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DEPARTMENT OF MINES

GEOLOGICAL SURVEY BULLETIN

No. 45

THE ROUND MOUNT DISTRICT

by

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FIG. 1.—Round Mount and Brazen Nose.

PREFACE

When the Department of Mines established the Regional Geological Base at Lorinna, it was anticipated that the intense programme of regional mapping and investigation of this well known mineral district would result in new ideas on the problems of the ore deposits known to exist in the area.

This Bulletin is the direct result of Regional studies, and presents many new thoughts on the problems of the old Round Mount Mining district. It adds much to the knowledge of the area, and will be of great assistance to future prospecting programmes. As the work of the Lorinna and other Regional Geological Bases progresses, this Bulletin will be followed by further publications covering the mapping and exploration done by these establishments.

J. G. SYMONS, Director of Mines.

Department of Mines,

Hobart, 5th December, 1957.

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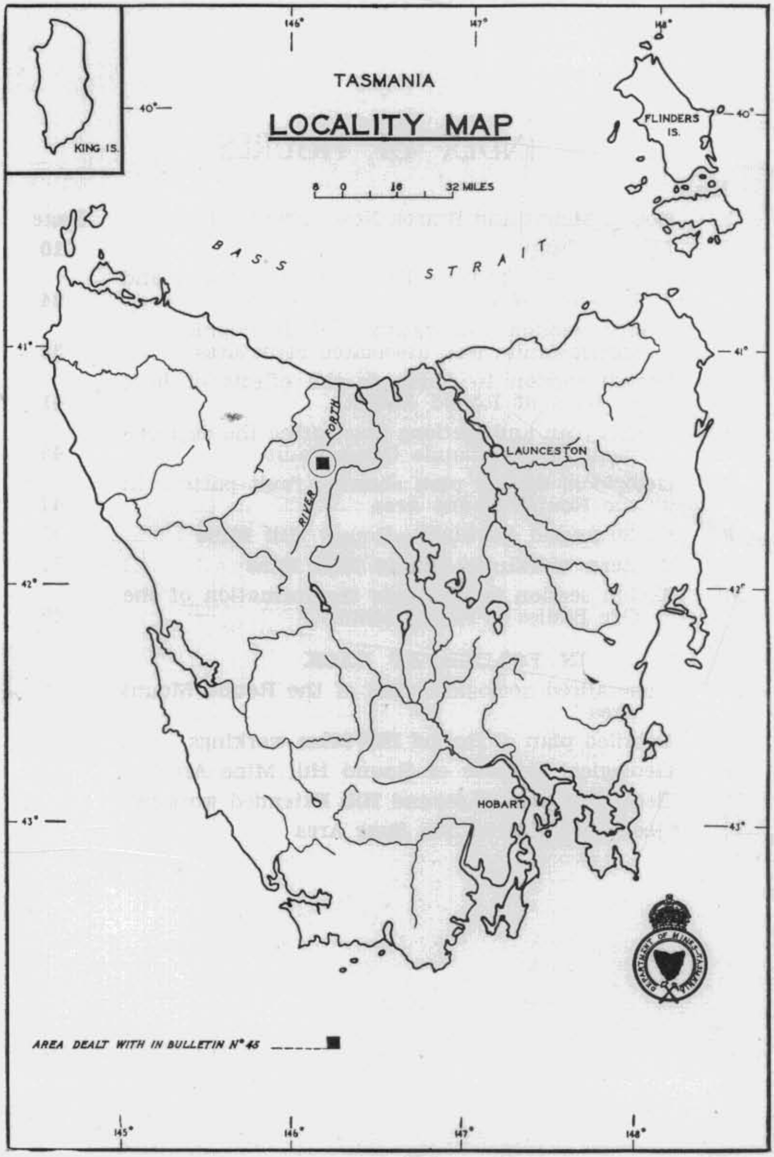

FIG. 2.—Locality Map.

