

REPORT

on the

WEST COAST RANGE COPPER PROSPECT

in the

LAKE MARGARET TO MOUNT MURCHISON AREA, TASMANIA.

by

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with appendices by

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PART I

	<u>Page</u>
<u>SUMMARY</u>	(a)

PART IIGENERAL DISCUSSION

Nature of the Prospect	(c)
Geological Background	(c)
Appraisal of Ore Possibilities	(d)
Red Hills Prospect	(d)
Lake Dora Prospect	(e)
Anthony Creek Prospect	(f)
Langdon Prospect	(f)
Cost of Initial Testing Programme	(f)
Recommendations	(g)

PART IIIAPPENDIX - GENERAL GEOLOGY (M.R. BANKS)

Access and general	1
Physiography	2
Stratigraphy	3
Carbine Group	3
Dundas Group	4
Red Hills Area	5
Langdon River Area	6
Lake Dora Area	7
Summary of Dundas Group	15
Junee Group	15
Structure	17
West Coast Range Anticlinorium	18
Tyndall Thrust	18
Gooseneck Syncline	18
Tyndall Anticline	19
Rolleston Syncline	19
The Crossfields	20
Faulting	20
Structure of the Dundas Group	21
Mineral Deposits	22
Red Hills Area	22
Langdon Area	23
Lake Dora	23
Igneous and Metamorphic Petrology (Beryl Scott)	24
Chlorite and Sericite Schists	24
Quartz Porphyries	25
"Felsite"	25
Hornblende "Andesite"	27
Nature and Origin of the Hydrothermal Alteration	30
References to literature	32
Locality Index	33

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PART I

SUMMARY

SUMMARY

A good deal of work, in the field during the last summer season and in the office and laboratory since, has now been done on the reconnaissance investigation of the West Coast Range copper prospect. The following report describes the progress which has been made in the examination of this difficult belt of country. Conclusions are drawn, and recommendations made for further testing.

The area examined was chosen for investigation because of its position in one of the most highly mineralised parts of the continent, and in particular its situation in relation to the Mount Lyell and Rosebery mining fields. The geological field work showed that the structures being sought did in fact continue from Mount Lyell into the district studied, and several situations favourable for the development of orebodies were found. These situations were found to be associated with evidence of copper mineralisation as indicated by old prospecting works, and also in one instance newly discovered by the present survey. The nature of the prospect is such that no particular brief is held for the possibility of finding small and rich lodes. The only practical target seems to be the possibility of developing a large orebody of the general character of that at West Lyell, and whose very size would be sufficient to offset the undoubtedly low grade.

Of the several prospects which have been brought into focus by the reconnaissance work, that at Red Hills is the most outstanding, followed by that at Lake Dora. At Red Hills, copper mineralisation is evident over a large area. A geochemical survey, with samples taken on an 80-yard grid, has shown the existence of significant copper mineralisation in the Red Hills area, over a zone 800 yards wide, and at least 1600 yards long.

There is a case to answer. The Red Hills prospect in particular offers a chance of providing a large body of low grade primary sulphide ore; there is no oxidised or secondary ore, because the land surface has been recently glaciated. Several methods of testing the zones are possible, but the cheapest and most suitable at this stage is to test the ground by vertical drill holes.

A fair start could be made on testing the most favourable parts of the Red Hills prospect by drilling about 50 holes, mostly 50 ft. deep, with occasional extensions to a depth of 200 ft. These could be on a grid spacing of 100 ft. By selecting the drill sites in the most favourable part of the prospect, it could be considered that if the drill holes were

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failures the prospect could be safely abandoned. Encouraging results in the drill holes would however involve continuing the work with substantial testing expenditure.

A testing programme of the type outlined could be expected to cost about \$15,000. This includes 4,000 ft. of drilling, and all subsidiary expenditure. A decision to embark on the programme should be followed by making preparations for the field season as soon as possible in the spring. It would be best to lay the preliminary plan for access and supply during October.

The following report consists of a general discussion of the project, supplemented by a more detailed appendix. The appendix deals with the local geology in such a way as to serve as a sufficient background for future work.

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PART II

GENERAL DISCUSSION

NATURE OF THE PROSPECT

The Mount Lyell field lies on the West Coast Range at Queenstown. Twenty miles further north is the Rosebery field. Showings of copper mineralisation are known sporadically along the range, with a gradation to lead and zinc in the neighbourhood of Rosebery. When the reconnaissance survey was undertaken, the geological structure and stratigraphy were reasonably well known for sixteen miles south of Mt. Lyell, but only for three or four miles north of Mt. Lyell, though in general it was known that the West Coast Range geanticline continued northwards for at least thirty miles from Mount Lyell. The structures and particular rock types which are associated with ore at Mount Lyell are now reasonably well known.

The reconnaissance survey has shown that there is not much chance of finding, at reasonable expense, rich lodes which might provide profitable mines in this area of high cost of supply and development. The survey aimed at, and has succeeded in finding, zones suitable for further testing for possible very large low grade ore bodies.

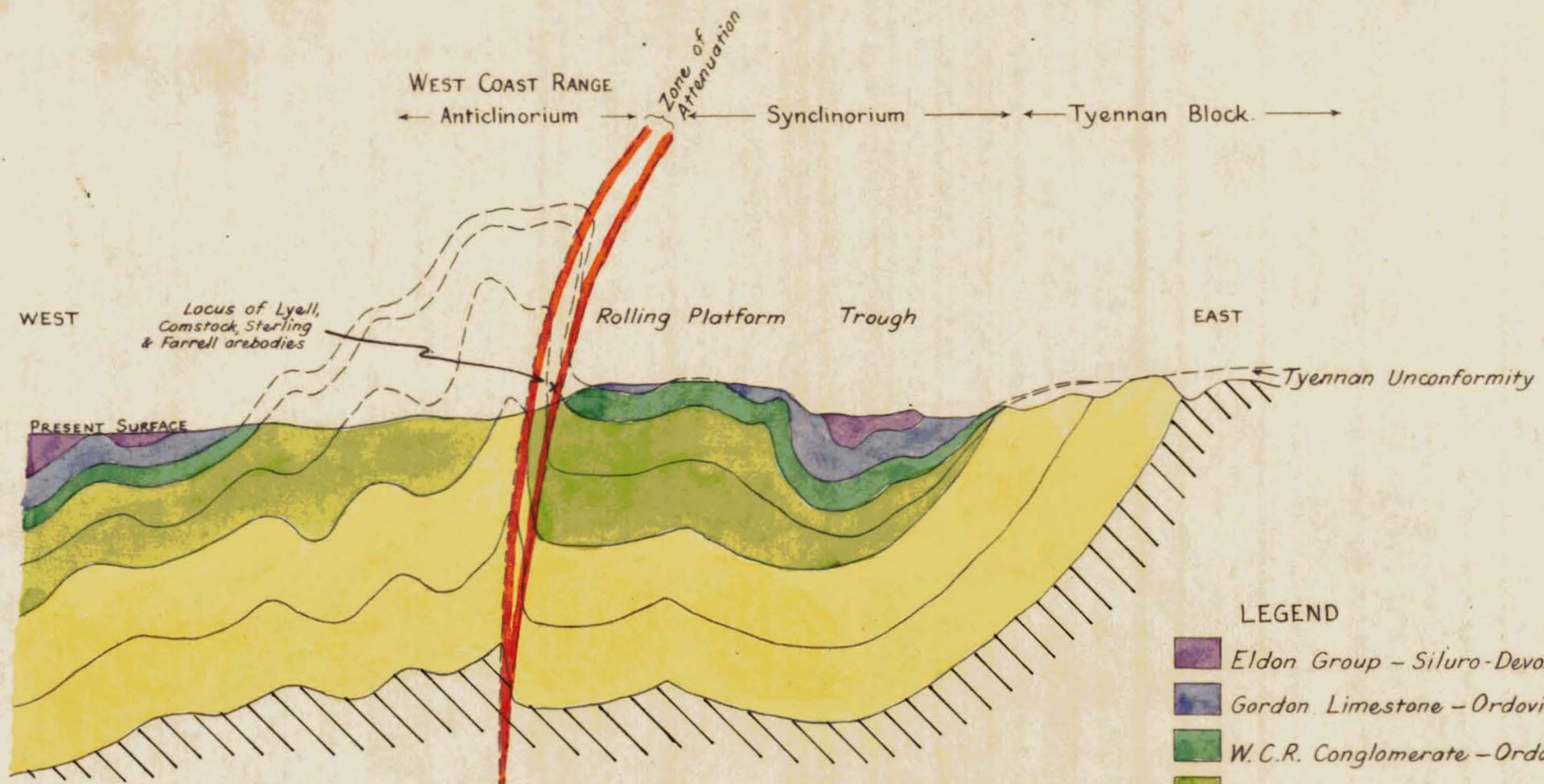
GEOLOGICAL BACKGROUND

The accompanying text figure 1, shows the broad stratigraphy and structure in a cross section through the West Coast Range. The geanticline is a complex major anticlinorium raised on the site of unusually thick Cambrian sedimentation consisting mainly of coarse and fine greywacke type sediments with basic lavas. The sediments were folded by Cambrian movements and strongly folded and faulted by the Devonian orogeny also. During the Devonian orogeny there was dynamothermal metamorphism with chloritisation, albitisation, and locally sericitisation. The sediments were altered to porphyroids and schists. Widespread pyritic copper mineralisation is evident from place to place right along the range.

At Mount Lyell the ore bodies are associated with:-

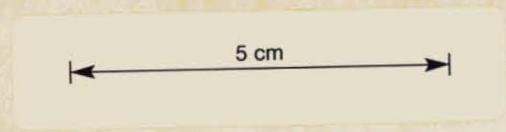
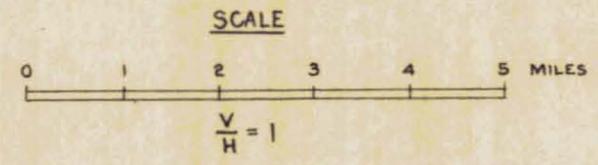
- (A) A regional zone of steep overturned dips with much attenuation, and west-block-north-and-up displacement, trending meridionally, parallel to the main geanticline.
- (B) Cross structures of two types - (a) N.W. to E.N.W. trending secondary folds which are commonly overthrust with overturning and attenuation of the N.E. limb; (b) S.W. to W.S.W. fractures interpreted by Carey as tensional. Both (a) and (b) seem to play a part in ore localisation though this point needs still more study.
- (C) Favourable stratigraphic zones for replacement, the most important being high in the Cambrian sedimentation not far below the base of the West Coast Range Conglomerate (Lower Ordovician).
- (D) Advanced hydrothermal metamorphism to sericite schist.

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LEGEND

- Eldon Group - Siluro-Devonian
- Gordon Limestone - Ordovician
- W.C.R. Conglomerate - Ordovician
- Dundas Group - Cambrian
- Carbine Group - Late Pre-Cambrian
- Davey Group - Pre-Cambrian



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A marked belt or zone of attenuation can be traced for a long distance northwards along the West Coast Range. It is shown diagrammatically on the accompanying text figures (Figs. 2 & 3) and with this as a guide may be picked out on the accompanying folded map of the area under consideration.

During the field study the structure and stratigraphy were mapped northwards from Lake Margaret (four miles north of Mount Lyell) to Red Hills, tracing particularly the attenuated belt, and watching the two sets of cross structures likely to affect ore control.

A close watch was also kept for signs of regional low grade pyritisation which gives a characteristic weathering in this district, and which might indicate a large low grade copper dissemination. This search was hindered by the removal of oxidised products during the Pleistocene glaciation.

A watch was also kept for evidence of metamorphism having advanced to the sericite schist stage. Here again, the removal of weathered products by glaciation rendered sericite less evident by casual observation than at Mount Lyell. Thus the preliminary field impression was that sericitisation was not extensive. Nevertheless the later laboratory study showed that the rocks collected were markedly sericitised, and therefore this environment^{al} condition appears more attractive than it did at an earlier stage of the investigation.

APPRAISAL OF ORE POSSIBILITIES

Red Hills Prospect.

This appears to be in the main zone of attenuation at a place where it makes a major jump to the east owing to the shift of the main shear movement between two large echelon shears as suggested by Fig. 3. A major north-west trending fault which is also associated with pyritisation at Lake Bera impinges on the attenuated zone here. Thus the structural position is generally favourable. The strata are Cambrian Dundas Group, not far from the base of the West Coast Range Conglomerate, but as there is an unconformity between the two groups here, the exact stratigraphic position is obscure. Metamorphism has reached the feldspar chlorite schist stage, and also the sericite stage. There is an extensive narrow zone of pyritic mineralisation nearly two miles long and half a mile wide. Several individual enrichments were opened up for copper last century but were not developed successfully. The most conspicuous enrichments with bunches of chalcopyrite are near north-west trending shears.

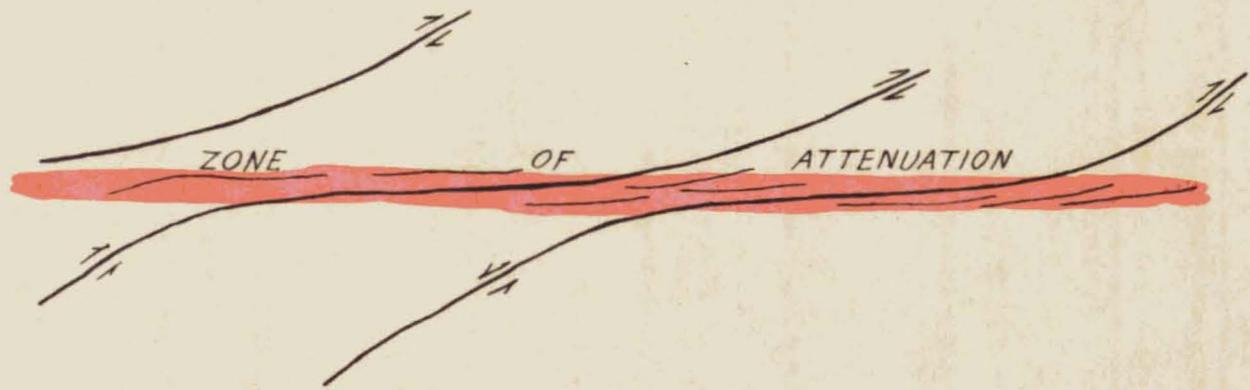


FIG. 3.

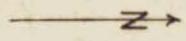
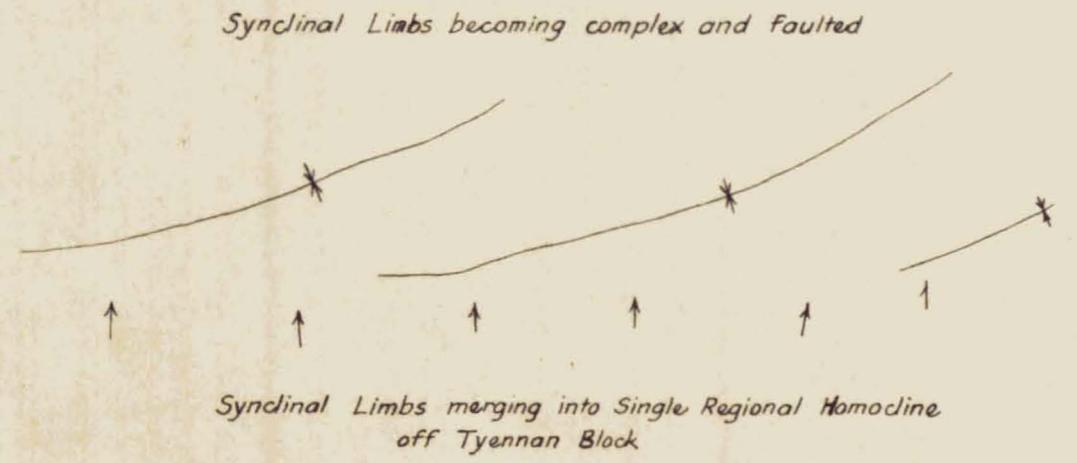


FIG. 2
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Figure 4 of this report shows the position of some of the old workings in the Red Hills area by a series of crosses. The main purpose of the figure is to show the results which were obtained from a geochemical survey of the area. Samples were taken, in all cases by avoiding obviously mineralised material, and subjected to analysis in the laboratory by recognised dithione chemical methods. Only sulphide copper and not silicate copper is detected in this way. It is considered that from zero to five parts per million is not significant; this effect may be introduced by reagents. The higher values for copper content have significance. The highest zone coloured on the diagram relates to a copper content in excess of 40 parts per million.

