant complex of quartz sericite schists and chlorite schists which have been grouped under the general term "porphyroids" it is difficult to distinguish the Cambrian volcanic rocks from the subsequent porphyries. The lodes are replacement bodies with sphalerite as the principal ore mineral and galena and chalcopyrite as important constituents. Gold and silver are present. Extending for about ten miles on either side of this zinc-lead sulphide belt are zones carrying silver-lead ore bodies.

An important belt of copper sulphide lodes and disseminations extends for nearly fifty miles northwards from Kelly's Basin to near Tullah. Included in this group are the important Mt. Lyell ore bodies. Right along this belt the ore bodies are closely associated with fairly large intrusions of Hypabyssal rocks injected during folding and faulting movements. A number of iron prospects are shown in this belt, but these are rather heterogeneous some being gossan caps of pyritic bodies and others being magnetite segregations (e.g. south end of Findon's). Gold is present in the primary sulphide and has contributed much to the value of the Mt. Lyell production. It has also been mined in gossan enrichments (e.g. Harris' Reward) and as small derivitive alluvial concentrations.

Taking the broad view of the West Coast mineral province, the distribution of the copper, zinc, silver and lead lodes is in accord with a general thermal zoning. This view was long ago expressed by Ward (1902) but is not universally accepted by geologists interested in the area today. However the Darwin-Lyell-Murchison copper belt coincides with the zone where large hypabyssal intrusions of porphyry are exposed at the surface. The Pinnacles, Rosebery, Queensbery zinc belt coincides with the zone where smaller intrusions reach the surface under conditions of more shearing and hydrothermal solutions and less actual magma, as compared with the copper belt. Between these two and again west of the zinc belt, the lodes are mainly silver-lead, while further westwards zinc is on the increase again. This picture is over simplified but is capable of amplification on larger scale study.

Ward went further and included the tin at Heemskirk and Renison Bell as the high temperature phase of this same sequence. However while this may prove to be correct, other views seem not impossible and some caution is desirable. Thus Dr. Browne has tentatively suggested (personal communication) that the non-sheared tin granites here as in the north-east may be distinctly later than the sheared intrusions which introduced the copper, silver and lead.

The tin fields themselves fall into two classes one consisting of quartz cassiterite lodes and disseminations, and the other of cupriferous sulphide bodies. The first group include the concentrations about Mt. Heemskirk, and Pearson's Hood where the tin is directly associated with broad outcrops of unsheared porphyritic granite. Stanniferous greisens and quartz tourmaline nodules have contributed to the production. To the second group belong Mt. Cleveland, Mt. Lindsay and the Renison Bell-Colebrook clusters of ore bodies which possess a number of peculiarities which brand them as cognate. These ore bodies are mainly simple replacements of folded sediments, and hence many of them are flat-lying or occupy the troughs of sharp synclines and hence do not persist indefinitely in depth. The tin ore is of a sulphide type with pyrrhotite as the dominant mineral and with chalcopyrite as a common accessory. The tin is of very fine grainsize and is partly in the form of stannite. The bodies are of relatively low grade but of large size, and represent considerable tonnages of tin. Valuable secondary enrichment gossans occur in the oxidized zone. A striking fact is that all these ore bodies are closely associated with ultra-basic rocks. This may be merely a coincidence, but since pyrrhotite and particularly cupriferous pyrrhotite are common magmatic segregation products from ultrabasic rocks, the possibility suggests itself that these tin-bearing cupriferous pyrrhotite bodies may be genetically related to the basic rocks, which if substantiated would constitute an unusual association for tin. The common occurrence of axinite and actinolite in these ore bodies also accords with this suggestion. On the other hand dykes of quartz porphyry do occur at Renison Bell and quartz porphyry has also been recorded by Reid (1923) at one spot at the Mt. Cleveland Mine, but I was unable to find any on my visit.