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Geological Survey Bulletin No. 45

THE ROUND MOUNT DISTRICT

I. INTRODUCTION

(1) GENERAL

The original discovery of silver-lead deposits in the bed of Claude Creek just north of Round Mount was made by two prospectors, Messrs. Shepherd and Weeks, about 1878. Whilst early developments of these ore bodies did not immediately disclose any large rich ore bodies they stimulated the search for further ore in the vicinity. Thus within a few years of the original discovery further metalliferous deposits were discovered at the Round Hill Extended, Round Hill Western workings and Tin Spur, together with a number of other small prospects in the general area.

Development of these deposits proceeded sporadically for the next 30 years or so. However, to date, the original deposits at Round Mount are the only ore bodies which have achieved any important production. The structure of the Round Mount lodes proved extremely puzzling to the early workers and although a great deal of prospecting was carried out much of this proved to be misguided.

Despite a number of set-backs prospecting and development was pushed on and eventually a number of large high-grade ore bodies were located by driving south under Round Mount from the original lodes discovered in Claude Creek. The period between 1913-1925 was the hey-day of the Round Hill Silver-Lead Company and some of the lodes discovered were exceedingly rich. One parcel of several tons of ore assayed 6% copper, 40% lead, 380 ozs. per ton silver and 1 oz. per ton gold, whilst some specimens of galena assayed from 360 to 900 ozs. of silver per ton.

The Round Hill Silver-Lead Company ceased operations in 1927 by which time the majority of the large ore bodies had been worked out. Even at this stage the structure of the ore bodies was still not clearly understood. To a large extent this severely hampered the mining operations in the area and the management was frequently at a loss to direct exploration and development programmes efficiently.

The West Mt. Claude Mining Syndicate took up the leases in 1948 and carried out further exploratory works. Again, much of this work was misguided due to a non-appreciation of the structural problems involved. The survey of the Round Hill Mine upon which part of this bulletin is based was made at the request of this syndicate and was carried out during March to June, 1955.

Since no important ore bodies are now exposed and all of the important workings are inaccessible the report is not based upon an examination of the large ore bodies originally worked. The survey is, therefore, essentially an attempt to predict the presence of further lodes from a close study of the structural geology of the area. It was considered necessary to study a large area in a general fashion before proceeding to a detailed examination of the leases. By this method the various structures have been relegated to their correct degree of significance. This is important as several orders of folding and faulting are present and the ore bodies are clearly related to the geological structure. Detailed surveys were made of the Round Hill leases, the Round Hill Extended and Tin Spur areas.

During the life of the various mines several geological examinations were made. Because of the inaccessibility of many of the important workings it has been necessary to review all this literature critically. The description of the various lodes, as exposed during the operations of the mining companies, have been drawn upon by the author. Wherever possible this information has been checked in the field but this has not always been possible.

Generally the area displays an important structural pattern which may have important implications over a much wider area.

Whilst the author is responsible for the overall structural interpretation and mapping, I wish to accord acknowledgement and appreciation to the following:—Mr. R. G. Robinson, Geologist, for detailed mapping in the vicinity of Tin Spur; Mr. K. L. Burns, Assistant Geologist, for assistance in mapping detailed structures in the vicinity of Round Mount; Mr. N. G. Haig, Field Assistant, for performing all the instrumental work in connection with the stadia surveys of the leases at the Round Hill Mine and help with plotting the maps.

Final drafting of the maps and sections was carried out at the Drawing Office of the Mines Department, Hobart, under the supervision of Mr. K. T. Kendall.

(2) LOCATION

The co-ordinates of Round Mount on the State 4-mile map of Tasmania are N. 891·1 E. 415·9. Round Mount is a distinctive topographic feature forming a high, steep-sided spur between the junction of Claude Creek and Weeks Creek. The main workings of the Round Hill Mine are situated on the South bank of Claude Creek, very close to the junction of Weeks Creek. These workings have been driven south-east from the Creek right under Round Mount itself.