Naturally, the copper content indicated by the geochemical work is far below that which is of interest for commercial purposes. However, the method is concerned merely to delineate the area within which copper mineralisation has taken place. It is commonly in use in the United States in testing for areas which may contain copper, lead, and zinc.

The contouring of the geochemical anomalies could be varied in detail to give a slightly different pattern, while using the same samples. In general however, the picture would remain the same. One significant feature is that the most intense mineralisation does not coincide with the old workings. Again, although there is some correlation between the trends of the contours and the trend of structures on the geological map, the most important trend on the geochemical contour plan is not parallel to such a structure.

The Red Hills prospect is in a favourable environment structurally and stratigraphically. There is geochemical evidence of widespread copper mineralisation. There is also widespread pyrite and chalcopyrite mineralisation evident in the field.

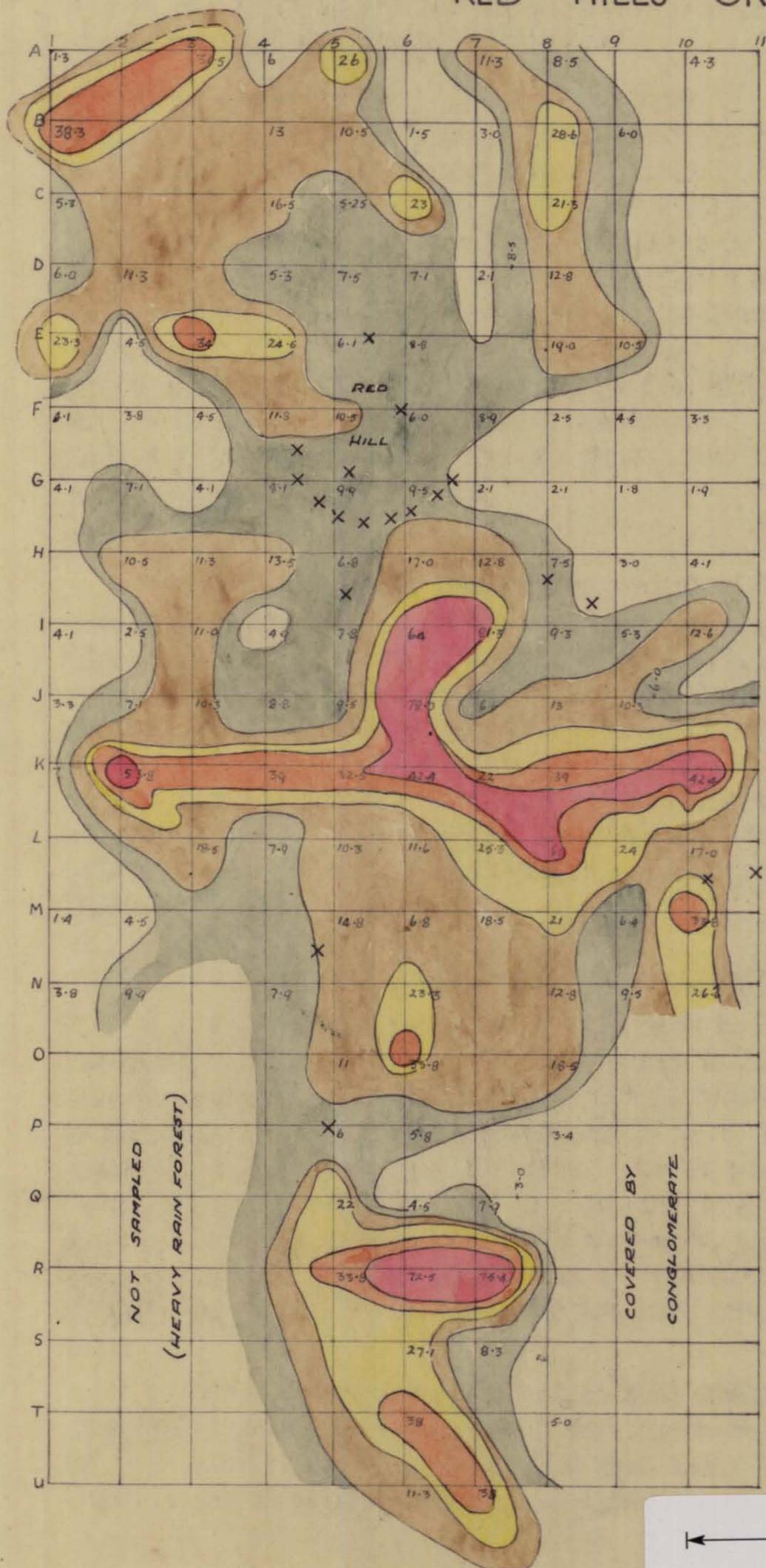
It is considered that the Red Hills prospect is as favourable as one could reasonably expect to find when hunting for evidence of a large and low grade copper ore body, in a glaciated environment.

Lake Dora Prospect.

This is not in the main attenuated zone. It is on a large transcurrent fault trending about north 30° west, which coalesces with the main shear some miles further north. The structure falls in the general synclinal zone. Stratigraphically the pyritised beds are near the top of the Dundas Group. The metamorphism has reached the chlorite schist stage but in general is less advanced than at Red Hills and Mount Lyell.

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GEOCHEMICAL ANOMALIES RED HILLS ORE



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 There is a zone of pyritisation about $1\frac{1}{2}$ miles long by $\frac{1}{2}$ mile wide. There are some old workings on copper enrichments, but they were not successful. In general, because of its structural position and slightly lower metamorphic grade this prospect is considered less attractive on present evidence than Red Hills, though it would be premature to eliminate it entirely. No geochemical work has yet been carried out.

Anthony Creek Prospect.

Pyritised rocks occur in the Dundas Group, though the horizon is not yet established because it is obscured by faulting. It is not in the main attenuated zone although there are faults in more than one direction. Evidence so far has not established an especially favourable structural environment. Metamorphism has reached the chlorite schist stage but is lower in grade than at Mount Lyell and Red Hills. There is a zone of patchy pyritisation half a mile by a quarter mile. It is not considered that this prospect would prove big enough to develop into an economic low grade mine and in any case the environment does not appear very promising.

Lansdon Prospect.

This is a newly discovered prospect on the main zone of attenuation not far from Lake Margaret. Chalcopyrite occurs in blebs in an altered lava some 300 ft. to 400 ft. thick and was proved to continue for at least a mile in the lower part of the Dundas. The lava is now a hornblende albite andesite, but neither the hornblende nor albite are original. In places it is veined with epidote and quartz, and in these places albite is more abundant. The prospect is obscured in large measure by glacial till, but does not at present have the appearance of being large.

COST OF INITIAL TESTING PROGRAMME

The Red Hills prospect should be tested first, and any success there should be used as a yardstick to determine whether work is warranted on the other prospects. Testing could be carried out by taking bulk samples from pits or costeans, for pilot scale milling or reduction for assay. It is considered however that this method would involve more expense than diamond drilling, and would also involve considerable difficulty in providing compressors and the like for excavating the openings. There would also be the difficulty of conveying the bulk samples out of the area.

The alternative method of diamond drilling is suggested. It is proposed that in the initial testing there should be forty diamond drill holes to a depth of 50 feet each, with ten to a depth of 200 feet each. This gives 4,000 ft. of drilling in all.

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A contract for this footage could perhaps be let at £2. 0. 0. per foot, and the drilling should be accomplished within three months. It would be necessary to establish a camp and to provide an access track suitable for taking in supplies, of which one of the heaviest items would be fuel for the diamond drill. Some technical field supervision would be required, and the samples of core would have to be brought out for assay. An approximate distribution of cost is as follows:-

4,000 feet of drilling @ £2. 0. 0. per ft.	£8,000
Establishment of camp and local equipment	500
Preparation of access track	1,000
Operation of supply train (Land Rover) 200 miles per week @ 2/- = £20. 0. 0. per wk.	400
Wages on supply train, £50. 0. 0. per wk.	1,000
Technical supervision	500
Sampling	300
Travelling and overhead	1,200
Use of Land Rover for period	200
Freight on drill and equipment	<u>100</u>
	£13,200
Contingencies	<u>1,800</u>
	<u>£15,000</u>
	<u>Total</u>

RECOMMENDATIONS

The area under study, and in particular the Red Hills prospect, offers as good an opportunity for developing a large low grade copper ore body as could reasonably be expected. The target is large, and if the testing were successful subsequent development would be expensive.

The Red Hills prospect would need to be tested ultimately over an area a mile long and half a mile wide, at least. Some idea of whether the prospect could develop into a payable ore body could be obtained by testing initially an area about 500 yards square, in the most favourable portion of the mineralised zone. This area could be tested by drilling 50 diamond drill holes, 40 of which would be to a depth of 50 ft. and 10 to a depth of 200 feet. This would cost approximately £15,000.

It is recommended that if this type of prospect is attractive in principle, action should be taken to implement the testing programme during the summer of 1952-3. This involves an early start on track preparation and the assembly of equipment.

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PART III

APPENDIX

DESCRIPTIVE GEOLOGY

by

M.R. BANKS and MISS E. SCOTT

ACCESS AND GENERAL

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The area surveyed lies in the western half of the Murchison quadrangle and is covered by aerial photos and mineral charts. These latter on a scale of 20 chains to the inch are the Tyndall and Mount Murchison Sheets. The area is bounded by Mt. Murchison, Lake Margaret, the H.E.C. Transmission Line and Henty River and the Sticht Range and its southerly extension. Trigonometrical stations are on Mt. Murchison and Mt. Geikie. Available literature on this area includes unpublished Mines Department reports, a bulletin of the Geological Survey of Tasmania, and some papers in the Proceedings of the Royal Society of Tasmania. See bibliography.

Access is by foot track from either the rail centre at Rosebery or the tram head at Lake Margaret Power Station. The tracks are rough and in many places also steep while in others they are overgrown and would have to be cleared in the event of further development. In wet weather many of the creeks are impassable and button grass plains become very difficult to cross. The track from Rosebery is not passable to pack horse at present and the track from Lake Margaret Power Station unsuitable for the transport by pack horse of any bulky or heavy articles. Because of these difficulties, supply to the field parties was difficult and at times interrupted.

The high tension Hydro-Electric Power Line passes within a mile of Red Hills and over the Langdon Prospect. Lake Dora is about 5 miles from the nearest power source and Anthony Creek about 4 miles.

The area lies in the highest rainfall belt in the State. The average at Lake Margaret Power Station is about 140 inches, with the maximum recorded as 180 inches, and the rainfall at Lake Dora is probably even greater although that at Red Hills would probably be slightly less. In the mining areas weather conditions were distinctly adverse (during the survey) and no more than seven consecutive fine days were experienced. The high rainfall renders access more difficult through flooding of the creeks.

Two main camps were established as centres of field work, with a temporary camp near Lake Rolleston. The camp site near Lake Julia is good with plentiful supply of water and wood and the additional shelter of the Hydro-Electric Commission hut. Although the party camped beside Lake Dora for several weeks the camp site was not really suitable and no suitable sites were found in that area. If development is intended in that area a hut

would be a considerable help. The camp site at Lake Rolleston is a reasonably good one and is more central than either of the other two, allowing easy access to Red Hills, Lake Dora and Anthony Creek. A small party used the huts at the Langdon River for a few days and these proved very comfortable.

The first month was spent in general survey with several parties, each of a geologist and an assistant, working from Lake Julia first and later Lake Dora and using 20 chain air photos as field sheets. In this way the general structure and stratigraphy were determined, but due to weather conditions and supply difficulties many areas received scant attention. In February, the Lake Dora area was first mapped in more detail and later the party split up, one section working in the Langdon Area, the other mapping the Red Hills area in more detail and collecting specimens (in the prospect area) for geochemical work.

PHYSIOGRAPHY

The district which is the northern part of the West Coast Range has a high relief and the highest peak reaches an altitude of over 4,000 feet. The main ranges are the Tyndall Range, and Mt. Murchison with the Gooseneck lying a little south west of Murchison, and the Sticht Range on the eastern limit of the surveyed area. Remnants of the pre-Permian peneplain are revealed below Mt. Sedgewick and on the flattish area between Mt. Read and the Hercules Mine to the west of the Henty River and it is possible that the more-or-less accordant levels of the Tyndall Range and Mt. Murchison may also represent this old level. The marked flattish areas at a lower level, such as those between Basin Lake and Newton Creek and the flats on which Lake Dora lies, suggest a later plain above which the main part of the West Coast Range projected as a residual. This last plain is now being dissected by the youthful to early mature streams which are the tributaries of the King, Yolande, Murchison, and Henty Rivers. The tributary streams usually arise in the mountain areas over which they flow in their mountain tract and then pass directly into a short plains tract before passing the knick point after which they again enter a mountain tract. Anthony Creek is a good example of this anomalous tract succession. Many of the streams rise in glacial lakes.

The most striking physiographic feature of the area is the glaciation, the mountain phase of which is classically exemplified in this area. Cirques, U-shaped and hanging valleys are very common while the area around Lake Dora is a fine example of the physiographic effects of sheet ice. There roches moutonnées, and striated pavements with erratics, many of them perched, indicate the former direction of flow of the ice sheet

and this is reflected by the orientation of many of the lakes which occupy the depressions scoured out by the ice. There are also fine examples of moraines of different types and occasional drumlins and perhaps eskers. This glaciation has had the effect of revealing almost unaltered bedrock and made possible any of the detailed work that was done.

The general physiography reflects the geology, the hard rocks such as the Carbine quartzites and the West Coast Range Conglomerate forming the main hills and ranges. With the latter formation the structure is also revealed and thus may be recognised on air photos. The Dundas Group generally forms flattish areas often with a hummocky appearance due to the development of roches moutonnees. The Gordon Limestone, due to its solubility, appears as a deep depression east of Lake Peter. Vegetation on the higher areas is generally stunted but in the valleys is usually thick and in the lower reaches of Anthony Creek is almost impassable. The Lake Dora Anthony Creek and Langdon prospects are not heavily timbered but the northern and southern limits of the Red Hills prospect are thickly covered and progress through the forest is difficult.

STRATIGRAPHY

Carbine Group

Along the eastern margin of the area a group of quartzites, argillites, chloritic schists, and phyllites are exposed and these are considered to be equivalent to the Carbine Group of the Dundas area. The rocks are well exposed in the Sticht Range and as a southerly extension of this. They may be underlain to the east of Lake Dora by more highly metamorphosed rocks such as contorted quartz mica schists and crenulated mica schists with a bed of quartz conglomerate, now also sheared. These latter rocks could be regarded as the equivalents of the Davey Group but the relationship to the Carbine Group was not determined as only a reconnaissance of the area was made.

The quartzites of the Carbine Group are generally very fine grained white siliceous porcellaneous rocks composed almost entirely of silica with only minor impurities of ferruginous material, and the coarser rocks are mineralogically similar. The phyllites are grey rocks with mica developed on the cleavage, and very fine grained quartz forms the greater part of the rock. The chloritic schists of the Carbine Group are exposed near the top of the group near the southern end of the Sticht Range. These chloritic schists are markedly different to the schists in the Dundas Group. They are grey in colour and consist of grey scales of a chloritic mineral with a minor amount of quartz while the felspar so characteristic of the Dundas Group chlorite

schists is absent. In addition the chlorite is a different species.