Mt. Bischoff has been much in common with these stanniferous sulphide bodies. There was a rich and extensive oxidized cap, now mostly removed, but the primary ore is pyritic and of replacement type, although the tin is coarser than in the other pyritic bodies. Dolomite is abundant and is regarded as an end product from the alteration of serpentine. However in addition to the replacement bodies there are important lodes of the fissure vein type. Also quartz porphyries are more abundant and these show evidence of intense pneumatolytic action with extensive topazisation.

The cluster of copper bearing sulphide bodies near Barn Bluff has many features in common with the foregoing stanniferous sulphide group and may well be cognate.

The Moina group of mines and prospects in the Forth Valley offers a wide diversity of minerals which at first sight suggests a thermal zoning pattern with tin tungsten and bismuth principally occurring in and around the Dolcoath granite and gold, silver, lead and copper more widely distributed through the country rock. However the question arises of the relation of the Dove River and Dolcoath granites and the relation if any of the former to the ore bodies. Here again there is the association of an unstressed granite carrying tin and tungsten and a sheared granitic rock in a broad gold, silver, lead, zinc field.

Another belt of considerable interest is the zone of copper-iron prospects which extends meridionally for 20 miles from Specimen Reef through Rio Tinto across the Savage River to the Pieman. This appears to consist of pyritic bodies of impressive dimensions. At depth the primary lodes are probably all pyritic with pyrites and chalcopyrite. Extensive caps of gossan and magnetite have formed near the surface as a result of deep oxidation. Secondary enrichment of gold has occurred, and this has been shed to the several payable alluvial accummulations along the Savage River, where much of the gold is coarse. This important zone has certainly not received the attention it would appear to deserve from prospectors or geologists. Difficulty of access, dense vegetation and high rainfall seem to have been the principal obstacles but these have been surmounted elsewhere. Indeed there is an extensive area of potential mineral country between the Pieman and the Arthur Rivers which merits thorough examination.

A mixed group of prospects occurs in the vicinity of the Dial Range. These include chalcopyrite lodes associated with the Housetop granite, Cambrian stratified haematites at the Blythe River, Ordovician haematite pebble conglomerates in the Dial Range, magnetite segregations in basic rocks at Hampshire, and tin and silver-lead associated with the granite in this same area. Argentiferous lodes also occur on the coast near Penguin. Further work is warranted in this region but much of the surface is covered by Tertiary basalt. There is little doubt that the richly mineralised zones of the West Coast extend continuously beneath the basalt to the north coast between Ulverstone and Burnie.

A marked feature of the mineral distribution map is the way in which the evidence of mineralisation cuts off suddenly along a line through Trial Harbour and Kelly's Basin. North of this line there is a dense swarm of mineral prospects and mines. South of this line there is practically nothing. Insufficient search and the covering of Tertiary sediments along the north-east shore of Macquarie Harbour do not supply the whole answer, and early Tertiary faulting seems to be a contributing factor. This north-west to south east trending faulting which broke up the late Mesozoic peneplain in the lower Miocene, has been discussed in the notes to accompany the new Geological Map. The coastline from the mouth of the Pieman to Trial Harbour and continuing thence to Kelly's Basin is a line of strong downfaulting to the south, and it would seem that this has had a good deal to do with the trucation of the mineralised rocks. Parallel to this but a few miles to the north-east there is evidence of another similar fault which was first suggested to me by Dr. Loftus Hills (personal communication). This would account for the 3,000 feet difference elevation between the Permian capping Mt. Dundas and that at Mallana. Such a fault would also have a marked effect probably on the south-western boundary of the Zeehan field.

<u>Miscellaneous Groups</u>

Quite independent of all the foregoing are the clusters of osmiridium, nickel and asbestos prospects which are in all cases directly derived from ultrabasic intrusive rocks. To this category also belong the chrome-bearing magnetite iron ores at Beaconsfield which are magmatic segregations in the serpentine, and also perhaps the magnetite deposits at Zeehan, Long Plains, Hampshire and Highclere.