The general plan covers an area extending from near Cethana in the north to Tin Spur in the south, an area of some three square miles. The access roads throughout the area are indicated on this plan. The detailed plans indicate the various workings within restricted areas .

The nearest large centre is Sheffield which lies about 12 miles to the north-east.

(3) ACCESS AND FACILITIES

The area is freely accessible by road. The road from Cethana to Lorinna passes through the area mapped. This is a narrow metalled road having a fairly good grade but with poor sight distance in many places. No rail facilities are available at any of the mines. At the time of writing the nearest railhead was at Roland, some 11 miles distant to the north-east. However, present indications are that this line is to be abandoned. If this is so, Railton, lying about 24 miles by road north-east of this area, will be the nearest railway station.

In reading the literature on this area one is easily confused by the use of such terms as the "old" road and "new" road from Cethana to Lorinna. The present road from Cethana to Lorinna was constructed during the 1930's, that is, after the reports by Twelvetrees and McIntosh Reid were written. Thus the "new" road of the old authors is the "old" road of today.

From Cethana access may be obtained by good roads to Sheffield and Railton and to the North-West Coast port of Devonport which lies about 35 miles north of Cethana.

A fair supply of timber, mainly eucalypt regrowth, is available in the immediate vicinity of the mine and large supplies could be obtained from sawmills in the Lorinna area about nine miles distant by road. An adequate water supply for milling purposes is available for about eight months of the year from Claude Creek. Previously the companies working at Round Mount derived enough water from the No. 3 adit to see them through the remainder of the year. In the Tin Spur area enough water for the milling could be obtained from Tin Spur Creek.

In the early days of mining at Round Mount the various companies engaged derived power from a Pelton Wheel driven by water picked up in a race from Claude Creek. However, it would be unwise to rely on a yearly supply of power from such sources and some alternative source of power would certainly be required. At present the nearest supply of electric power is at Staverton, approximately three miles north of the Round Hill Mine.

The telephone line from Cethana to Lorinna passes close to all the known ore bodies in the area except the Round Hill Extended workings which are situated about half a mile south of the telephone line. Apart from a small hut near the Round Hill Mine no accommodation exists in the area mapped.

The West Mt. Claude Mining Syndicate has erected a small mill near the No. 1 adit. This mill has not been in operation since 1951, is in poor condition and suitable only for small scale operations. A compressor owned by the same syndicate, together with rough haulage gear is situated near the No. 11 adit. Air and water lines have been laid to most of the Round Hill Mine workings but these are inadequate for anything but small scale operations.

There is no plant in the vicinity of the Round Hill Extended or at Tin Spur.

II. PREVIOUS LITERATURE

The general geology of the area covered by this bulletin has been described in Geological Survey Bulletin No. 14 by W. H. Twelvetrees (1913) and No. 29 by A. McIntosh Reid (1919). However, these publications were designed to deal mainly with the various mines in a very much larger area than this and the structural problems have therefore been treated only briefly. Apart from these publications a number of reports dealing with individual areas, chiefly around the Round Hill Mine, are available. The chief centres of interest in the area are the Round Hill leases, Round Hill Extended, and the Tin Spur Area. The literature dealing with the three areas is summarised briefly below:—

(1) ROUND HILL MINE

The various workings in this area have been examined previously by several geologists. The first reports are those of Thureau in 1881 and 1885. At that time a good deal of the work was centred around the No. 3 adit. This writer recommended that this adit be abandoned, at least temporarily, and that open cut mining methods be applied to the known ore bodies near Claude Creek.

Montgomery visited the mine in 1893 but at that time developments were still concentrated upon the central workings, largely the No. 3 adit and his report, consequently, is not optimistic.

In 1898 Harcourt-Smith examined the workings but only a small amount of prospecting was being carried on and he also was not optimistic.