Very interesting current and wave ripple marks are found in the quartzite beds, indicating currents coming from several directions. Generally the bedding is massive but sometimes flaggy and laminated and some cross bedding is present. No idea of thickness could be obtained because of the complicated detailed structures which include overfolding from the east and north-east. The structure is more complex in the Carbine Group than elsewhere in the area.

Along the western side of the Sticht Range the Carbine Group is overlain unconformably by a rock which appears very like the West Coast Range Conglomerate and is correlated with that formation by Mr. J. Bradley. A fuller discussion of this rock will be found in the section on the Dundas Group. Further south the Carbine is unconformably overlain by crenulated chlorite schists with intercalated marble lenses. The unconformity is shown by the fact that structures of the Carbine Group strike directly into the Dundas Group both on a major and a minor scale. A marked difference in strike and dip is exhibited by the two groups in many places and was observed and photographed by Mr. Ahmad and Mr. Bartlett near Lake Spicer.

Summarising, the Carbine Group in the Sticht Range and contiguous areas consists of a group of quartzites, argillites, phyllites, and chlorite schists, complexly folded and overlain unconformably by the Dundas Group. They were probably originally sandstones and mudstones deposited in shallow water on a slowly sinking floor. There is no sign of mineralisation in them.

Dundas Group

In several parts of the area the West Coast Range Conglomerate is underlain by rocks which are correlated with the Dundas Group on the grounds of similar stratigraphic position and lithology. No fossils were found to make the correlation more positive.

Dundas Group outcrops occur along the western side of the Tyndall Range from Lake Margaret to Newton Creek, then west of Julia Hill and the Geocleneck where they connect with the outcrops in the Red Hills area. A second belt runs from south of Lake Spicer beneath Lake Bore, along the western side of the Sticht Range and Anthony Creek to just east of Mt. Murchison.

The only place where the thickness of the group could be estimated was east of Walfords Peak where it was about 5,000 feet. This contrasts with the 10,000 feet recorded some fifteen miles to the west in the Dundas area. The Dundas Group was

deposited unconformably on the Carbine Group, as shown by the exposures east of Lake Dora. It is overlain by the West Coast Range Conglomerate in several places but the relationship to that formation is variable. In the low ridges just west of the southern end of Lake Dora the topmost beds of the Dundas Group pass conformably and gradationally up into the Conglomerate but only a mile or so to the north on the eastern slopes of Walfords Peak there appears to be an unconformity as the dip of the Dundas Group is steeper than that of the Conglomerate and there is a slight difference in strike. In addition, in that locality the Conglomerate overlies different beds of the Dundas Group. Along the western side of the Tyndall Range the relationship with the Conglomerate is obscure but there appears to be a difference in strike and dip between the two groups and again different formations in the Dundas Group are in contact with the base of the Conglomerate. At Red Hills this relationship again seems to apply. To the north of Red Hills the Conglomerate overlies a greywacke conglomerate and included among the boulders in the basal parts of the conglomerate are boulders of the Dundas Group rocks. Further south the Conglomerate overlies a fine grained rock which was probably originally tuffaceous and dips to the west while the Conglomerate dips to the east. Thus generally it would appear that there is an unconformity between the Dundas Group and the Junee Group in the area studied with, however, a transitional relationship in at least one place.

The rock types of the Dundas Group generally range from sub-greywacke and sub-greywacke conglomerate in the Lake Dora area to greywackes and greywacke conglomerates along the west side of the Tyndall Range. In many places the greywacke rocks have been altered to quartz chlorite or quartz feldspar chlorite schists. Igneous activity during the deposition of the Dundas Group is indicated by the development of lavas and tuffaceous sediments at Lake Dora, Red Hills, and the Langdon River area. These have since been greatly altered and Miss Scott, as a result of petrological work which is included with this report, thinks that most of the lavas were basic to intermediate in character.

No succession of formations was established which was generally applicable to the area and no correlation can be attempted with the type area of the Dundas Group. The assignment of these rocks to this group rests on the evidence of lying beneath the West Coast Range Conglomerate and the sedimentary and volcanic associations. At Lake Dora and Red Hills, sections were measured through the Dundas Group and observations made on the succession in the Julia Hill and Langdon River areas.

Red Hills Area

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A section was traversed from east to west just north of the mining sections at Red Hills and other isolated observations were made. At the eastern end of the section, overlain by the West Coast Range Conglomerate, there is a rock which can best be described as an acid breccia. It is pale in tint and has a greenish hue due to the development of some chlorite. Fragments, all angular, of light coloured volcanic rocks can be seen on the broken and weathered surfaces and are shown well on cut and polished faces. Angular fragments up to an inch in length can be seen and on closer examination are identifiable as rhyolite, some showing flow structure. The groundmass is mostly quartz with fragments of acid volcanic rock and cracks in the groundmass have been filled with chlorite. Many of the quartz fragments have some crystal boundaries and show resorption and pseudo-inclusions. A feature of this rock noticed in the field was the presence of fragments of haematite. This rock was exposed for about 150 feet and overlain by rocks porphyritic in feldspar.

Outcrops of this type of rock are found west as far as the power line, but there are minor variations in type. Most of the "porphyries" are buff or pink in colour but some are greenish due to the development of chlorite. The pink colour is due to the presence of haematite and also of albite in pink phenocrysts. The groundmass consists of albite and quartz with perhaps some orthoclase, magnetite weathering to haematite, chlorite and occasionally sericite. The rocks are somewhat scoriaceous in that fragments of more coarsely grained volcanics are included. In one specimen flow structure is suggested by the aggregation in irregular lines of the chlorite and other materials. Most of the porphyry is massive and shows no schistosity. The rock appears to be a keratophyre with incipient chloritisation. The cracks in the rock are also occupied by chlorite. Some pyritisation has occurred. Zones of shearing in the keratophyre are marked by a well-developed schistosity resulting in a rock with euhedral albite porphyroblasts in a groundmass of quartz feldspar and sericite, with chlorite developed in the schistosity. The albite porphyroblasts are clear when compared to the phenocrysts in the unshattered lavas. Some quartz is present as phenocrysts showing marked resorption phenomena indicating the volcanic origin of the rock. Haematite is present in small amount.

Just west of the power line there was a thin band of chlorite schist containing porphyroblasts of feldspar and there is some sign of sericite on the schistosity. Because of the

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schistosity no slides have yet been cut.

From this outcrop westward the traverse revealed only a "quartz felspar porphyry" as far as the foothills of the Gooseneck. This rock is a massive, pink to grey rock in hand specimen with well developed phenocrysts of both quartz and a pink felspar in a fine grained lithoidal groundmass. No flow structure was seen in the field or in hand specimen. Thin sections show a porphyritic to glomero-porphyritic texture with phenocrysts of quartz and albite in a fine grained groundmass of quartz and felspar with many fine grains of haematite. In some slides the felspar is clouded with inclusions but in others it is clear and shows multiple twinning. The quartz shows very marked resorption effects including coronas of fine grained quartz around the phenocrysts. Both chlorite and sericite are developed in small amounts in the groundmass. Flow structure was not detected in the sections unless the line of quartz grains seen in one slide represents it. It is difficult to decide whether this rock is hypabyssal or volcanic on the evidence available, but it is certain that it was not originally a sediment which has been silicified and albitized as was at first suggested by Bradley. While it is admitted that this process of granitization does occur on the West Coast, the clearly displayed resorption phenomena of the quartz phenocrysts is evidence against such an origin for this particular rock. It will be seen in the separate report by Miss Scott on these rocks that she considers them to be original basic volcanics later albitized and silicified but this view is not held by the writer of this report who would prefer to consider them as originally acid volcanics (?) because of the resorption phenomena shown by the quartz and the texture which shows no traces of any basaltic or spilitic nature.

Near the end of the track from the Power Line to Red Hills and a few yards to the north-east of the Red Hills Proprietary Mine an outcrop reveals blocks of a massive grey to pink lava showing incipient shearing effects in a matrix of chlorite schist with somewhat irregular porphyroblasts of pink felspar, probably albite. The included fragments have irregular to euhedral phenocrysts of plagioclase, probably albite, which are cloudy due to the presence of minute inclusions, in a groundmass of quartz and felspar with some ilmenite, haematite, and chlorite. This is considered to have been a fragment of keratophytic lava in a matrix of chlorite schist probably representing a greywacke.

Much of the rock in this vicinity is a fine grained chlorite schist with well developed schistosity but showing porphyroblasts of felspar and perhaps some talc and sericite.

021
The Red Hills Proprietary Mine is excavated in sheared, scoria-
ceous acid lava, probably later feldspathised and silicified which
is intricately veined with quartz carrying pyrite, galena, and
sphalerite, with some siderite.

Specimens were collected from Red Hills during the
geochemical survey. At J-3 a shattered light coloured rock
showed fragments of feldspar and acid volcanic rocks in a siliceous
and feldspathic groundmass. This showed evidence of extensive
silicification and the introduction of some chlorite and sericite.
Haematite was also present in small amounts. It is probable that
this represents a tuff which has been silicified to some extent.

At grid point O-3 a pink, fine grained rock is found
showing irregular masses of chlorite macroscopically. On micro-
scopic examination the chlorite is seen to be replacing the
original feldspar phenocrysts and also occupying the joints. Veins
and replacements of sericite are common. The chlorite in some
places seems to have replaced biotite and there are still resid-
uals of the latter mineral. Both ilmenite and magnetite are
present and have been weathered. The groundmass is unevenly
fine grained and seems on a preliminary examination to consist of
quartz and feldspar. The rock is probably a biotite keratophyre
which has suffered sericitization and chloritization.

Further south, on the south-eastern flank of Red Hills,
at U-7½ a pink to buff rock occurs which shows a rough banding
on weathered surfaces but is massive where freshly broken.
The banding dips steeply west and the rock is overlain a little
to the east by West Coast Range Conglomerate dipping east, thus
establishing an unconformity. Macroscopically the rock is also
characterised by the abundance of small masses of haematite,
some of it apparently replacing feldspar phenocrysts and this is
confirmed on microscopic examination when it is seen that the
feldspars have been partially replaced by magnetite which has
weathered to haematite. Thin sections also indicate that the
lines on the weathered surface are due to flow structure as
shown by the orientation of the feldspar phenocrysts. The
rock shows no schistosity. The magnetite has not only replaced
the feldspars but also parts of the quartzo-feldspathic groundmass
which is very fine grained. Only a minor amount of chlorite is
present. Although quartz phenocrysts are present they are only
a minor constituent of the rock. The feldspar is albite, and
the rock could be considered as a keratophyre.

In several places along the western side of Julia
Hill the section in the Dundas Group was observed and the relation-
ship to the overlying conglomerate studied. This latter contact
seems to be unconformable although the dips and strikes of the

022

two groups are only a little removed from each other. Bradley suggested in the early part of the survey that there was a low angle overthrust separating the groups, but from a careful examination of the contact this seems unlikely although it cannot be entirely ruled out. Near the junction of the Lake Dora-Mt. Read track with the Red Hills track the succession upward near the contact is sub-greywacke with beds of sub-greywacke conglomerate followed by siliceous argillite and that by a quartzite and the conglomerate. Further south greywackes and greywacke conglomerates with beds of sub-greywacke are followed upwards by a prominent ridge-making conglomerate with a sub-greywacke matrix and fragments dominantly of siliceous rocks but also with rhyolite, laminated argillite and haematitic material. This is only 20 feet thick and commonly has lenses of argillite. Overlying this is a thickness of 80 to 100 feet of laminated argillites which are siliceous and somewhat chloritic. From outcrop to contour relationship these all appear to be dipping to the east at a high angle. Further east and higher up the hill are fine white quartzites with bands of white to pink conglomerate dipping at 83° to the west thus suggesting unconformity and an overfold to the east. Minor variations in the succession occur further south again and the sub-greywacke conglomerate bed was found to include fragments of rhyolite or keratophyre and hornblende andesite. The rhyolite boulders were very large in places and some boulders of chert were also observed. The lithology and structures with the rapid variation in rock type in the Dundas Group here indicate rapidly changing conditions of sedimentation. The sub-greywacke conglomerate is underlain further south by a rock consisting of large and small boulders and fragments of rhyolite in a matrix of fragments of quartz, feldspar, rhyolite and perhaps also some chlorite. A thin section of a boulder revealed phenocrysts of quartz showing well marked resorption phenomena in a quartz-feldspathic groundmass containing also some haematite and ilmenite now altered to sphene. Some feldspar phenocrysts were also present and seem to be albite. The rock is thus a keratophyre, and the rock as a whole a keratophyre breccia or scoriaceous keratophyre. It is underlain in turn by a fine grained sub-greywacke conglomerate which contains boulders of keratophyre which increase in number down through the section.

Langdon River

South of Newton Creek the Dundas Group is exposed at many places along the track from Lake Margaret to Lake Julia. Close to Newton Creek the West Coast Range Conglomerate overlies a sub-greywacke conglomerate and this in turn overlies a quartz keratophyre which is well exposed below the towers of the Power Line. This relationship is again observed about a mile to the

023

south where the lava contains more feldspar and has lost the large phenocrysts of quartz. Magnetite has been introduced, some of it replacing the feldspar and some the groundmass. On the flanks of the Tyndall Range about a quarter of a mile to the south-east of this last locality, a pink rock outcrops close to the West Coast Range Conglomerate. On examination the pink rock is seen to be composed very largely of fragments (?). There has also been considerable introduction of sericite and chlorite and some silicification so that the original nature of the rock is not easy to determine. Fragments of angular to crystallized quartz are common and there are many fragments of feldspar. Grains of magnetite and ilmenite are also present. The most likely original rock type is an acid tuff.

This type of rock apparently continues further south since a specimen very similar in macroscopic appearance was collected a thousand feet or so along the foot of the Tyndall Range and this had been even more extensively albitized. On the track east and south-south-east of the centre point of photo 23873, Marchison Run 5, a greywacke breccia is exposed which contains much feldspar in addition to blocks of lava, slate or argillite and cherty material. These are dipping at about 30° to the north-east.

At a spot close to the track $3\frac{1}{2}$ inches east south-east of the centre point of the same 20-chain photo, a bedded rock showing small angular fragments of feldspar on the weathered surface is exposed. Examination of a cut surface reveals that the rock consist of fragments of greenish argillite and small fragments of white to pink feldspar in a greenish, probably chloritic, matrix. This rock is a greywacke.

A couple of hundred yards along the track south of the ford over the creek flowing from the prominent waterfall on the western side of the Tyndall Range another outcrop of greywacke was examined. This was similar to the rock further north except for the marked development of blebs of pink feldspar and the formation of epidote along the joints.

Perhaps the most interesting rock type collected during the survey was the hornblende andesite from the area just north of Basin Lake near the headwaters of the Langdon River. This rock drew the attention of the writer at an early stage in the survey as such rocks had not previously been reported from the Dundas Group and the remarkable development of the hornblende "phenocrysts" was particularly noticeable. Many interesting exposures of the rock occur on the track from Lake Margaret to Lake Julia where it skirts north of the magnificent Basin Lake Moraine. Blocks of scoriaceous andesite with xenoliths of andesite in an andesitic matrix were observed closely and

photographed as also were blocks of andesite showing few xenoliths but having well marked flow structure. The flow lines were seen to be contorted in some places and the hornblende phenocrysts to be oriented with the flow lines. It was realized at the time that there might be debate about the origin of the rock so that the relationship of the flow lines to the cleavage of the rock was carefully noted, and it was found that the two were at an angle of about 100° . The cleavage was not well developed and there is certainly no schistosity visible on the surface of the lava. From the field evidence the writer considers that the hornblende crystals had already formed before the lava reached the surface. They may have already suffered the changes described in more detail by Miss Scott in her separate report. Veins of quartz and epidote were common in the blocks of andesite and the presence of chalcopyrite disseminated through the rock was relatively common. As Miss Scott has described this rock in some detail no further description will be given here.