Isolated groups of alluvial gold accummulations occur about the Jane River and again about the Mainwaring River. In neither case has the source of the gold been found, and in both cases a systematic search is warranted. In the case of the Mainwaring the source is likely to be an enriched gossan capping primary sulphides. The Jane River field is however in a very different environment and the source may prove to be of sedimentary type in the Pre-Cambrian rocks.

The Cox's Bight tinfield is grouped round a small intrusion of unstressed granite in Pre-Cambrian rocks. Since the granite is very limited the tin-bearing area is not likely to extend far. Wolfram is also present.

An important tin tungsten province occurs on King Island. The principal known deposit is the King Island Scheelite body which is a contact reation deposit at the junction of granite and limestone. But in addition good prospects for wolfram and cassiterite quartz reefs exist along the old Sea Elephant Prospecting Association leases in the centre of the Island, and alluvial tin occurs on leases originally held by the same association; cassiterite, monazite, rutile and zircon are constant constituents of the Frazer River beach limenite sands.

There is doubtless considerable promise in this region but the principal obstacle is the thick mantle of soil and superficial deposits which cover so much of the island.

The small group of gold prospects about Cygnet is unique in that this is the only known occurrence of Post-Triassic metallogenesis in Tasmania. The gold has been introduced by alkaline nepheline syenite porphyries of late Mesozoic or early Tertiary age.

CONCLUSION

I append individual reports by Messrs. Henderson and Keid. A list of references to earlier papers quoted in this report and an index to localities mentioned in this report have also been added.

Finally I wish to express my thanks for the loyal co-operation of the officers of the Geological Survey during the year.

MR. HENDERSON'S REPORT

The following is a summary of the field investigations undertaken by me during the year ended December, 1945.

The Mount Cleveland Tin Mine
The Bellerive-Risdon Ground Water Supply

and a summary of the reults obtained are contained in the Government Geologist's annual report.

The Mt. Farrell District

The systematic geological survey of the Farrell district was continued during the first three months of the year, but progress was seriously retarded owing to an abnormally wet season. Most of the time was occupied in extending the main control survey to the north and east of Mt. Farrell. The traverse of the West Coast Conglomerate was completed for the whole of Mt. Farrell, including Little Farrell.

The White Hawk line of mineralization was examined in part only and the provision of adequate track facilities is necessary before the work can be completed satisfactorily.

Diatomaceous Earth

The deposits of diatomaceous earth at Andover were visited for the purpose of obtaining samples and as the quality was unattractive for the required purpose no further development occurred.

Alleged Ammonia Deposits - Trial Harbour

At Trial Harbour, geological conditions are distinctly unfavourable for the formation of the extremely rare ammonium minerals and climatic conditions are such that there would be no accummulations of the highly soluble ammonium salts. The barren conditions of the area in respect to vegetation give no reason to suspect the presence of any mineral deposit with the properties of a fertilizer.

Butlers Gorge - Dam Foundations

The Butlers Gorge Dam site was visited for the purpose of continuing the detailed geological examination of the dam site excavations. The study of the fracture pattern revealed the existence of three primary systems of fractures, which through a lack of observable flow structures could not be correctly orientated. Regarding the fault which traverses block A the evidence of striae and slickensides indicates that the general movement has been horizontal in the direction of the fault. Although this fault has been long inactive there is no evidence of its stability and the possibility of renewed movement along the fault cannot be overlooked entirely.

The study has shown that there are no clay seams of sufficient magnetude to affect seriously the stability of the dam foundations. As the three directions of maximum weakness are south 87 degrees west at an elevation of 45 degrees, south 20 degrees west at an elevation of 19 degrees and south 8 degrees west at an elevation of 22 degrees it is apparent that the direction of the major thrusts of the dam are most advantageously placed.

"Rhodochrosite."

An examination of the Read-Rosebery ore bodies was undertaken to determine the possibility of obtaining supplies of rhodochrosite to meet a London demand for this mineral. The examination established that the mineral recorded as rhodochrosite was in fact only a manganiferous carbonate. Although fairly abundant in the ore hand picking would be necessary and this is possible only when the market value of the product is sufficiently high. As rhodochrosite was not present in sufficient quantity in the ore no further action was taken.