The first important description of the mine is contained in Geological Survey Bulletin No. 14 written by Twelvetrees in 1913. He gives a brief description of the geology and structure and a detailed account on the mine workings at that date. By this time the No. 3 adit had been abandoned, the Western workings had reached their maximum development, No. 1 adit had been driven 190 feet and No. 2 about 75 feet. Twelvetrees pointed out the anticlinal control of the ore bodies and made the following points:—

1. The characters of an ordinary lode are missing, the ore bodies are contained in a "compound lode". However, he expected the vertical component of the lode system to descend in the manner of ordinary veins.
2. The ore bodies are contained in a series of small parallel, vertical fissures intersecting the beds mainly at the crests of the anticlines. Some ore is present as irregular bunches extending down the limbs of the folds.
3. In view of these conclusions, he pointed out that exploration in this area would make heavy demands on the judgment and skill of the manager, and recommended a policy of driving on the anticlinal axis and sinking on any ore bodies thus located.

The next report is that by McIntosh Reid contained in Geological Survey Bulletin No. 29 published in 1919. This report is important as the Eastern workings were then in an advanced stage of development and several ore bodies were exposed. The writer gives an account of the mineralogy and structure of these ore bodies which must necessarily be drawn on by any later writers as it contains the only real description of the lodes. Reid also describes the other workings in the area but this is simply a reiteration of Twelvetrees' earlier work. No further work had been done on the No. 3 adit or the Western workings between Twelvetrees' visit and the time of Reid's report. Important points made by Reid are as follows:—

1. Again the anticlinal control was noted.
2. He observed that the ore bodies were related to the softer bands interbedded in the quartzites.
3. Introduced the idea of the ore bodies pitching conformably with the folds.
4. Described the folds as of the "parallel" type and states that there is evidence of both "Flowage" and "Fracture" folding. He stated that the axial planes of the folds were vertical.
5. He gave an account of the ore bodies, noted some evidence of replacement but observed that the ore is mainly along ore channels, bedding planes and joints and to a small extent in the country rock.

Neither Twelvetrees nor Reid attempted any structural mapping in the area.

In 1948 Hughes studied the general area surrounding the mine and made the first attempt at mapping the folds in which the ore bodies are contained. At this time the mine workings were inaccessible and he pictured the ore bodies as being contained in vertical, fractured zones in the axial planes of the anticlines. He also mapped the Claude Creek fault over some distance. Some conclusions contained in this report are as follows:—

1. The axial planes of the folds are vertical and the folds have no appreciable plunge.
2. The folding is of the "parallel" type.
3. The chronological order of events leading to the present structure is (*a*) thrust faulting; (*b*) folding; (*c*) ore deposition.

The report gives an account of the development of the mine from Twelvetrees' visit until it closed in 1927, together with production figures. The report recommends that the search for further ore bodies should be concentrated on the anticline nearest the Claude Creek fault. He recommended a drilling programme, part of which was carried out by the present lessees.

(2) ROUND HILL EXTENDED

The account of workings in this area by Reid in Geological Survey Bulletin No. 29 covers this mine fairly well. Reid recognised the futility of explorations by means of low level adits. He pointed out that the ore bodies do not have a strong vertical component and thus prospecting by the usual methods adopted for fissure deposits was wasted effort.

(3) TIN SPUR AREA

Twelvetrees and Reid described the workings in this area in their bulletins on the Mt. Claude and Middlesex area. At the time of Twelvetrees' visit the Falls Mine had not been discovered and work was centred around the Lower workings. Twervetrees considered that the area warranted further prospecting.

Later when Reid examined the area he was most impressed with its possibilities. He recommended that the Falls Mine and the Lower workings should be amalgamated. Subsequent to his visit these leases were amalgamated and Reid again visited the area and submitted a further report. This report also was most optimistic and he recommended that two cross cut adits be driven to test the "Main" ore body which he considered lay under the scarp of Tin Spur Creek fault. Neither of these adits were commenced and work in the area lapsed soon after his visit.