Also in the vicinity of the huts at the Langdon River there are slates and argillites associated with the andesite.

Lake Dora

One complete section was measured across the Dundas Group near the northern end of Lake Dora and several subsidiary incomplete sections were also studied.

Immediately overlying the Carbine Group just east of the northern tip of Lake Dora is a bed of crenulated chlorite schist with included blocks of folded quartzite and argillaceous material probably representing an incompetent sandy and muddy bed with sandy lenses. This is followed by a bed of limestone the two together being about 100 feet thick. The limestone is now a marble and chlorite, rhodochrosite and pyrite have been introduced. The rock is generally pale in colour and appears to have been brecciated. Extensive replacement by silica has occurred on some bedding planes. Fossils were sought but without success as only indeterminate traces of curved surfaces were found. These were not crystal faces or curved cleavages. The limestone was again picked up half a mile or so to the south east but did not appear to be continuous enough to provide a mappable horizon. The limestone is followed by about 40 feet of greenish quartz chlorite schist which in places is rich in fragments of pink plagioclase, probably albite. A few fragments of this latter mineral show crystal outlines possibly due to regrowth. The rock probably represents a sheared sub-graywacke.

Overlying the schist is approximately 100 feet of cross-bedded, flaggy to massive felspathic sandstone with some arkosic bands. The cross bedding indicated that the dip to the west is not a reversed dip. A thickness of 80 feet of conglomerate followed the sandstone. The conglomerate is fine to medium grained with sub-angular to sub-rounded pebbles of rose quartz or iron stained quartz and was fairly well sorted. Chlorite and feldspars were common on some horizons. On the weathered surfaces this rock resembled a fine conglomerate of the West Coast Range Conglomerate formation and the resemblance led Bradley to consider it as such and invoke a considerable thrust from the west to explain the occurrence of Dundas Group rocks to the west. The writer considers this view to be incorrect because of the presence of feldspar and chlorite in the rock and the occurrence of quartz chlorite schist below the member. This association is not normal in the West Coast Range Conglomerate and the undoubted Conglomerate just to the west on Walfords Peak is quite normal. Bradley invokes granitisation of argillaceous bands in the conglomerate to explain the abnormality but this hypothesis is unnecessarily complicated and evidence for the granitisation is weak. The overlying bed is a sandstone with some quartz pebbles and some bands of fine conglomerate as before. The sandstone is somewhat unusual in that mica is present in addition to chlorite and feldspar. This member is 250 feet thick. The next member is an argillite or slate, black in colour and appearing a possible source of fossils, which, however, were not found despite intensive search. The argillite is followed by a quartz chlorite schist and this in turn by a grey chloritic schist with porphyroblasts of feldspar and rarely quartz. A sheared sub-greywacke follows the schist. It is greyish when freshly broken and fine fragments of feldspar and quartz can be seen in a chloritic matrix. Microscopic examination supports this diagnosis and further reveals the presence of fragments of acid volcanic and pyroclastic rock as well as a former chloritic schist. The schistosity of the included fragment is almost perpendicular to the schistosity of the main rock as pointed out by Miss Scott. The grains are all markedly angular. There has been some subsequent introduction of feldspar and chlorite. The schistosity is marked by the chlorite. Magnetite is present in considerable quantity.

The next member is a greyish rock showing some phenocrysts of quartz and considerable shearing. Microscopic examination reveals many quartz phenocrysts, some of them deeply embayed, and rare phenocrysts of feldspar in a quartzo-felspathic groundmass. Some xenoliths of volcanic rock are also shown.

Sericite and chlorite have both been introduced in considerable amounts and are developed along two preferred directions, probably of shearing but possibly one of them is the original flow. As the Lake Dora Camp site is approached a thin band of sub-greywacke conglomerate is found and this is followed in turn by a quartz chlorite schist with some feldspar porphyroblasts and occasional pebbles representing an original sub-greywacke conglomerate. The number of included pebbles increases as the camp is approached. Beyond the camp the rock becomes a sub-greywacke then a greywacke which is overlain by a lava with feldspar and chlorite phenocrysts and rarely phenocrysts of quartz. The groundmass is pink, fine grained, and shows the introduction of magnetite. Some of the phenocrysts are embayed. Some xenoliths of a feldspar porphyry were observed. The boundary between the lava and the underlying quartz chlorite schist is quite sharp but is not straight and the bottom surface appears rubbly. Thus a preliminary examination suggests that this rock is a lava flow and not a granitized sediment as was suggested to explain the porphyries. The percentage of quartz phenocrysts was thought to increase upward through the flow which was some hundreds of feet thick. There are also many xenoliths of slate and greywacke schist near the top of the flow and these seem to be elongated parallel to one another and roughly parallel to the strike.

The lava is overlain by a quartz chlorite schist which is locally the repository for minerals such as disseminated pyrite, chalcopyrite, sphalerite and galena and several prospect trenches and adits have been excavated in this rock. A thin section shows abundant very angular fragments of quartz and rarely feldspar in a matrix of quartz and chlorite, the latter being drawn out and providing the schistosity. This rock was undoubtedly originally a sub-greywacke.

The chlorite schist is comparatively thin and is followed by another lava with phenocrysts of quartz and feldspar and xenoliths of lava. This has been highly sheared and chlorite has developed. Overlying this again is a quartz chlorite schist with a band of greywacke conglomerate. This schist bed has been prospected in several places. About fifty feet below the top of this bed the rock has been injected along the joint planes by quartz and epidote.

The overlying rock is another acid lava, probably keratophytic, which is scoriaceous, the xenoliths being commonest near the base. The lava appears blocky and is associated with another scoriaceous lava with phenocrysts of chlorite in addition to the quartz and feldspar. The chlorite is seen to be associated with sericite in replacements of original feldspar phenocrysts.

A prospect trench in this lava is rich in pyrite and some chalcopyrite and galena were also present. This rock is overlain beneath Walfords Peak by West Coast Range Conglomerate dipping less steeply to the west than the shear planes in the lava which are greatly developed near the contact. There is however, no sign of faulting at the contact.

The succession from the southern end of the Sticht Range, across the divide between Anthony Creek and the creeks flowing into Lake Dora to the conglomerate at the northern end of Walfords Peak is somewhat different. The basal formation is a thick conglomerate band which can be traced along the length of the Sticht Range and overlies the Carbine Group quartzites. The basal beds of the conglomerate are pudding stone conglomerates composed essentially of siliceous rock types with some boulders of different types in a siliceous matrix. The rock becomes finer upwards and grades up into fine white sandstone. The conglomerate is lithologically very similar to the West Coast Range Conglomerate with which Bradley and others wish to correlate it. The writer objects to this correlation on the grounds that the rock is in the wrong stratigraphic position, lying beneath the Dundas Group. Bradley solves this anomaly by introducing an overthrust fault but the evidence for this is inferential only and no actual displacement can be shown. The writer suggests that this conglomerate represents the basal formation of the Dundas Group and is composed of boulders torn off a newly elevated mountain chain composed of the sediments of the Carbine Group and identifies the Sticht Range with part of the elevated land surface.

The fine sandstone is followed by a sub-greywacke conglomerate and then a quartz chlorite schist. An acid lava with the appearance of flow lines on its weathered surfaces succeeds the schist. This shows phenocrysts of quartz showing resorption and feldspar phenocrysts of feldspar badly altered to sericite. The feldspar phenocrysts have a roughly parallel orientation. The final rock type in the succession is another quartz chlorite schist with disseminated pyrite and chalcopyrite. This also contains small quantities of sericite.

Two other rock types are of more than ordinary interest in the Lake Dora area. The first is a keratophyric rock interbedded with greywacke conglomerate beneath the West Coast Range Conglomerate at the south end of Lake Dora. The second was the well exposed biotite keratophyre outcropping in the canal leading into Lake Dora from the west. This rock shows phenocrysts of feldspar and some phenocrysts of quartz and chlorite altering from biotite in a very fine grained quartz-feldspathic groundmass which contains a quantity of magnetite.

Summary of Dundas Group

The Dundas Group in the Mt. Murchison-Tyndall Range area consists of more than 5,000 feet of sediments and lavas with some pyroclastic products. The lavas range in composition from intermediate to acid and belong for the most part to the spilitic suite, the main feldspar being albite. The lavas are considered to have been originally acid and not to represent hydrothermally altered basic lavas. While there is evidence of introduction of quartz and albite in several places, the writer considers that most of the quartz and feldspar are original.

Pyroclastic rocks are not common but a few acid tuffs and breccias were found. The sediments range from limestones and siliceous sandstones and conglomerates near the base of the group to sub-greywackes and greywackes which, in their altered state, constitute the greater part of the group in the Lake Dora area and on the west side of the Tyndall Range. These have now been partly or completely altered to chloritic schists containing some small quantities of sericite where the hydrothermal alteration is most intense. A feature is the small proportion of fine grained sediments such as slate and argillite, and this supports the suggestion that much of the sediment was derived from a nearby source, probably mostly to the east.

The association is typical of the eugeosynclinal environment showing rapid uplift and rapid sinking in the depositional areas.

Junee Group.

In this area the Junee Group consists of the West Coast Range Conglomerate and the Gordon Limestone, the Caroline Creek Sandstone not being developed as far as the survey showed. The Eldon Group was not found in the area.

The West Coast Range Conglomerate occurs along the length of the Tyndall Range and eastwards from this to Walfords Peak. Further north the conglomerate occurs on the hills around Lake Julia, on the Gooseneck, and on a number of hills east of Red Hills, while the mass of Mt. Murchison is composed of rocks of this formation.

The thickness of the formation varies considerably. Immediately to the west of the south end of Lake Dora the conglomerate would be no more than 500 feet thick but this small thickness is probably due to strike faulting of which there is independent evidence. On the Tyndall Range the formation must be more than 1,200 feet thick as it is almost horizontal and forms the cliffs on the eastern side of Mt. Geikie. No estimate of thickness for the conglomerate on Mt. Murchison can be attempted

because of the folding on the mountain. Well over a thousand feet of conglomerate are exposed in the walls of Huntley Gorge and on the slopes of the hill lying immediately north-west of Lake Huntley.

The formation consists mostly of siliceous conglomerates, sandstones, and siltstones, with the exception of the basal beds which for the lowest few feet are really sub-greywacke conglomerates. The mineral composition and the types indicate different origins. The rock is intersected by quartz veins commonly and veins of goethite were noticed in one place. The boulders in the conglomerate beds were normally reef quartz, quartzite, red jasper, and chert but in the basal beds other rock types were present. These included a crenulated quartzite like that of the Sticht Range and also boulders of porphyritic igneous rocks and of greywacke.

The thickness of the bedding varies considerably from finely laminated or shaly to massive and in some sections is remarkably uniform.

Just north of Lake Huntley some of the sandstone bands show intense intraformational slumping and folding with some rolling but this is unusual for the formation. The boulders are up to two feet in diameter exceptionally and many are 1 to 4 inches long. The boulders are sub-angular to sub-round and it is notable that the finer particles are angular.

In several places the effects of compression on the finer grained beds of the formation are shown. Thus just to the north of Lake Huntley in the core of a tight anticline the siltstone has been highly sheared and could now be termed a schist. At the northern end of the Tyndall Range just above Newton Creek there is a zone close to the big fault where the finer beds have become slaty due to the development of a very marked cleavage.

The only place where a succession was established was in the vicinity of Lake Huntley. The beds in the core of the anticline are pink conglomerate associated with tubicoler sandstone and these are overlain by purple sandstones with some bands of white sandstone. This is succeeded by crenulated tubicoler sandstone with which is associated white laminated to massive quartzite. Overlying this is a thick pink conglomerate with thin bands and lenses of purple siliceous siltstone with shaly bedding. A thick member of white quartzite succeeds the pink conglomerate and may be over a thousand feet thick. The top beds in this area are red conglomerates which are also comparatively thick.

In the section immediately west of the south end of

030

Lake Dora the succession upwards from the greywacke conglomerate which marks the top of the Dundas Group, begins with a deep red conglomerate and sandstone member which grades from the greywacke upwards into a true siliceous conglomerate. The deep red member is faulted against a white quartzite with some pebbles and this is overlain by fine pink conglomerates and quartzite. Other members are present above these but the section was not observed.

To the east of Red Hills the West Coast Range Conglomerate rests on the Dundas Group. The basal beds of the conglomerate contain very large boulders lacking any sign of sorting and very little rounding and in addition many of the boulders are igneous or composed of greywacke. Rapid variations in the currents depositing the conglomerate are shown by sandstone lenses while imbrication of the boulders indicates currents coming from the north. The basal beds of the conglomerate on the Geoseneck contain boulders of a quartz feldspar porphyry like that now outcropping on the plains west of Red Hills.

The Gordon Limestone occurs in the deep valley lying to the west of Lakes Dora and Spencer, according to reports received from local prospectors. The formation was not examined there. The base of the limestone is exposed on the island at the head of Lake Margaret and consists of basal beds of fossiliferous sandstone followed upwards by an arenaceous limestone with fossils. The age of the fossils has not yet been determined.

The main formation of the Junee Group in the area will be seen to be the dominantly siliceous conglomerate with sandstone and siltstone bands. The colour varies from white to pink or dark red, and the mineralogy and sedimentary structures indicate that the rock is a member of the orthoquartzite-limestone suite in contrast to the greywackes and sub-greywackes of the Dundas Group.

STRUCTURE

The regional structure is thought to be more or less as outlined in an earlier report. The Sticht Range is the western limit of the large Tyennan block, an anticlinorium, and also a geanticline during the Cambrian. Westward lies the northern equivalent of the Eldon or King Synclinorium which here consists of two structures, the eastern, Rolleston Syncline, and the western, Tyndall Anticline. Further west again there is the main West Coast Range Anticlinorium separated from the Tyndall Anticline by a shallow syncline usually with the western limb overturned to the east or overthrust.

031

The main folds trend slightly west of north and are affected by cross folds trending approximately north-west which, however, are relatively shallow. These are roughly parallel to the prominent north-west striking steep angle overthrusts which downthrow to the north-east. Approximately perpendicular to the overthrusts are minor tensional faults most of them down-throwing to the south-east.

A compressive force acting from the west or a little south of west caused the development of the main structures and the Tyndall thrust. These were later subjected to a shearing couple as indicated earlier by Professor Carey, and this caused the cross folding and the more spectacular overthrusts, one of which displaces the Tyndall Thrust for about half a mile to the north-west. The tensional faults probably developed about the same time.

West Coast Range Anticlinorium. This structure was not studied in any detail but a few observations were made. Near the Langdon River the rocks of the Dundas Group are striking approximately north-west to west but the strike swings around further north and a shallow syncline was mapped in the Dundas Group about half way along the Tyndall Range. This trends north north-west but could not be traced for any distance. To the west of Julia Hills the Dundas Group is dipping to the west at a very steep angle.

Tyndall Thrust. This is indicated by exposures in the cuttings for the Lake Margaret Pipeline where the West Coast Range Conglomerate is dipping to the west but is shown to be overturned. From this point the thrust runs along the western side of the Tyndall Range almost to Newton Creek where it is displaced about half a mile to the north-west by the Huntley Thrust, and then continues northward along the western flank of Julia Hill and the western side of the Gooseneck north of which it is cut by the Henty Fault. The nature of this Thrust is not demonstrable in many parts but it is indicated on the Lake Margaret Pipeline cuttings by the strong development of gash veins and bedding plane slides. Elsewhere the nature of the structure is not shown beyond the fact that the Dundas Group rocks dip very steeply and the West Coast Range Conglomerate also dips steeply and in many places develops minor folds.