The remainder of the year was spent on survey computations in connection with the Farrell control survey, the preparation of plans and report on the Farrell Mine, together with the proposed programme of exploratory drilling and general routine matters.

MR. KEID'S REPORT

During the year a total period of 35 weeks was spent in the field 14 weeks of which were spent in camping.

With the exception of a period of six weeks spent in an examination of the area in the vicinity of Cradle Mountain all the field work has been done in the district between the east coast of the State and a line joining Boobyalla, Gladstone, Goulds Country and St. Helens.

Although a general examination of the area was made the principal object was the stimulation of the tin-mining industry in the north-eastern part of the State with particular attention to search for areas of alluvial ground considered suitable for testing by boring.

A report has been submitted in which attention has been drawn to the nature of the known deposits and emphasising the necessity for closely spaced bores in testing any new areas. Maps have been prepared and attention drawn to potential tin-bearing areas. The mining of lode or vein tin ore has never had continued success in the district and operations have been spasmodic. Suggestions have been made relative to searching for new veins.

There is no gold mining in the district and prospects are not bright for its resuscitation. As suggestions have been made relative to the re-opening of the old Portland Mine special attention has been drawn to Geological Survey Bulletin No. 25 in which is recorded the narrowness of vein and low grade of ore when the mine last closed down.

In the Cradle Mountain district the work was hampered by bad weather. An exceptionally wet summer resulted in snow and sleet over the greater portion of the period spent there. A general examination of the district was made and a map was prepared to record the geological and principal topographic features.

The period in office was devoted to the writing of reports and compilation of explanatory maps.

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INDEX TO LOCALITIES CITED

Name.	Quadrangle	Latitude S	Longitude E
Adamsfield	Huntley 73	42°49'	146°20'
Andover	Oatlands 68	42° 5'	147°27'
Arthur Valley	26,27,28,35,36	41°10'	144° 4'
Barn Bluff (5114')	Mackintosh 44	41°44'	145°56'
Battery Lode	Magnet 35	41°25'	145°23'
Beaconsfield	Beaconsfield 30	41°11'	146°45'
Bellerive	Hobart 82	42°52'	147°24'
Blue Bell	Eddystone 25	40°53'	148° 4'
Blythe River	Burnie 28, D'port,29	41° 6'	145°59'
Boco Creek	Mackintosh 44	41°42'	145°32'
Boobyalla	Boobyalla 24	40°53'	147°53'
Bulgobac	Mackintosh 44	41°37'	145°35'
Burnie	Burnie 28	41° 4'	145°53'
Burns Creek	St. Clair 59	42°12'	146°45'
Butlers Gorge	King William 66	42°17'	146°12'
Bischoff, Mt.(2596')	Valentines Pk. 36	41°27'	145°32'
Cameron, Mt.	Boobyalla 24	40°59'	147°57'
Cape Barren Is.	15 and 14	40°20'	148°15'
Caroline Creek	Sheffield 37	41°20'	145°24'
City of Melbourne Bay	S.W. King Is. 10	40° 1'	144° 8'
Clarke Dam	King William 66	42°17'	146°12'