III. SURVEY AND RELIABILITY

The general plan of the area together with the accompanying sections are intended to indicate the overall structure of the area. This is important as there has been a tendency in the past to confuse structural units of various orders. On this general plan many of the minor folds have not been indicated. The distribution of the various rock units is accurate within the limits imposed by the scale, continuity of outcrop and deficiencies of the base map. This base map is prepared from stadia traverses along the roads and a few chain and compass traverses to fill in detail. Close to the traverses it can be regarded as accurate but this accuracy varies considerably away from the control traverses. The form lines were sketched in in the field and should not be taken for contour lines.

The detailed plans of the Round Hill workings were prepared from stadia traverses covering the whole of the area and can be taken as accurate enough for all general purposes. The stadia work was carried out with a Watts No. 1 Microptic theodolite. All underground surveys are by tape and compass commencing from fixed stadia points.

The Round Hill Extended area was mapped by a series of closed chain and compass traverses. The levels were obtained by Abney level readings.

The Tin Spur area was mapped by setting out a framework of stadia stations and picking up detail from these by both stadia shots and chain and compass methods. All the workings in this area are based on stadia readings. This survey was carried out at various periods between March-July, 1957.

Where geological boundaries and structures have been extrapolated due to lack of exposures this has been indicated on the geological plans. The sections incorporate all the available data but frequently rely heavily upon the author's interpretation of structure. Due to the lack of exposures and complicated minor structures much extrapolation is inevitable in the sections and this should be borne in mind when referring to them.

All bearings stated in this bulletin are magnetic. The level datum for the detailed Round Mount sheet is based on aneroid heights transferred from the Railway level at Roland whilst the level datum for the Tin Spur sheet was transferred by aneroid from more recently established bench marks at Lorinna.

IV. PHYSIOGRAPHY

(1) GENERAL

The area covered by this bulletin is too small to have any distinct large-scale land forms developed. Indeed it is only when one considers this area as a small portion of the physiographic units stretching from the Central Plateau to the North-West Coast, that its relationship becomes apparent.

A study of the general geological plan reveals a marked structural control of the physiography. The anticlines form ridges whilst the valleys are formed by synclines or faults. Of the valleys it will be apparent that the most profound valley-forming structures are the important thrust faults along Claude and Tin Spur Creeks. Along Claude Creek particularly, the drainage pattern has been dominantly influenced by faults which strike slightly obliquely to the fold systems. However, the western portion of the area is dominated by the valley of the Forth River and here less structural control is evident.

The anticlinal ridge type of physiography is usually an indication of a youthful stage of dissection. It therefore appears strange at first sight that Palaeozoic and older rocks, folded since the Lower Devonian should exhibit such youthful stages of dissection. The reason is that until comparatively recent geological times these older rocks have been preserved from erosion.

The Round Mount area lies approximately on a northern limit of the dissected Central Plateau. Valley glaciers during the Pleistocene glaciation may possibly have reached as far north as this but if they did, it was only for short periods and by minor ice tongues reaching down from the higher country to the south.

Some miles south of this area we have clearly preserved glacial pavements on the Central Plateau which was occupied during much of the Pleistocene by an extensive ice-cap from which valley glaciers protruded in all directions. North of Round Mount no evidence of this glacial period can be found. Thus, this area seems to have been for the most part just beyond the limits of continuous glacial activity but was probably subjected to extensive stream erosion during and since the glaciation.

The glacial deposits found in this area consist of accumulations of quartz sands, cobbles and large boulders, occasional pebbles of basalt and dolerite may be found. Most of the fragments, particularly the larger sizes show some degree of rounding and since many of the pebbles are in contact the deposits indicate evidence of sorting which is unusual in tills. These remarks are, of course, a generalisation and certainly in particular areas exceptions to this may be found. However, the rounding of particles, re-working or sorting, presence of sand and grit lenses, absence of striated pavements and glacial erosion features all point to a fluvioglacial origin for these deposits rather than true tills.