Gooseneck Syncline. The anticlinorium is generally separated from the adjacent Tyndall Anticline by a sharp syncline which is well exposed along the western side of the Tyndall Range from Lake Margaret for about four miles to the north. The western side of the syncline in this area is very steep and overturned while the eastern limb is more gently sloping to the west. The surface of the western side of Mt. Geikie is a dip slope into

032

this syncline. The syncline plunges gently north from Lake Margaret. The syncline is not identifiable to the north until the Gooasneck is reached when a syncline plunging rapidly to the south is exposed. The western limb of this structure is again generally steeper than the eastern. The structure may continue on the south side of Julia Creek but this is not yet clear.

Tyndall Anticline. This is one of the most striking structures in the area and runs from Lake Margaret in the south to Red Hills and the western foothills of Mt. Murchison in the north. Along the length of the Tyndall Range only West Coast Range Conglomerate is exposed but on the probably southern projection of the structure, the Sedgewick Anticline, Dundas Group rocks are exposed as the result of the northward plunge. To the north of Newton Creek the anticline loses its identity for a small distance but is then replaced by an anticline east of Lake Julia which continues, although broken by faulting, northward and passes just east of the Lake Julia Hut and on up to Red Hills before it is cut off by the Henty Fault. In the area north of Newton Creek it plunges to the south, fairly steeply in the Red Hills area and more gently near Newton Creek. The southward plunge continues along the Tyndall Range as far as Lake Tyndall where it becomes reversed, and the northward plunge continues as far as Lake Margaret. The Red Hills mining area lies on the eastern flank of this structure.

The anticline is more complicated than has been indicated as minor folds affect the main fold especially near Newton Creek, where minor folds roughly parallel to the main fold creasulate the crest and both flanks. The eastern flank is particularly susceptible to this minor folding as shown by the syncline and anticline near Lake Hantley, the probable continuations of the same structure to the south near Farquhar's Lookout, and the well developed structural terraces east of Red Hills. The folding on the western end of Mt. Murchison is probably a continuation of the same feature.

Rolleston Syncline. This structure is well shown to the east of Lake Peter where a deep valley has been excavated in the Gordon Limestone. It runs west of north to the western foothills of Walfords Peak but then loses its identity beneath the flats of Anthony Creek. The conglomerate east of Red Hills dips to the east in a series of structural terraces and reaches its lowest level in a syncline just to the east of Arnold Peak beyond which it begins to rise again. This syncline is considered to be the northerly continuation of the Rolleston Syncline. A big fault displaces this syncline to the north-east about half a mile and it then continues to Mt. Murchison. Dips into this syncline are very steep and near the axis are almost vertical at the head of Lake Rolleston. The eastern flank of the syncline rise is a

series of minor anticlines as are well exposed on the western side of Walfords Peak and near its northern end. The Dundas Group is exposed beneath the West Coast Range Conglomerate along the eastern limb of the syncline, and it is in this environment that the Lake Dora and Anthony Creek deposits are found.

At the southern end the syncline plunges to the north but the plunge reverses before Walfords Peak is reached and there the axis is horizontal for some distance before again plunging to the north. This plunge apparently continues for some distance as it is found again east of Arnolds Peak, but it apparently reverses again just south of Mt. Murchison. Thus two distinct basins are produced, one to the south-west of Walfords Peak, the other on the southern slopes of Mt. Murchison.

Part of the eastern limb of the Rolleston Syncline is formed by the Sticht Range and its southerly structural continuation. This is composed of Carbine Group rocks, overlain unconformably by the Dundas Group, and the Carbine is intensively folded with overfolds both to the east and the west. Most of these observed had a north-east trend but the structure of the Sticht Range was not studied in detail.

The Crossfolds. Two distinct but relatively shallow folds trend north-west across the main structures. One passes from the basin east of Farquhar Lookout to Lake Tyndall but was not identified beyond the Tyndall Range. This is a cross syncline which itself seems to plunge to the south-east as far as the Rolleston Syncline but the plunge reverses there.

The second cross fold is not so well defined but is picked up at the head of Lake Rolleston where the plunge of the Rolleston Syncline reverses. It is thus an anticline and trends north-west for a short distance before it is lost. A south-east plunging cross fold runs from Red Hills to Lake Selina and may be the continuation of the anticline near Lake Rolleston.

The third cross fold is another syncline and is found on the southern foothills of Mt. Murchison but field work was not detailed enough to trace it.

Faulting. There is an extensive development of faulting in the area but the faults are thought to be resolvable into two main sets. The first to occur were the north trending faults overthrusting to the east. The main representative of this class has already been described but there are several others which are possibly important in controlling ore deposition. There is strong northerly shearing along both sides of Red Hills and on the hill itself and it is probable that the shears in places are due to faults but this could not be proved due to the

apparent uniformity of rock type in the immediate vicinity. It is probable that more detailed mapping than was possible in the time available would answer this problem. The westernmost shear is associated with the talc (?) sericite schist described earlier. In the Red Hills area, though not on the hill itself, east trending faults, possibly conjugate with the shears, are found.

In the Lake Dora area the northerly shearing is particularly noticeable and several very strong and long shears occur east of the mining area. Again the exact significance of these structures is not known and it is uncertain that they were actually faults or overthrusts. Mineralisation in the Lake Dora district seems to have been controlled to some extent by the shearing.

These faults are intersected and in some cases displaced by a group of prominent north-west trending faults overthrust to the north-east. These are well displayed along the Tyndall Range and near Hoya Rock and in all cases are seen to dip at 60° , or more steeply, to the south-west. They are associated with marked shattering. One of them, the Huntley Thrust, displaces the main Tyndall Thrust about half a mile to the north-west, and it is probable that there is considerable horizontal slip associated with the movement. A bunch of these faults cuts and ends the northerly shears just south of Red Hills and then continues to the south-east beyond Lake Westwood to Julia Hill before they disappear below the plains of Anthony Creek and they could not be identified further to the south-east. Most of these north-west trending faults do not seem to continue beyond the Rolleston Syncline.

A fault separating the Dundas Group from the Carbine Group east of Lake Dora trends south-east for a mile or so before turning south. This fault is, however, apparently a normal fault downthrowing to the west and south-west.

Finally there are a set of minor faults trending north-east and downthrowing to the south-east and these are normal faults representing the conjugate set to the overthrusts.

Structure of the Dundas Group. The structure outlined above is that affecting the rocks up to the Eldon Group and is thus Tabberabberan in age. From the evidence of the unconformity between the Dundas Group and the West Coast Range Conglomerate it is known that there was an earlier orogeny, the Tyennan, of Middle to Upper Cambrian age. Structures associated with this orogeny have not been analysed because the field work was not sufficiently detailed or lengthy to allow mapping of formations within the Dundas Group in this area. In the Lake Dora and Anthony Creek areas the Dundas appears to be dipping consistently to the west although north of the latter area anticlines and

synclines are indicated on the air photos but were not studied on the ground. At Red Hills the dips were steeply eastward to the east of Red Hills but steeply westward to the west. Thus it seems likely that the structure there is an anticline with its axis to the east of the main Tyndall Anticline and with steeper dips on both flanks than the latter. West of Lake Julia the Dundas is dipping very steeply but no structure can be adduced with any confidence. At the Langdon cleavage bedding relationship indicates that the andesite and associated slates are on the western side of a north-west plunging anticline but the extent of this is unknown.

MINERAL DEPOSITS

Mineral deposits occur in this district exclusively in the Dundas Group but apparently not on any one horizon in the group. Mineralisation consisted mainly of the introduction of quartz and a little albite accompanied usually by chlorite, and pyrite and chalcopyrite were the main metalliferous minerals with small quantities of sphalerite, galena, and siderite. Oxidised minerals are rare due to the recent glaciation in the area which has removed any oxidised zone which might have been present. Boxworks and gossan are rare for the same reason.

The areas of mineralisation occupy different structural positions. The Langdon area lies to the west of the main Tyndall Thrust although the main mineralised zone must lie close to it. Red Hills is apparently the crest of the Tyennan anticline lying to the east of the crest of the Tyndall Anticline, and has been subjected to later shears which localised the mineral deposits. The Lake Dora deposits lie in the eastern flank of the Rolleston Syncline where it has been affected by northerly shearing, and the poorer Anthony Creek prospects occupy a similar position although the shears do not appear to be present.

Red Hills. Mineral deposition took place in acid volcanics, keratophyres, and chloritic schists with porphyroblasts of albite. At the northern end, in Section 1707/W or within the rectangle D-4, D-6, H-6, H-4, of the geochemical grid, much prospecting has been carried out. The mineralisation is in the form of quartz veins with chlorite pyrite and chalcopyrite, as well as disseminations of the above minerals and magnetite in chloritic schist. This does not appear as a geochemical anomaly, although assays of up to 5% copper were recorded by earlier geologists. In many places, however, the percentage was less than one. No attempt can be made on the evidence gathered during the survey to estimate the likely grade or quality of ore available.

At the extreme southern or really south western

limit of the Red Hills such work was done in the early days. This section is numbered 1705/M, and is the rectangle of Q-5, Q-7, U-7, to U-5 of the geochemical grid. Disseminations of pyrite and chalcopyrite in chloritic schist were revealed by the workings, while in the section to the north pyrite disseminations were shown. This would correspond to the open cut and tunnel in the square south-west of M-5.

On the eastern side of Red Hills, between L-10 and M-10, another tunnel was driven and showed disseminated pyrite and haematite with small amounts of chalcopyrite in chlorite schist.

A comparison of the geological map with the map showing the geochemical anomalies shows an interesting correlation of the anomalies with two north-west trending overthrusts which pass through the centre of the Hill and at the southern end of the Hill. The display of mineralisation in Section 1707/M is also close to the northernmost of these overthrusts. The samplers were given instructions to choose pieces of rock which did not show abnormally rich chalcopyrite and in this way the analyses may have given the area an unduly low value. The east-west trend seen in the centre anomaly does not find a ready geological explanation but in the next anomaly south this trend is connected with a structural weakness.

Mineralisation was also obvious in the vicinity of the Red Hills Proprietary Mine on Section 1325/M. The country rock is a badly shattered keratophyre which has been subsequently mineralised with pyrite, galena, sphalerite, and siderite. On the main track to the west of the Red Hills Proprietary Mine, disseminations of chalcopyrite in the schist were noticed. This area was sampled for analysis which has not yet been done. A correlation with the north-westerly overthrusts is again suggested.

Langdon. Mineralisation in this area has not previously been reported but some was seen during the survey. The mineralisation has affected the hornblende andesite near the Tyndall Thrust and took the form of the introduction of chalcopyrite with quartz, albite and epidote with some sericite, indicating hydrothermal alteration. No work was done to test this prospect in any way as it was considered of less importance than the Red Hills and Lake Dora prospects. However, the presence of visible chalcopyrite makes it possible that a better prospect may be shown at depth.

Lake Dora. The country rocks are chloritic schists and lavas including keratophyres and biotite keratophyres. The schists represent former sediments, mostly greywackes and greywacke conglomerates. The mineralisation consists of disseminations of pyrite mostly with some chalcopyrite and rarely galena and cobalt

minerals. Magnetite and haematite also occur and there is some sphalerite. The copper minerals include native copper, chalcocite and bornite.

Much of the mineralisation also occurs in veins with quartz but most of it is associated with the schistosity of the chlorite schists, and these latter rocks seem to be more favourable for mineral deposition than the lavas although there is some mineralisation in the lavas. A line of prospects runs along the western side of Lake Dora in a direction slightly west of north to the saddle between Walfords Peak and the Sticht Range. In this belt the mineralisation is almost exclusively in the chlorite schist or near the contact between the schist and the underlying lava. Insufficient detailed work was done in the Lake Dora district to allow positive correlations to be made between mineralisation and general geology.

IGNEOUS AND METAMORPHIC PETROLOGY

(by Beryl Scott)

The mode of origin of the igneous looking rocks in this area, as elsewhere on the West Coast, is a matter of controversy. They have been discussed by writers as being on the one hand intrusive and on the other replacement, i.e. derived from metasomatically altered sediments and volcanic rocks.

No unaltered igneous rocks exist, in the area. The groups most commonly developed are the chlorite and sericite schists, quartz porphyries, "felsites" and hornblende "andesite". There appears to be no distinct boundary between the quartz porphyries and the schists. With the coming in of chlorite and sericite the quartz porphyries grade into chlorite and sericite schists.

Chlorite and Sericite Schists.

This rock type is very common in the area, particularly about Lake Dora.

In the hand specimen it is dark green in colour and bears a marked schistose structure. Porphyroblasts of quartz, and less commonly albite, are usually present. Under the microscope the rock consists of angular porphyroblasts of quartz up to 2 mm. in size set in a very fine grained quartz feldspathic groundmass containing abundant green chlorite whose habit gives the rock a schistose structure. The boundaries of some of the quartz porphyroblasts are diffuse and some often show "replacement borders" (Miech 1949) indicating that the quartz is growing out of the groundmass. Pseudo inclusions of the groundmass are sometimes found and in one instance chlorite surrounded by a halo of feldspar was found in the centre of a quartz porphyroblast which

showed fracture and undulose extinction. When present the feldspar is usually turbid and slightly kaolinized. It shows no twinning, hence the type is difficult to discern but from evidence gained elsewhere it is most likely albite. Sericite in the form of very fine flakes is a very common constituent and is sometimes more abundant than the chlorite. The schistose structure winds around the porphyroblasts giving a pseudo flow effect. Pyrite limonite and chalcopyrite showing iridescence are not uncommon and when present are drawn out in a schistose fashion like the chlorite and sericite. Ilmenite, often altering to leucoxene, is also commonly found.

Evidence that the chlorite and sericite schists for the most part have been derived from tuffaceous rocks and greywackes is revealed by the presence of fragments of quartz felspathic rocks and schist with their schistosity perpendicular to that of the schist proper.

Quartz Porphyries.

Like the schists into which they grade the quartz porphyries are abundant. Best examples are found on Walford's Peak but even there the gradation to schist is evident.

Macroscopically they consist of porphyroblasts of quartz in a brown coloured stony groundmass. Microscopically the quartz porphyroblasts may be quite xenoblastic or ididioblastic in form. They show the presence of pseudo inclusions and veins of groundmass. "Replacement borders" are common. Some turbid feldspar ididioblasts are present but these are not as numerous as those of quartz. The groundmass is usually quartz felspathic with a little sericite. Occasionally lens shaped streaks of very finely divided sericite are present and as these increase the rock takes on a schistose structure. Ilmenite crystals altering to leucoxene are common and secondary sphene is sometimes present. No primary ferromagnesian mineral is present but patches of radiating chlorite may appear.

"Felsite".

At Red Hills a felspathic rock is developed. In hand specimen it is pink to fawn in colour specked with black. Under the microscope it is seen to consist of small interlocking grains of feldspar with some patches of hematite and sometimes a little granular quartz. Patches of secondary albite and occasionally veins of quartz and chlorite are present. The chlorite is dark green and radiating and grades imperceptibly into biotite. Narrow veins of sericite often traverse the rock.

This rock type grades into a schist with the coming in of sericite or a porphyry with the development of albite "phenocrysts". Evidence of the formation of the ididioblasts of

felspar shows that numerous small grains of felspar coalesce and either the groundmass or chlorite is sometimes retained in the interspaces.

Twelvetrees and Petterd (1899) describe some of the felsites and associated rocks of the Mount Read District which are similar to those in the Tyndall Range - West Marchison Area. In summarizing their descriptions they say, "The rocks have a compact quartz-felspathic (felsitic) groundmass, with quartz and orthoclase and albite phenocrysts, sometimes distributed sparingly, at other times so crowded as almost to lose the porphyritic stamp. In the typically porphyritic varieties are altered spherulites and signs of flow structure".

In all the slides examined spherulites or true flow structure were not noted. Actually the "flow structure" described is a pseudo flow effect and is very misleading. It is really a schistose structure as indicated by the direction of the sericite streaks. In the field the weathering of the schistose structure resembles flow structure but when thin sections of the rock are examined the schistose nature is readily recognised.