Name	Quadrangle	Latitude S	Longitude E
Claude, Mt. (4047')	Sheffield 37	41°30'	146°12'
Cleveland,Mt. (3000')	Magnet 35	41°25'	145°23'
Colebrook	Brighton 75	42°32'	147°22'
Collingwood Riv.	Lyell 58	42°10'	146°50'
Cox's Bight Tinfield	Bathurst 92	43°29'	146°15'
Cradle Mt. (5069')	Mackintosh 44	41°42'	145°58'
Cygnet	Kingborough 88	43°10'	147° 7'
Darwin, Mt. (3300')	Lyell 58	42°16'	145°36'
Davey, Pt.	Davey 91	43°20'	146°
Derwent Valley	Hobart 82	42°30'	146°30'
Dial Range	Devonport 29	41°11'	146° 1'
Dove Riv.	Mackintosh 44, Middlesex 45	41°36'	146°
Dundas, Mt. (3920')	Zeehan 50	41°54'	145°28'
Dundas, Nth.	Zeehan 50	41°52'	145°28'
Eddystone Pt.	Eddystone 25	40°59'	148°21'
Eldon Series	Murchison 51	41°58'	145°44'
Farrell Mt.	Mackintosh 44	41°43'	145°32'
Farrell, Little	Mackintosh 44	41°46'	145°33'
Farrell Siding	Mackintosh 44	41°43'	145°32'
Findon's	Lyell 58	42°14'	145°35'
Flinders Is.	Bass Strait	40°	148°
Fly-by-Night-Mine	Eddystone 25	40°58'	148° 1'
Forth Valley	Sheffield 37, Middlesex 45	41°25'	146°15'
Fraser Riv.	Sea Elephant 6	39°54'	144° 2'
Freycinet Peninsula	Swansea 63, Schouten 70	42°13'	148°18'
Furneaux Group	Bass Strait	40°	148°
Gordon Riv.	65,72,73	42°45'	145°45'
Gould's Country	Blue Tier33, St.Helens 41	41°15'	148° 3'
Grand Flaneur	Eddystone 25	40°52'	148° 4'
Great Pyramid Tin Mine	St. Helens 41	41°26'	148°11'
Guilford	Valentines Pk. 36	41°26'	145°41'
Gunns Plains	Sheffield 37	41°18'	146° 1'

Name	Quadrangle	Latitude S	Longitude E
Hall's Cut.	Magnet 35	41°25'	145°23'
Hampshire	Valentines Pk. 36	41°16'	146°47'
Hanlon's Ck.	Trowutta 27	41°11'	145°20'
Harris' Reward	Lyell 58	42° 9'	145°32'
Heemskirk, Mt.	Zeehan 50	41°54'	145°12'
Henry's Cut	Magnet 35	41°25'	145°23'
Henty Riv.	50, 51, 57	42° 2'	145°18'
Hercules Mine	Zeehan 50, Murchison 51	41°50'	145°30'
Highclere	Burnie 28	41°12'	145°49'
Horror, Mt.	Ringarooma 32	41° 4'	147°44'
Housetop	Valentines Pk. 36	41°18'	145°55'
Jane River Goldfield	Pillinger 65	42°28'	145°50'
Jeanbrook Ck.	Sheffield 37	41°24'	146° 2'
Jukes-Darwin Area	58 Lyell	42°13'	145°35'
Jukes, Mt. (3800')	Lyell 58	42°11'	145°36'
Junee	Styx 81	42°46'	146°38'
Kelly's Basin	Davey 91	43°17'	145°53'
Killiecrankie	N.W. Flinders 7	39°50'	147°52'
King Riv.	Strahan 57, Lyell 58	42°10'	145°30'
Lake Jukes Track	Lyell 58	42°10'	145°35'
Lefroy	Beaconsfield 30	41° 5'	146°59'
Lilydale	Piper River 31	41°14'	147°13'
Lindsay, Mt.	Corinna 43	41°43'	145°12'
Lisle Goldfield	Piper River 31	41°13'	147°20'
Long Plains	Corinna 43	41°32'	145°13'
Lorinna Road	Middlesex 45	41°32'	146° 9'
Lyell	Lyell 58	42°11'	145°25'
Lyell, Mt.	Lyell 58	42° 3'	145°37'
Lynch Ck.	Lyell 58	42° 7'	145°33'
Lynchford	Lyell 58	42° 7'	145°31'
Luck's Lode	Magnet 35	41°25'	145°23'
McCusicks Ck.	Lyell 58	42° 5'	145°33'
McGowan's Shaft	Eddystone 25	40°56'	148° 4'
Mackintosh Riv.	Mackintosh 44	41°43'	145°37'