(2) PHYSIOGRAPHIC HISTORY

The folding in this area is thought to be of Lower Devonian age and for the purpose of deriving the present topography all events before this are relatively unimportant. At that time the Roland Conglomerate and Moina Sandstones were overlain by the

Gordon Limestone and succeeding members of the Junee Group. Following the profound folding and thrust faulting of the Lower Devonian the area was rapidly reduced to some semblance of a peneplain before the onset of the Permian sedimentation. Studies further south from here indicate that the surface underlying the basal Permian beds was of subdued, mature topography. A rough reconstruction from the available data suggests that the level of this surface was between 2600 and 2800 feet in this area. That is, the Moina Sandstones were probably showing through the land surface over the top of Round Mount. Permian and Triassic sedimentation followed perhaps by Jurassic dolerite intrusions then covered this surface and erosion recommenced some time in the Jurassic.

By the time of the Lower Tertiary basaltic extrusions, evidence of which occurs widespread south of here, the Mesozoic rocks had been mostly removed. The soft upper Junee Group members were then actively eroded between the anticlinal ridges. Since the Moina Sandstones are quite resistant and are overlain by the soluble Gordon Limestone the streams were established along the edges of the limestone outliers and migrated laterally down dip undercutting and dissolving the limestone. This same process is continuing today some miles to the west of here along the southern slopes of Mts. Roland and Gog.

Whilst the pre-basaltic topography was probably well entrenched into the Palaeozoic and older rocks it is clear from studies a few miles to the south that a very large part of the erosion which has produced the present topography has occurred since the basaltic intrusions. This suggests that the Pleistocene glaciation has been the dominant erosional influence in this area, but that this erosional cycle has not yet been in operation long enough to produce anything more than an extremely youthful topography on the folded Palaeozoic basement rocks.

If we consider this area as a portion of the northern edge of the Central Plateau it is interesting to note the geomorphological change produced in the plateau edge by differing rock types. In the Mole Creek district the plateau is composed of a thick roughly horizontal dolerite sill underlain by Triassic and Permian sediments and the Palaeozoic basement is only just being exposed. There the plateau ends abruptly in the great escarpment of the Western Tiers. The younger rocks forming this scarp are ideally suited to a process of reduction by the retreat of a steep scarp face. At Round Mount, however, the plateau edge is formed by the older folded rocks whose fold belts strike at an angle to the general direction of scarp retreat. The result is a zone of complicated juvenile topography back-wearing and down-wearing by fierce stream action. It is only the major folds lying somewhat east of Round Mount at Mts. Roland and Gog which form large enough topographical features for the action of sedimentation processes to be clearly recognizd.

(3) WEATHERING PROCESSES

The remaining blocks of Gordon Limestone in Claude Creek are being actively reduced by solution processes. In these masses solution processes can be clearly seen. The Moina Sandstones and Roland Conglomerate are much more resistant to erosional processes. Locally along faults these formations are intensely sheared and there they are quickly undercut by creek action. The huge angular masses of conglomerate and quartzite in Claude Creek and Tin Spur Creek are due to this process of undercutting along flatly dipping break thrusts followed by the collapse of huge blocks bounded by the major joint systems. Elsewhere these rocks are reduced by the action of freeze and thaw and by ice-wedging. The less dense beds in the Moina Sandstones are porous enough to permit the entry of water and in these horizons, which constitute a significant proportion of the formation, chemical erosion of the matrix takes place.

Crushed zones in the Roland Conglomerate and Moina Sandstones away from the stream channels, are also subjected to preferential weathering. Water percolates into the brecciated rock and ice action wedges the grains apart. The matrix of the Roland Conglomerate where crushed is quite susceptible to this process whilst its dense quartzite pebbles are only rarely affected. Scree accumulations occur around the steeper slopes of Round Mount, Brazen Nose and under the scarp of the Tin Spur Creek fault.