Following a detailed study of the Cambrian volcanic rocks of the West Coast one of us (Beryl Scott) has come to the conclusion that these acid "igneous" looking rocks which throughout the literature have been referred to as felsites, keratophyres, quartz and felspar porphyries, etc., are not true acid lavas and their equivalent intrusives, but are metasomatised lavas and sediments.

The alteration begins by a complete replacement of the original rock by quartz and albite to a very finely granular quartz albite mosaic rock as at Red Hills. With further silicification some of the quartz grains seem to coalesce and eventually take on the appearance of a quartz "phenocryst" even to the extent of the development of well defined crystal faces. It is noticed that it is not uncommon to find such idioloblasts surrounded by very fine (finer than the groundmass material) granules of quartz as though the quartz had to be as fine as possible before it could be absorbed or "digested". Misch (1949) describes similar "replacement borders" when discussing the metasomatic origin of granite-porphyry from the Sheku area in China. Likewise, as soda metasomatism advances albite "phenocrysts" are developed from the minute granules of the groundmass.

Some original acid volcanic rocks may have existed. If they did it is now impossible to distinguish them from the very metasomatised basic rocks. However, it is interesting to note that on King Island, at Smithton, and at Groom's Slip near Penguin where the least altered basaltic rocks of the group occur, no acid eruptives comparable with a keratophyre or felsite have

been found, the most acid differentiate being a felspathic basalt. Also, the keratophyres seem to be restricted in occurrence predominantly to the zone of the structural weakness where metamorphism has been at its maximum. Surely, if true acid volcanic differentiates existed, a trace of them would have been found with the least altered basaltic rocks.

Hornblende "Andesite".

Not only idioblastic quartz and albite but also hornblende seem to grow into euhedral porphyroblasts by a similar process as mentioned above. This is revealed in specimens of rocks collected along the Tyndall Track near Lake Margaret. The rock in the field shows evidence of flow structure in the alignment of hornblende "phenocrysts" and contains many cognate inclusions.

In the hand specimen the rock consists of beautiful idioblastic crystals of fresh hornblende up to 1/2" in length and smaller crystals of feldspar in a grey coloured stone groundmass. Veins of quartz and epidote sometimes traverse the rock. On first appearance it could be classed as a hornblende andesite.

In thin section the rock consists of these large idioblasts of green hornblende which show good cleavage, strong pleochroism (X = yellow, Y = greenish brown and Z = brownish green, giving the absorption scheme $X \lt Y \lt Z$, and both simple and multiple twinning, abundant "phenocrysts" of plagioclase and a few of quartz and orthoclase in a fine grained groundmass. Observation of a number of slides indicates that the groundmass varies. Sometimes it is composed of tiny laths of feldspar with chlorite, calcite and granules of sphene; in others it is predominantly felspathic with some quartz while in still others it is predominantly quartzitic with some feldspar. With an increase in quartz in the groundmass there is an increase in quartz "phenocrysts". These quartz "phenocrysts" seem to be secondary and always show the "replacement borders". The plagioclase shows slight alteration to sericite. It has an extinction angle of 48° and as its refractive index is less than that of Canada balsam the variety is albite with the composition $Ab_{96}An_4$. Just how much of the plagioclase originally belonged to the lava and how much is secondary is difficult to say. The porphyritic lavas which are fairly common on the West Coast contain phenocrysts of both augite and plagioclase but there is definite evidence that some of the "phenocrysts" of albite are secondary. They, too, show the "replacement border".

There is evidence to suggest that this rock did not originally crystallize as a hornblende andesite but as a pyroxene porphyritic basic lava such as occurs along Lynch Creek, at Boulah,

041

Beaconsfield and along the Mackintosh River. The change to hornblende andesite is due to subsequent alteration. This clue is given by the presence of augite which is in the various stages of being altered. The first change appears to be in the formation of chlorite around the edge and along the cleavage planes and cracks of the augite. As alteration proceeds tiny granules of sphene and epidote are developed and even a little iron ore. The end stage is a complete pseudomorph after the idiomorphic augite by chlorite and sphene. At a later stage hornblende is born out of these alteration products. The power of crystallisation is apparently great because soon afterwards idiomorphic crystals are developed. Sometimes patches of the unincorporated alteration products are left as inclusions or "embayments" in the hornblende and inclusions of idiomorphic albite crystals are quite numerous. It seems that the hornblende began life as tiny needles which gradually coalesced to give a plate of the mineral. Upon close observation, fringes of the hornblende which have a similar optical orientation to the plate traverse the mass of alteration products. In the same specimen all stages from the breakdown of the augite to the formation of the idiomorphs of hornblende may be traced.

The secondary nature of the hornblende is also revealed by its relationship to the veins and vesicles of secondary minerals. In one slide an idiomorph of hornblende cuts across a quartz vein. The hornblende extends a short distance into the vein and then needles of hornblende which are similarly optically orientated extend from the extremity of the crystal across the quartz to almost join the needles extending from hornblende on the other side of the vein. It seems as though the hornblende was able to form quite readily from the material available in the groundmass but when it came to the quartz its growth was impeded. With further growth and coalescing of the needles in the quartz both ends of the hornblende would be united to form a perfect crystal of hornblende. In yet another slide a large idiomorph of hornblende cuts across a vesicle of epidote and quartz. The boundary between the minerals in the vesicle and the hornblende is sharp.

Evidence is also revealed that hornblende is, in some cases, a direct alteration product of the augite. In ordinary transmitted light it is often difficult to distinguish it from chlorite with which it is closely associated. In fact, one mineral seems to merge imperceptibly into the other. Calcite and hornblende sometimes occur together as the alteration products of the pyroxene.

At Lake Dora in some rocks which are probably in the process of forming the hornblende andesite no hornblende is present

but pseudomorpha of chlorite and sphene after hornblende are crammed full of idiomorphic to subidiomorphic crystals of feldspar, orientated differently. It may be possible that as the small crystals of feldspar grew chlorite was developed between. At a later stage, with an increase in temperature, the chlorite gave rise to hornblende. It is interesting to note that some of the feldspar associated with the chlorite is fresher (i.e. less turbid) than that in the groundmass.

The mode of origin of this andesitic rock is very controversial. According to Hatch, Wells and Wells (1949) the hornblende of hornblende andesites is usually the brown "basaltic" variety and generally shows that it is not in equilibrium with the magma because all degrees of magmatic resorption are displayed. They say "At an early stage this may amount to no more than a slight "peppering" with magnetite granules, but at a later stage of alteration the hornblende is progressively replaced by an aggregate chiefly consisting of granules of nearly colourless clinopyroxene and octahedra of magnetite." After critically examining the thin sections of this rock it seems that the reverse is true. The clinopyroxene, a stable diopside augite, is in keeping with the variety suggested as being typical of andesites.

The alignment of the hornblende "phenocrysts" is suggestive of a primary origin but the petrographical evidence is against such an origin. The pyroxene which is usually stable shows more alteration than the usually less stable hornblende. The needles of hornblende, optically orientated similarly to the rest of the hornblende, cut across what Hatch, Wells and Wells would regard as the alteration products of the hornblende. One may suggest that if the hornblende is secondary after pyroxene then the pyroxene originally was orientated in the direction of flow. The hornblende, as suggested, is usually not directly formed from the pyroxene but is the metamorphic product of its alteration products (chlorite, epidote, etc.). However, some slides show hornblende directly replacing pyroxene. If the pyroxene was originally orientated then the hornblende must have grown with the same orientation, yet in most cases none of the original mineral was left to control the direction of growth of the new mineral. Another suggestion is that the orientation of the hornblende crystals may be a metamorphic effect, but the rocks in general do not exhibit structures indicative of dynamic metamorphism. The direction of alignment is at an angle to the cleavage. If as one of the authors (Beryl Scott) thinks this rock is not a true hornblende andesite the orientation of the hornblende remains a puzzle.

The Nature and Origin of the Hydrothermal Alteration.

The predominant types of alteration are albitization, silicification, chloritization, and sericitization.

Because the assemblage of minerals produced - albite, chlorite, quartz, etc. - is not indicative of high temperature formation the hydrothermal solution could not possibly have been above its critical temperature. The minerals could be formed readily at temperatures below 300°C. The formation of hornblende possibly requires a slightly higher temperature. Petrographical evidence indicates that hornblende developed after the low temperature alteration so it may have been formed during the rising crescendo of the Tyennan (Late Cambrian) orogeny or since it is developed most strongly in rocks along the structural weakness any rise in the temperature below (possible during the Tabberabberan orogeny) could be transmitted readily to the rocks above. This is discussed more fully below.

The authors prefer the suggestion that metasomatism has taken place by diffusion of dissolved material through pore fluids (or gases) and the movement of these through inter granular spaces rather than by "solid diffusion" through crystal lattices.

One of the authors, Scott (1952), has shown that the hydrothermal alteration is the result of eugeosynclinal orogeny. The Tyennan uplift which commenced in the early Middle Cambrian and continued throughout the Upper Cambrian was coeval with the Dundas sedimentation according to Carey (1952). It was probably during this orogeny, particularly in its latest stages when the accumulation of sediments was greatest, that metasomatism took place.

Evidence that this phase of metasomatism was completed before the deposition of the basal beds of the Junee Group (Lower Ordovician) is revealed by the presence of boulders of Darwin granite (reported by Hills, 1914) and "porphyroid" in the West Coast Range Conglomerate.

During the Tabberabberan orogeny an important very deep shear, which in places has its surface expression in a fracture and elsewhere as a zone of overturned attenuated strata was developed according to Carey (1952) who expresses its distribution thus "What is suspected to be the continuation of this structure runs from the southern end of Mt. Darwin through the Jukes copper prospects, then northwards to Mt. Lyell, through the Comstock workings, then through the western end of Lake Margaret whence it may extend northwards to the Red Hills Copper prospects continuing thence into the shear zone of the Sterling Valley mine, then across the Murchison through the Mt. Farrell field". This overturned and attenuated zone is associated with local sericitization and

044
with numerous hydrothermal ore bodies.

The so-called hornblende andesite from the Tyndall Range near Lake Margaret is very close to this shear zone. It is possible that the development of the hornblende which, as previously indicated, probably needs a slightly higher temperature of formation and followed the low temperature alteration may belong to this second period of metasomatism. Most probably the earlier formed porphyroids suffered further alteration and shearing. Two periods of alteration are suggested by petrographic evidence (i.e. the fragments of quartz-felspathic rock and schist in the chlorite schists) and it is interesting to note that the second period gave rise to the development of more quartz than albite.

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LOCALITY INDEX.

<u>Name</u>	<u>Quadrangle</u>	<u>Latitude</u>	<u>Longitude.</u>
Anthony Creek	Murchison 51	41° 52'	145° 35'
Arnold Peak	Murchison 51	41° 50'	145° 35'
Basin Lake	Murchison 51	41° 59'	145° 32'
Beaconsfield	Beaconsfield 30	41° 11'	146° 45'
Beulah	Sheffield 37	41° 26'	146° 24'
Comstock	Lyell 58	42° 02'	145° 39'
Farquhar Lookout	Murchison 51	41° 57'	145° 35'
Gooseneck	Murchison 51	41° 52'	145° 34'
Grooms Slip	Devonport 29	41° 07'	164° 06'
Henty River	Strahan 57		
	Zeehan 50	42° 2'	145° 15'
Hercules Mine	Zeehan 50	41° 50'	145° 30'
Julia Creek	Murchison 51	41° 83'	145° 34'
Julia Hill	Murchison 51	41° 52'	145° 35'
King Island	King Island	40° 16'	143° 50'
King River	Strahan 57	42° 10'	145° 30'
	Lyell 58		
Lake Apollo	Murchison 51	41° 59'	145° 37'
Lake Dora	Murchison 51	41° 58'	145° 39'
Lake Huntley	Murchison 51	41° 55'	145° 35'
Lake Julia	Murchison 51	41° 54'	145° 34'
Lake Magdalene	Murchison 51	41° 58'	145° 35'
Lake Margaret	Murchison 51	42° 1'	145° 37'
Lake Martha	Murchison 51	41° 58'	145° 36'
Lake Mary	Murchison 51	41° 58'	145° 25'
Lake Paul	Murchison 51	41° 59'	145° 37'
Lake Peter	Murchison 51	41° 59'	145° 37'
Lake Phillip	Murchison 51	41° 59'	145° 36'
Lake Rolleston	Murchison 51	41° 55'	145° 37'
Lake Selina	Murchison 51	41° 53'	145° 36'
Lake Spicer	Murchison 51	41° 59'	145° 39'
Lake Tyndall	Murchison 51	41° 57'	145° 34'

Comstock

Apollo

<u>Name</u>	<u>Quadrangle</u>	<u>Latitude</u>	<u>Longitude.</u>
Lake Westwood	Murchison 51	41° 53'	145° 35'
Langdon Prospect	Murchison 51	41° 58'	145° 31'
Langdon River	Murchison 51	41° 59'	145° 31'
Lynch Creek	Lyell 58	42° 7'	145° 33'
Mackintosh River	Mackintosh 44	41° 43'	145° 37'
Moye Rock	Murchison 51	41° 52'	145° 35'
Mt. Darwin	Lyell 58	42° 16'	145° 36'
Mt. Geikie	Murchison 51	41° 58'	145° 35'
Mt. Jukes	Lyell 58	42° 11'	145° 36'
Mt. Murchison	Murchison 51	41° 50'	145° 36'
Mt. Read	Murchison 51	41° 53'	145° 33'
Mt. Sedgewick	Lyell 58	42° 01'	145° 35'
Mt. Tyndall	Murchison 51	41° 54'	145° 33'
Murchison River	Murchison 51	41° 51'	145° 42'
Newton Creek	Murchison 51	41° 54'	145° 34'
Newton Peak	Murchison 51	41° 54'	145° 35'
Penguin	Devonport 29	41° 7'	146° 3'
Red Hills	Murchison 51	41° 52'	145° 35'
Rosebery	Murchison 51	41° 47'	145° 32'
Hikir	China	30° 00'N	108° 18'
Sticht Range	Murchison 51	41° 54'	145° 38'
Tyndall Range	Murchison 51	41° 56'	145° 37'
Walfords Peak	Murchison 51	41° 56'	145° 38'
Yolande River		41° 46'	145° 30'
	Strahan 57	41° 47'	145° 27'

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4th January, 1954.

MEMORANDUM :

1. On the 8th October, 1952, the Deputy Warden of Mines, Devonport, referred to me certain applications and correspondence relating to the occupation of land, under the provisions of the Mining Act, in the region of Williamsford, Red Hills and Lake Dora.

2. There was conflict between two parties, in the matter of applications, and the recommendation of the Deputy Warden was too conditional to be accepted as a final determination upon issues between the parties.

3. The two parties are -

Hilary E. Dodds represented by W. J. Cadwallader in the first instance and later by Dr. M. D. Garretty, all of Melbourne, and

A. J. Noldart, represented by Graham Hall of the Electrolytic Zinc Company of Australasia Limited.

4. It is reasonable to assume that the interests of Hilary E. Dodds and Dr. M. D. Garretty were related to mining interests on the mainland and that the interests of A. J. Noldart were related to the mining interests of the Electrolytic Zinc Company of Australasia Limited.

5. I have found that on the 17th November, 1951, there appeared in "The Advocate" a notice under Regulation 6a of the Mining Act, being a notice to apply for a Special Prospector's Licence in respect of an area of land defined in such notice. The person named thereunder was A. J. Noldart.

I have found that on the same day, the 17th November, 1951, there appeared in "The Advocate" a notice under Regulation 6a of the Mining Act, being a notice to apply for a Special Prospector's Licence in respect of an area of land defined in such notice. The person named thereunder was W. J. Cadwallader, Agent for Hilary E. Dodds.

049
4th January, 1954.

522051 2.

the Hon. the Minister for Mines.