Name	Quadrangle	Latitude	Longitude
Macquarie Harbour	Macquarie Harbour 64	42°15'	145°25'
Macquarie Valley	Macquarie Harbour 64	42°15'	145°25'
Madam Howard Plains	Lyell 58	42° 4'	145°32'
Mallana	Strahan 57	42° 2'	145°20'
Mangana	Ben Lomond 48	41°36'	147°53'
Mathinna	Alberton 40	41°26'	147°52'
Meander Riv.	Quamby 46	41°31'	146°40'
Moina	Sheffield 37	41°30'	146° 6'
Murchison, Mt. (4400')	Murchison 51	41°50'	145°36'
Murchison Riv.	Murchison 51	41°51'	145°42'
Newton Ck.	Murchison 51	41°56'	145°35'
North Pieman-Huskinson	Zeehan 50	41°46'	145°25'
Nietta	Sheffield 37	41°22'	146° 4'
Parsons Hood (2850')	Corinna 43	41°41'	145°20'
Penguin	Devonport 29	41° 7'	146° 3'
Pieman Riv.	Corinna 43, Zeehan 50	41°50'	145°20'
Pinnacles	Corinna 43	41°31'	145° 1'
Portland	Eddystone 25	40°55'	148° 4'
Prince Darwin Section	Pillinger 65	42°16'	145°35'
Queen Riv.	Lyell 58	42° 7'	145°33'
Queensbery Mine	Strahan 57	42° 1'	145° 3'
Queenstown	Lyell 58	42° 5'	145°33'
Railton	Sheffield 37	41°21'	146°27'
Read, Mt. (3890')	Murchison 51	41°53'	145°33'
Read-Rosebery Mine	Murchison 51	41°46'	145°32'
Reardons Mine	Middlesex 45	41°33'	146° 9'
Renison Bell	Zeehan 50	41°49'	145°27'
Ringarooma Valley	24, 25, 32	41°14'	147°45'
Rio Tinto	Magnet 35	41°28'	145°13'
Risdon	Hobart 82	42°50'	147°20'
Rocky Riv.	Corinna 43	41°39'	145°13'
Rosebery	Murchison 51	41°49'	145°28'
Roys Hill	Snow Hill 55	41°50'	147°50'
St. Helens	St. Helens 41	41°17'	148°22'

Name	Quadrangle	Latitude	Longitude
St. Marys	St. Marys 49	41°17'	148°12'
Savage River	Magnet 35, Corinna 43	41°33'	145° 9'
Scamander	St. Helens 41	41°28'	148°16'
Sea Elephant Pr. Ass. Leases	King Island	39°50'	144°
Sth. Esk Valley	Alberton 40, Ben Lomond 48	41°30'	147°51'
Smithon	Smithon 21	40°52'	145° 7'
Smithy Lode	Magnet 35	41°25'	145°23'
Snake Peak	Lyell 58	42°16'	145°36'
Storeys Creek	Ben Lomond 48	41°37'	147°43'
Stronach, Mt.	Ringarooma 32	41°10'	147°35'
Tamar	Beaconsfield 30 & Frankford 38	41°16'	147°
Trial Harbour	Zeehan 50	41°59'	145°11'
Tullah	Mackintosh 44	41°44'	145°36'
Tyndall, Mt. (3800')	Murchison 51	41°56'	145°35'
Ulverstone	Devonport 29	41°10'	148°10'
Waterhouse Pt.	Boobyalla 24	40°52'	147°38'
Warrentinna	Ringarooma 32	41° 6'	147°43'
Western Tiers	Lake Riv. 54	41°38' to 42° 6'	146° to 147°16'
Whyte River Valley	Magnet 35, Corinna 43	41°30'	145°14'
William, Mt.	Eddystone 25	40°55'	148°11'
Wynyard	Table Cape 22	41° 1'	145°42'
Zeehan	Zeehan 50	41°56'	145°21'

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22nd October, 1946

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