(4) DRAINAGE PATTERN.

As pointed out earlier the drainage in this area is strongly controlled by the geological structure. The area forms a very small portion of the Forth drainage basin and the creeks have a north-westerly trend parallel to the fold axis and plunge steeply into the Forth River. The steep stream profiles indicate the immaturity of the topography and the Forth River, being a much larger feature, is down-cutting at a faster rate than most of its tributaries. Since only a very small portion of the Forth is covered by this area its physiographic relationships are not apparent. In this area it cuts directly across the folded Ordovician and Cambrian rocks in a series of steep gorges.

The main creeks tend to have graded reaches as they run along the structural trends. However, when the creeks are deflected across the structure, they do so in a series of spectacular waterfalls. This is to be seen in Tin Spur Creek which trends away from the Tin Spur Creek Fault and plunges over a series of waterfalls near the road bridge. Claude Creek also forms waterfalls as it follows the Claude Creek Fault to the upper falls and then cuts across the north-east limb of the Claude Creek Synclinorium.

(5) VEGETATION

Since the geological structure has such a dominant influence on the physiography it also influences the vegetative types since they are related to aspect. None of this area has been cleared for agriculture but in the past timber has been cut in the vicinity of the Round Hill Mine and used for mine timbers. The following associations are present:—

(1) Eucalypt vegetation—this is mostly open and occurs mostly on the less shaded portions. However there is a good deal of overlap between the various associations. Where the eucalypts occur in the shaded areas they may be accompanied by dense under-

growth. The eucalypt vegetation covers the majority of the area and is the typical vegetative type. Fair quantities of this timber are available in the vicinity of the Round Hill and Round Hill Extended Mines but no useful timber occurs on Tin Spur above the old road.

(2) Buttongrass—this occurs in undrained and poorly drained areas near Round Mount but is common on the exposed slopes around Tin Spur.

(3) Ti-tree—occurs as dense colonies on steep hillsides and in shaded gullies. The colonies may be sufficiently thick to impede progress where well developed.

(4) Bauera—occurs as localised patches in the more elevated areas.

(6) RELATION OF TOPOGRAPHY TO MINING

In an area of strong relief the development of lodes by adits is logical. In the past the big majority of the mineral deposits in this area were explored and worked by such means. However, the structure of the lodes at the Round Hill Mine is such that if great care is not exercised in the laying out of exploratory workings much needless expense will be incurred. The No. 3 adit at Round Hill and the No. 1 at the Round Hill Extended are mute testimony to the undesirability of adits to explore for such lodes. The fact is that at Round Hill the lodes do not have a pronounced vertical component and explorations by adits, unless guided by diamond drilling, may frequently be unsuccessful.

The higher relief allows water under high pressure to be diverted by races to many parts of the area. At Tin Spur a good deal of sluicing was carried out in the early days by water brought in races from Tin Spur Creek. As mentioned earlier a Pelton wheel at Round Hill provided power for the mill for much of the year. Many of the water races near the various mines can still be traced for a large portion of their length and could probably be restored again without prohibitive expenditure.

V. GENERAL GEOLOGY

STRATIGRAPHY

(a) Nomenclature

Whilst no Cambrian fossils have been found in the older rocks in this area it has nevertheless been thought desirable at this stage to correlate these rocks with the Dundas Group of Elliston. In the past this group of sediments, lavas and porphyries has been the subject of considerable controversy. The old term "porphyroid" has been applied to these rocks in the past. However the term is meaningless from a stratigraphic point of view and has been misused so frequently in the literature that it should no longer be used.

The definition of the Dundas Group includes similar rock types to those which occur here, and it occupies a similar stratigraphic position. Therefore, to avoid coining unnecessary new names this association of volcanic and pyroclastic rocks together with their associated greywacke type sediments shall be referred to tentatively as the Dundas Group. A forthcoming publication will treat this group much more fully and is to be based on a study of a very much wider area.