6. I have found that an application for a Special Prospector's Licence, dated the 14th November, 1951, and bearing the signature of A. J. Noldart, was forwarded to the Warden of Mines, Devonport.

I have found that an application for a Special Prospector's Licence, dated the 23rd November, 1951, and bearing the signature H. E. Dodds (Hilary E. Dodds) was forwarded to the Warden of Mines, Devonport.

7. In seeking to obtain a Special Prospector's Licence it was sufficient to allow that each party had followed normal procedures and, all things being equal, each application would have succeeded but for an overlapping of the areas.

8. Instrumental surveys had not been made but from the description of the location of datum pegs and the direction of boundary lines it was reasonably clear that the eastern portion of the area applied for in the name of A. J. Noldart overlapped the northern portion of the area applied for in the name of Hilary E. Dodds.

9. I have found that in a letter addressed to the Mining Warden, Devonport, H. E. Dodds withdrew the application for the Special Prospector's Licence as from 10 a.m. on the 27th May 1952 and synchronised the withdrawal with the pegging of mineral leases on portion of the land marked out for the purpose of the application for the special prospecting licence. Applications for mineral leases bearing the date 30th May, 1952, were duly lodged with the Department of Mines.

10. I have found that there was a formal objection by interests representing A. J. Noldart to the application made by H. E. Dodds for a Special Prospector's Licence but the objection was not heard by the Warden of Mines.

11. Objections having been lodged with the Warden of Mines to the granting of a prospecting licence, notice of intention to apply for which was advertised by W. J. Cadwallader, as Agent for Hilary Ethel Dodds, and an application having been made by H. E. Dodds for a licence, it was incumbent upon the Warden of Mines to fix a time and place for the hearing.

The Hon. the Minister for Mines.

The Warden of Mines did not proceed in the matter and a complexity developed in May 1952 when applications were lodged by H. E. Dodds for 13 mineral leases.

12. There was a formal objection by Graham Hall as Agent for A. J. Noldart to the granting of seven (7) of the applications for mineral leases lodged by H. E. Dodds.

13. Normally, objections to the granting of applications for mineral leases are referred to and heard and determined by the Warden of Mines but in this case it was found that the seven (7) applications, against which the objection had been lodged, were in respect of land proclaimed as exempt from occupation under the provisions of the Mining Act, 1917, for the purposes of the Hydro Electric Commission, the proclamation being published in the Tasmanian Government Gazette on the 16th December, 1919.

14. The remainder of the applications for mineral leases appear to be partly on and partly off the area reserved from occupation under the provisions of the Act. There was no objection to these applications.

15. The exemption had not been lifted and in consideration of its existence the land was not Crown land available for occupation under the provisions of the Mining Act, 1929.

In consequence, there was no case to be referred to the Warden of Mines for hearing and determination following the objection lodged by the representative of A. J. Noldart, because the land within the boundaries of the land proclaimed exempt from occupation under the provisions of the Mining Act, 1917, was not available for occupation either as a special prospecting area or a mineral lease or any other form of tenement under the provisions of the Act.

16. The effect of the reservation upon the activities of the Hydro Electric Commission was referred to the Commission for an advice. The Commission advised that it would have no objection to the exemption being lifted provided a specific condition is imposed that where any mining leases are granted, the lessees must take such steps as are necessary to prevent erosion and the discharge of materials into tributaries of the Pieman River and that a suitable penalty be fixed to ensure enforcement of such a

The Hon. the Minister for Mines.

condition because there is danger of a future reservoir on the Murchison being silted up if precautions are not taken.

17. The attitude of the Hydro Electric Commission opened an avenue for granting of occupational rights under the Mining Act on the area which was the subject of a conflict between the two parties but no mining rights could be granted until the proclamation had been rescinded.

18. The exemption has not been lifted because it would not validate any application for occupational rights made prior to the effective date of rescinding the proclamation and an untimely move to lift the exemption could place either one of the two parties at an unfair disadvantage.

19. The Director of Mines expressed his preparedness to arrange for the exemption to be lifted if it would assist in resolving the problem in conflict.

20. The Director of Mines was troubled by the delay occurring in providing for a solution of the problem and made representations to the Warden of Mines.

21. The Warden of Mines was granted leave of absence, owing to illness, and a Deputy Warden of Mines was appointed.

22. There was a conference between the Deputy Warden of Mines and the Director of Mines and all relevant matters were assembled for the consideration of the Deputy Warden.

23. After consideration, the Deputy Warden returned to the Director of Mines all relevant applications and files with the submission that A. J. Noldart is agreeable, if necessary, to accept a Special Prospector's Licence for the area applied for, less so much thereof as is covered by the proclamation of 8th December, 1919.

The Deputy Warden submitted that as this reduced area is not in conflict with the area applied for by Dodds, he is prepared to recommend the application for such reduced area provided the Director of Mines is satisfied that such area is available and that the conditions as to work to be done and men employed are satisfactory.

052
4th January, 1954.

522054 5.

The Hon. the Minister for Mines.

The Deputy Warden further submitted that he should place on record, however, that if the area covered by the proclamation becomes available then the acceptance by Noldart of the reduced area should not prejudice his rights for any of the larger area subject to whatever rights Dodds may have in respect thereto. The Deputy Warden further recorded that it seemed to him, however, that as the area covered by the proclamation is exempt from the provisions of the Mining Act, whatever marking out may have been done thereon is ineffective.

24. The submission by the Deputy Warden provided no solution of the major issue and being somewhat conditional in certain material aspects it could only be accepted that the Director of Mines was left with a vexatious problem. The recommendation was too conditional for immediate action at administrative level.

25. As no material progress was being made in resolving the conflict between the parties and in consideration of the circumstances outlined, a move was made to bring the parties together in an effort to reconcile the differences, at administrative level, in the interests of mining in Tasmania.

Mr. V. I. Chambers, Solicitor for the Electrolytic Zinc Company of Australasia Limited, Mr. Graham Hall, Superintendent of the Electrolytic Zinc Company of Australasia Limited at Rosebery and Mr. O. W. Hawkins of that Company, appeared in the interests of A. J. Noldart.

Dr. M. D. Garretty represented the interests of Hilary Ethel Dodds.

The circumstances were outlined by the Director of Mines, whereupon Mr. V. I. Chambers questioned the procedure adopted in bringing the parties together and considered that as there appeared to be definite conflict of issues it was highly undesirable that either party should discuss with the other any evidence that may be the basis of the applications for Special Prospectors' Licences or Leases.

Mr. Chambers was not prepared to advise his clients to discuss the matter in the presence of the opposing party whilst the matter was in the hands of the District Warden of Mines. He submitted that there was a proper method of dealing with the matter and in his opinion the Warden of Mines should conduct an inquiry.

4th January, 1954.

522055 6.

the Hon. the Minister for Mines.

Mr. Chambers further submitted that the recommendation of the Deputy Warden of Mines should be accepted particularly as Mr. Graham Hall was prepared to accept a Special Prospector's Licence exclusive of the area referred to.

The reasons why the submission by the Deputy Warden of Mines was not acted upon have been outlined and, to those reasons, I must add that the Warden of Mines had failed to hear the objection lodged by the Noldart interests against the application made by the Dodds interests for a Special Prospector's Licence. There was, therefore, no determination of priority of application and it could not be accepted that a licence should be issued to cover any part of the area sought by the Dodds interests under the application for a Special Prospector's Licence, as any such move could be construed as recognition of a priority of application and may wreck any priority of representations made by the Dodds interests for mineral leases on the area exempt from occupation under the provisions of the Mining Act.

It has been an established principle to accept applications for mineral leases on the basis of priority of representations for leases in all cases where an exemption is lifted to enable applications for leases to be satisfied. Under such circumstances I was not prepared to create a hazard of administrative inconsistency.

Dr. M. D. Garretty representing the Dodds interests expressed preparedness to proceed with the matter on the basis of the procedure adopted by the Director of Mines in calling the parties together as he felt that if all the facts were known to both parties it would become evident that one of the parties would have an unassailable case or that there was a solution for both parties. He further submitted that he would have no objection to the matter being dealt with by the Warden of Mines as represented by the Noldart interests. Dr. Garretty, however, was concerned that any priority that might have been established by the application for a Special Prospector's Licence by Hilary E. Dodds should not be disturbed.

The attitude of Dr. M. D. Garretty was one to be appreciated as against the attitude of the solicitors for the Noldart interests.

An endeavour was made to isolate the interests of the parties in part of the area under exemption but neither party would forego any interest consequently a reconciliation of interests could not be arranged.

CC 054
4th January, 1953.

522056 7.

The Hon. the Minister for Mines.

After much discussion, the Director of Mines submitted that he would endeavour to get the matter into the Warden's Court and expressed his preparedness to recommend that the exemption be lifted if it would assist in resolving the problem.

The Solicitor representing the Noldart interests considered that the exemption should be lifted prior to the matter being referred to the Warden. This request was considered but was not agreed to for the reasons outlined herein.

There were other discussions upon procedures but the conference failed to advance the matter to a basis that would reconcile the interests of both parties at administrative level.

26. Following the conference, referred to in the preceding paragraph, the Director of Mines prepared and submitted a case for consideration by the Warden of Mines, who had resumed duties.

The circumstances were fully outlined. It was explained that the differences could not be resolved at administrative level and that whereas one party offered to support a resolution of the problem on that basis, feeling that such an approach was the correct one, the other party held that the differences should be heard and determined by the Warden of Mines.

The observations of the Warden were requested as such might assist materially in clarifying the possibility of having all the involved issues heard and determined in the Warden's Court.

27. This effort to get a case before the Warden of Mines served no useful purpose, as the Warden advised that after having had the opportunity of discussing the matter with the Director of Mines he could only confirm his opinion that in view of the proclamation of 8th December, 1919, excluding an area affected by both applications from the operation of the Mining Act, there can be no case for him to determine in the Warden's Court for the reason that the proclamation has of necessity ousted his jurisdiction and that neither of the parties can have acquired any rights in respect of such land.

28. The reaction of the Warden was the one to be expected under the circumstances and it was clear any lifting of the exemption would not have lawfully validated any prior application for occupational rights nor would it have created any dispute for hearing and determination by the Warden of Mines.

The Hon. the Minister for Mines.

The reaction of the Warden of Mines revealed no fault in the conceptions of the Director of Mines but there remained no solution of the initial problem of priority of rights in the applications for special prospecting licences nor of rightful occupation of land on the exempt area in the event of a rescinding of the proclamation. The former aspect should have been determined by the Warden of Mines at the appropriate time as a small part of the area sought by Hilary E. Dodds in the application for a Special Prospector's Licence was exterior to the area under exemption but on part of the area sought by A. J. Noldart in his application for a Special Prospector's Licence,

Had the Warden of Mines heard and determined the objection by Noldart interests to the application by Hilary E. Dodds for a Special Prospector's Licence it would have, at least, determined the priority of applications.

It is allowed that the application by Hilary E. Dodds was withdrawn to enable applications to be lodged for mineral leases and despite the fact that the lease applications relate mainly to land on the exempt area there is no determination that the small part of the area sought under the application for a Special Prospector's Licence by Hilary E. Dodds was available to be included in the area sought in the application for a Special Prospector's Licence by A. J. Noldart.

To issue a Special Prospector's Licence to A. J. Noldart with an inclusion of the small area, being part of the area sought by Hilary E. Dodds in the application for a Special Prospector's Licence would be an administrative admission that the application by the Noldart interests was of lawful priority. To exclude it would mean an admission of priority in the case of Hilary E. Dodds. It must be appreciated, therefore, that the conditional recommendation of the Deputy Warden of Mines, that a Special Prospector's Licence be issued to A. J. Noldart of such reduced area as the Director of Mines is satisfied is available, then created a difficulty at administrative level and that other avenues were being sought to resolve the conflict between the two parties.

29. Formerly, V. M. Cottle held a Special Prospector's Licence covering the area applied for by A. J. Noldart but as in the case of Noldart the interests represented by Cottle were the Electrolytic Zinc Company of Australasia Limited.

The licence was held by Cottle for a period of twelve (12) months and it was stated in the licence that the area was exclusive of private land, municipal and public reservations and

The Hon. the Minister for Mines.

roadways, Crown land occupied under lease or licence or reserves under any Act relating to Crown land.

Exclusive of the case of Hilary E. Dodds, the same conditions would have been imposed in any issue of a licence to A. J. Noldart.

The Electrolytic Zinc Company of Australasia Limited, V. M. Cottle and A. J. Noldart could submit that there was no knowledge of the existence of an exemption for the purposes of the Hydro Electric Commission but any submission to that effect would be of doubtful acceptance lawfully particularly in consideration of the conditions endorsed on the licence.

It could also be submitted that the application by A. J. Noldart was nothing more than a follow on from the licence held by V. M. Cottle and that it was an expression of a bonā fidē intention to continue with prospecting and other exploration in the Red Hills - Lake Dora region. That may be so but the licence was held by Cottle for the statutory period of twelve (12) months at the expiration or near the expiration of which no move was made by the licensee or the Company to apply for mineral leases. The Noldart interests could submit that investigational work had not been advanced to a stage to enable a decision to be made upon the merits of applying for mineral leases.

There could have been a brief time-lag between the hour of expiration of the licence held by V. M. Cottle and the hour of marking out for the purpose of the application by A. J. Noldart. Evidence upon this point has not been made available.

30. The interests representing Hilary E. Dodds may also submit that there was no knowledge of the existence of an exemption for the purposes of the Hydro Electric Commission and that potential areas of mineralisation at Red Hills and Lake Dora had been under examination with the object of acquiring tenements at the first opportunity.

It is patent that there was knowledge of the date of expiration of the licence held by V. M. Cottle because no opportunity was lost in marking out an area for the purpose of an application for a Special Prospector's Licence.

The time of marking out was disclosed as 7 a.m. on the day after the expiry date of the licence held by V. M. Cottle. Apparently this move was made to establish a priority in the event of a time lag in marking out by any person representing the same interests as V. M. Cottle.

037
4th January, 1954.

522059 10.

The Hon. the Minister for Mines.

There was no lack of expression on the part of the interests representing Hilary E. Dodds to proceed with applications for mineral leases because prior to and after the date of marking out for the purpose of the application for a Special Prospector's Licence and before any recommendation had come forward from the Warden of Mines the application for a licence was withdrawn to enable areas to be marked out for the purpose of applications for mineral leases.

An unfortunate aspect of the matter was that the Warden of Mines did not hear and determine an objection by the Noldart interests to the application for a Special Prospector's Licence by Hilary E. Dodds. This would have determined time lag and priority in marking out.

An objection was lodged by the Noldart interests to several of the applications by H. E. Dodds for mineral leases but as the particular applications related to land on the area exempt for the purposes of the Hydro Electric Commission no useful purpose could be served by referring the objection to the Warden of Mines for hearing and determination.

Whereas the interests representing Hilary E. Dodds moved to acquire leases, the interests representing V. M. Cottle had made no move to acquire leases even though the area had been in occupation for twelve (12) months. An aspect of this nature could favour the interests representing H. E. Dodds.

34. In consideration of the attitude of the Hydro Electric Commission in allowing the exemption to be lifted for mining purposes and the preparedness of the parties to have the conflict determined in the Warden's Court much thought was given to how or in what manner a dispute could be created for hearing and determination by the Warden of Mines.

Lifting the exemption would not validate any application made prior to any effective date of rescinding the proclamation but would only restore the area to the basis of Crown land available for occupation under the provisions of the Mining Act.

To proceed with a lifting of the exemption without consideration of the interests of both parties could place one of the parties at a disadvantage in securing occupational rights on the principle of priority.

A suggestion was made that an agreement should be arranged for simultaneous pegging with a lifting of the exemption in order to create a dispute for submission to the Warden's Court.

4th January, 1954.

522060 11.

058

The Hon. the Minister for Mines.

Section 36 of the Act provides that where applications are based on simultaneous marking out, the priority shall be determined as prescribed.

Regulation 25 provides that where there is simultaneous marking out and the applicants agree to make joint application either of the applications may be amended and the other application shall lapse.

In this case there could be no reconciliation on the basis of a joint application.

The regulation further provides that in the absence of such an agreement the priority of the applicants shall be determined by lot at such time and place as the Warden may direct but where any such applicant as aforesaid claims that his marking out was prior to that of any other applicant he may lodge an objection as provided.

Simultaneous marking out and the drawing of lots provided no solution of the problem but there could be created some grounds for dispute for reference to the Warden of Mines in the latter part of the regulation.

Whilst this procedure might bring into consideration a case for submission to the Warden of Mines it might be regarded by the Warden as relating only to the circumstances as applying at and from the effective date of lifting of the exemption and not related to any of the circumstances surrounding moves made to acquire occupational rights prior to the effective date of lifting the exemption.

One party was prepared to move in the manner that would produce a dispute for hearing and determination by the Warden of Mines and the other party was also prepared to move similarly but provided the circumstances of previous moves to acquire occupational rights were not prejudiced thereby. As the Director of Mines could offer no security in the matter of consideration by a Warden of Mines of circumstances preceding the effective date of lifting an exemption to restore an area to the basis of crown land available for occupation there was little scope for arranging a mutual agreement for creating a dispute for hearing and determination by the Warden of Mines.

32. All these considerations lead to a conclusion that the recommendation of the Deputy Warden of Mines could be accepted to an extent of granting a Special Prospector's Licence to A. J. Noldart to cover a reduced area of what the Director of Mines considers to be available land without prejudicing any rights or priority of rights of Hilary E. Dodds.

059
4th January, 1954.

522061 12.

The Hon. the Minister for Mines.

The area to be so defined would extend from the western boundary of the area delineated for the purpose of the application for a Special Prospector's Licence to the western boundary and a northerly projection of the western boundary of the area exempt from occupation under the provisions of the Mining Act for the purposes of the Hydro Electric Commission.

Had the Warden of Mines heard and determined the objection by the interests representing A. J. Noldart to the application by Hilary E. Dodds for a Special Prospector's Licence and had favoured the application by A. J. Noldart it would have been lawfully permissible to have included in the licence an area of land along portion of the northern boundary of the exempt area but if the Warden of Mines had favoured the application by Hilary E. Dodds for a Special Prospector's Licence then such northern strip of land was not available for occupation under the licence applied for by A. J. Noldart and would still not be available for inclusion in the licence because its occupation by the interests representing Hilary E. Dodds preceded the time of marking out for the purpose of the application by A. J. Noldart.

Whether such an administrative recommendation to the Minister would result in a protest or objection by the interests representing A. J. Noldart, to wit the Electrolytic Zinc Company of Australasia Limited or the interests representing Hilary E. Dodds, to wit Dr. M. D. Garretty, is unpredictable but the attitude of each party must be ascertained as a further move in resolving the conflict.

There is a hazard in issuing a Special Prospector's Licence to A. J. Noldart on the basis outlined because it could imply that the Director of Mines has conceded priority in the case of the application for a Special Prospector's Licence by Hilary E. Dodds and that the land was not available to the application by A. J. Noldart. This and the other reasons, outlined, compelled the Director of Mines to refrain from causing the Minister to issue a licence in the absence of a reconciliation of matters in conflict.

As an alternative and following the withdrawal of the application for a Special Prospector's Licence by Hilary E. Dodds, the interests representing A. J. Noldart could withdraw the application for a Special Prospector's Licence and some person representing the same interests could proceed to apply for a licence covering an area on the western and northern boundaries of the exempt area but it is doubtful if the interests representing A. J. Noldart would take advantage of any such alternative because

060
4th January, 1954,

The Hon. the Minister for Mines.

it could prejudice any rights which might be claimed as having been established by the application of A. J. Noldart.

33. There remains for consideration the vexed problem of -

- (a) The applications by Hilary E. Dodds for mineral leases on the area exempt from occupation under the provisions of the Mining Act for the purposes of the Hydro Electric Commission,
- (b) The objection lodged by the interests representing A. J. Noldart to the granting of applications by Hilary E. Dodds in respect of seven (7) leases, and
- (c) The expressed concern of the interests representing A. J. Noldart, to wit the Electrolytic Zinc Company of Australasia Limited, in holding any rights that may have been established to the area embraced by the seven (7) applications.

Under normal circumstances, where representations are made for occupational rights on an area exempt from occupation under the provisions of the Act such representations have been held for consideration on the basis of priority of representations if and when the exemption is lifted.

In this case, a lifting of the exemption would not validate any applications already made but, in the absence of other representations, it would enable Hilary E. Dodds, represented by Dr. M. D. Garretty, to mark out and submit new applications.

If such were done, in the present case, it would enable the interests representing A. J. Noldart or the Electrolytic Zinc Company of Australasia Limited to lodge an objection to the granting of the applications but the case which such interests may regard as having been established under the extenuating circumstances outlined herein could be prejudiced because a Warden of Mines might regard such circumstances as irrelevant to applications lodged after the land had been restored to the basis of Crown land available for occupation under the provisions of the Mining Act.

34. Moves have favoured a hearing and determination by the Warden of Mines but there is now no dispute for submission to the Warden's Court, despite any contention by either party. Suggestions for the creation of a dispute, in a regular manner and in order that all the circumstances may be properly examined, have not produced a positive result completely satisfactory to both parties.

The Hon. the Minister for Mines.

As implied, the exemption could be lifted and applications for mineral leases could be received from one of the two parties with the other party lodging an objection against the granting of the applications but, as implied, the rights of the party lodging the objection could be prejudiced.

35. The parties could be advised, in a hard manner, that the Minister is prepared to accept a recommendation for rescinding the proclamation exempting the area from occupation under the provisions of the Act and is prepared to arrange a date for the effective operation thereof whereupon it would be for the respective parties to determine their own issues in the matter of applications for mineral leases. In such a case, it should be an administrative direction that the exemption would not be lifted to enable the area to be occupied under a Special Prospector's Licence but only for the purpose of applications for mineral leases for bonā fidē mining activities.

36. In the absence of evidence from the interests representing A. J. Noldart, I am inclined to the opinion that the interests representing Hilary E. Dodds, to wit Dr. M. D. Garretty, gained a time advantage in the marking out of areas for the purpose of applications for special prospecting licences but, the absence of evidence from the interests representing A. J. Noldart and in consideration of the failure of the Warden of Mines to hear and determine the objection to the application by Hilary E. Dodds prior to its withdrawal to enable applications to be lodged for mineral leases, I am unable to subscribe to a substantial decision thereon.

37. Finally, it is to be observed that there is conflict between interests representing A. J. Noldart and interests representing Hilary E. Dodds in the matter of rights to occupy an area reserved from occupation under the provisions of the Mining Act but it is clear that there is no dispute for hearing and determination by the Warden of Mines.

The Director of Mines called the parties together with the expectation that the problem could be resolved at administrative level but the Solicitor representing the Noldart interests and the Electrolytic Zinc Company of Australasia Limited objected to such a procedure and submitted that the dispute should be referred to the Warden's Court for hearing and determination by the Warden of Mines but the Warden of Mines submitted that there was no case for hearing and determination by him.

062

4th January, 1954.

522064 15.

The Hon. the Minister for Mines.

A suggestion was made that the parties to the dispute should agree to create a case for submission to the Warden of Mines and to facilitate the matter the Director of Mines expressed preparedness to recommend that the exemption be lifted. This suggestion produced no positive result that might not prejudice any prior rights already established by one or both parties.

The Solicitor representing the Noldart interests suggested that the exemption be lifted prior to any matter being referred to the Warden of Mines but as a lifting of the exemption would not validate occupational rights there could still be no case for reference to the Warden of Mines without new applications after the effective date of rescinding the proclamation. As new applications might prejudice moral / or other rights already established by one of the parties the exemption was not lifted.

The Director of Mines remains convinced that the solution of the problem would have evolved from a conference exhaustively held at administrative level and remains satisfied that such a procedure was the logical procedure under the circumstances. The Dodds interests, represented by Dr. M.D. Garretty, expressed preparedness to follow that procedure but the Noldart interests, represented by the Solicitor for the Electrolytic Zinc Company of Australasia Limited, dissented and thereby created a complex.

The legislation makes no provision for a hearing and determination upon a question of what party should be given preferential rights in the occupation of any land not available but to be made available for occupation under the provisions of the Act.

The circumstances and the position which the Minister could assume have been outlined.

38. As the Solicitor representing the Noldart interests has expressed a desire and has endeavoured to interview the Minister in the matter, it is submitted that both parties be given an opportunity to confer with the Minister not separately but jointly at the same time and on the same date to consider all the matters referred to herein and, additionally -

- (a) Whether the Minister should issue a Special Prospector's Licence to A. J. Noldart but only in respect of the much reduced area outlined by the Director of Mines as being available in the absence of a determination upon priority of applications by the Warden of Mines,

The Hon. the Minister for Mines.

- (b) Whether in view of the dissension of the Noldart interests to preferential rights of occupation of the reserved area being determined at administrative level, the expressed attitude of the Warden of Mines that there is no dispute or conflict for hearing and determination by him, and that in consideration of the opinion that a lifting of the exemption would not validate any rights assumed to have been established, the Solicitor representing the Noldart interests should submit a procedure that would have lawful application and establish preferential rights to occupation of land not yet available but which could be made available for occupation under the provisions of the Mining Act on the area reserved for the purposes of the Hydro Electric Commission, and
- (c) Any suggestions that would enable either party to acquire mineral leases for bona fide mining operations on the exempt area and not for holding the area under cover of a special prospecting licence.

An explanation of the outlined circumstances surrounding Clause (a) should produce a reaction in the matter of priority and preferential rights.

The Solicitor for the Electrolytic Zinc Company of Australasia Limited, representing the Noldart interests, was the dissenting party in the conference at administrative level and submissions made by him on procedures were not of useful application. The Director of Mines could see no logical reason why the Solicitor representing the Noldart interests should have advised his clients against the submission of evidence at the conference if the case for the Noldart interests was substantially sound.

Reference to the three concluding paragraphs of Section 33 and the final paragraph of Section 34 of this memorandum could be a significant introduction to inviting the Solicitor representing the Noldart interests to make new suggestions for procedures that would lawfully resolve the problems in conflict having regard for ^abreak-down in the conference at administrative level and the correctly cited opinion of the Warden of Mines that there was no case for hearing and determination in the Warden's Court.

If the Minister accepts the suggestion for a conference and will nominate a convenient date and time after

064

4th January, 1954.

522066 17.

The Hon. the Minister for Mines.

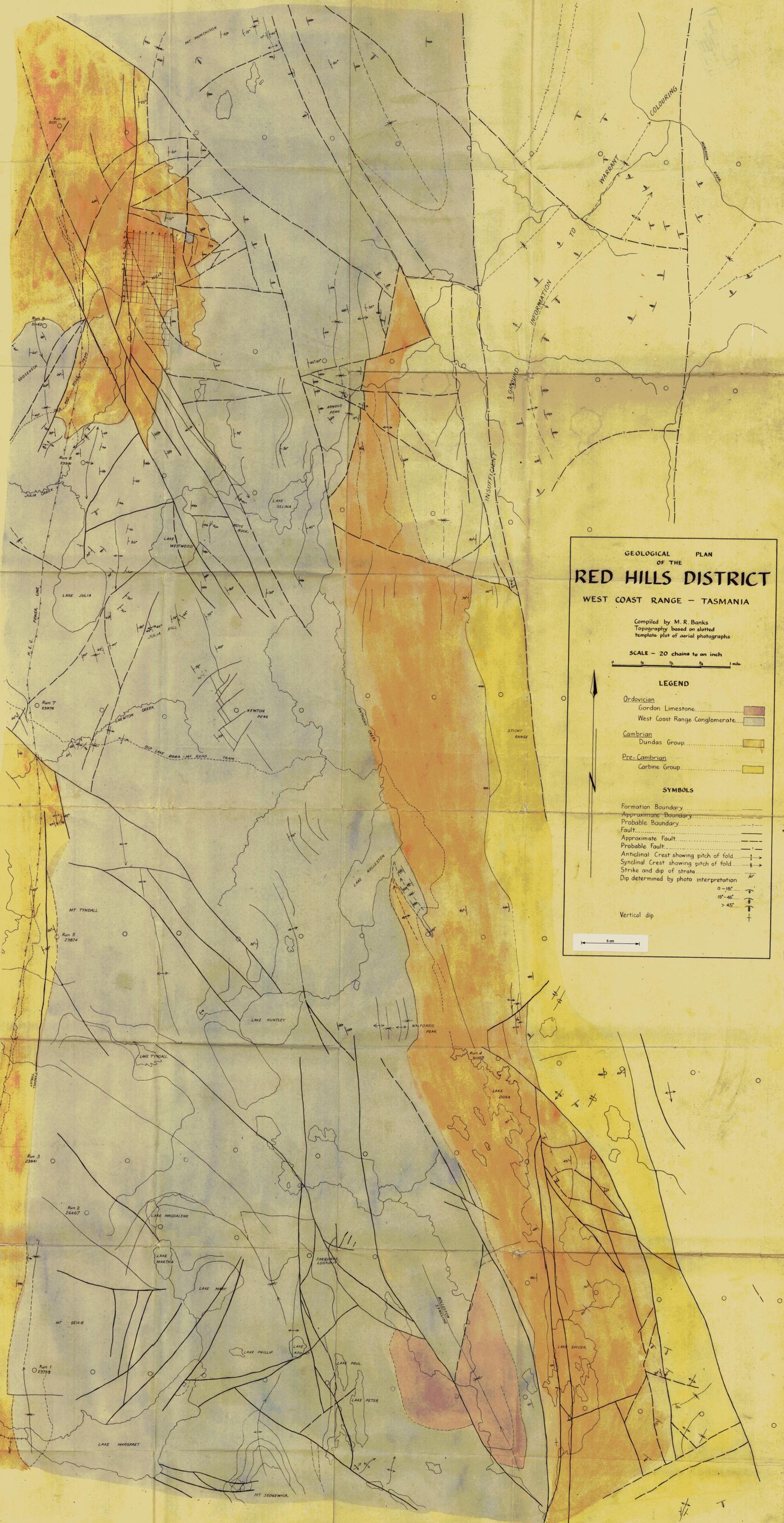
the 8th February, next, I shall be pleased to advise the parties concerned.

A handwritten signature in cursive script, appearing to read 'W.H. Williams', written in dark ink.

(W.H. Williams)
DIRECTOR OF MINES

The Hon. the Minister for Mines.

522067



**GEOLOGICAL PLAN
OF THE
RED HILLS DISTRICT**
WEST COAST RANGE - TASMANIA

Compiled by M. R. Banks
Topography based on slotted
template plot of aerial photographs

SCALE - 20 chains to an inch

0 1/4 1/2 3/4 1 mile

LEGEND

Ordovician
Gordon Limestone..... [Red box]
West Coast Range Conglomerate..... [Grey box]

Cambrian
Dundas Group..... [Orange box]

Pre-Cambrian
Carbine Group..... [Yellow box]

SYMBOLS

Formation Boundary..... [Solid line]
Approximate Boundary..... [Dashed line]
Probable Boundary..... [Dotted line]
Fault..... [Line with ticks]
Approximate Fault..... [Line with ticks and dots]
Probable Fault..... [Line with ticks and dots and dots]
Anticlinal Crest showing pitch of fold..... [Line with arrows and ticks]
Synclinal Crest showing pitch of fold..... [Line with arrows and ticks]
Strike and dip of strata..... [Line with ticks and numbers]
Dip determined by photo interpretation..... [Line with ticks and numbers]

Vertical dip
0 - 15°..... [Symbol]
15° - 45°..... [Symbol]
> 45°..... [Symbol]

5 cm