The 800 ft. (approx.) of quartz conglomerate which forms Round Mount is clearly equivalent to part or whole of the Owen Conglomerate as re-defined by Bradley. However, the Owen Conglomerate as defined includes at least three thick conglomerate members separated by quartzites, sandstones and chocolate shales, &c. Obviously it is not possible to correlate the single conglomerate member in this area with any one or all of the units included in Bradley's definition. The formation here, as on the West Coast, so far as is known, is unfossiliferous. It seems likely that in the near future the Owen Conglomerate of the West Coast may be split into smaller units and re-defined. Because of these difficulties it has been decided to define the conglomerate in this area as a distinct formation called the Roland Conglomerate. The type area chosen on the north face of Mt. Roland gives a continuous outcrop of the formation from the type area to Round Mount.

Lying above the Roland Conglomerate we have a distinctive formation several hundred feet thick consisting very largely of quartzites, sandstones and shales. In the past these rocks have usually been referred to as the Tubicolar sandstones or quartzites. This name is unacceptable as it contains no geographical sense and as the tubicolar organisms upon which the name is based also occur in rocks of a different age. For the present, therefore, the writer has decided to revert to the name Moina Sandstones used for this formation earlier by Twelvetrees.

However, the position is still not completely clear as this formation is probably equivalent to the Caroline Creek Beds as defined by Stephens. The original description of the Caroline Creek Beds merely refers to a small cutting along the railway line near Dulverton. No type section has been defined for the formation and the stratigraphic position of these beds together with their thickness and relation to the overlying and underlying formations in the type area has certainly not been demonstrated beyond reasonable doubt. The Caroline Creek Beds contain an abundant

Tremadocian trilobite fauna and no equivalent fossils have yet been found in the Moina Sandstones. Nevertheless the Moina Sandstone, at first thought to be unfossiliferous except for the tubicolar casts, is beginning to yield brachiopods on certain horizons upon closer inspection. The term Moina Sandstones has therefore been used as a compromise to avoid using a new name pending a complete re-investigation of the validity of the Caroline Creek Beds as a stratigraphic unit.

The following table indicates the various rock units present:—

Age	Unit	Approx. Thickness
Recent	Residual soil talus and alluvium	
Pleistocene	Fluvioglacial deposits	
	UNCONFORMITY	
Lower Devonian	Dolcoath Granite	
Ordovician	Gordon Limestone	200 ft.+
Ordovician	Moina Sandstones	800 ft.
Ordovician	Roland Conglomerate	100-800 ft.
	UNCONFORMITY	
Cambrian	Dundas Group	1,000 ft.+

(b) Stratified Rocks

i. Dundas Group

From an economic point of view the Dundas Group rocks in this area are relatively unimportant. They form the basement and are exposed on either side of the Round Mount Synclinorium but no known ore bodies are associated with them in this area. For this reason the Group has not been split into its various units in this report. The Group comprises a suite of pyroclastics, lavas, porphyries and greywacke type sediments. These rocks outcrop at several places along the Lorinna Road and show an unconformable relationship with the overlying Roland Conglomerate wherever the contact is exposed. The most convenient exposure of this unconformity is in the road cutting about one mile north of the Round Hill Mine. Very close to this contact a small thrust fault displaces the beds but this does not in any way disguise the unconformable relationships between the two units as shown in Figure 3. Similar exposures can be seen in two localities on either side of Tin Spur and of these the exposure above the road near the Tin Spur Creek fault is by far the most convincing. Apart from the main outcrops of the Dundas Group on either side of the Round Mount Synclinorium, three other small exposures of the Dundas Group occur. These are under Brazen Nose, along the Cockatoo Road and just upstream of the bridge over Tin Spur Creek. In these localities the rocks consist of sheared, grey-purple quartz felspar porphyries. Exposures of these sediments and the associated porphyries can be seen in the road cuttings between the Round Hill Mine and Cethana.

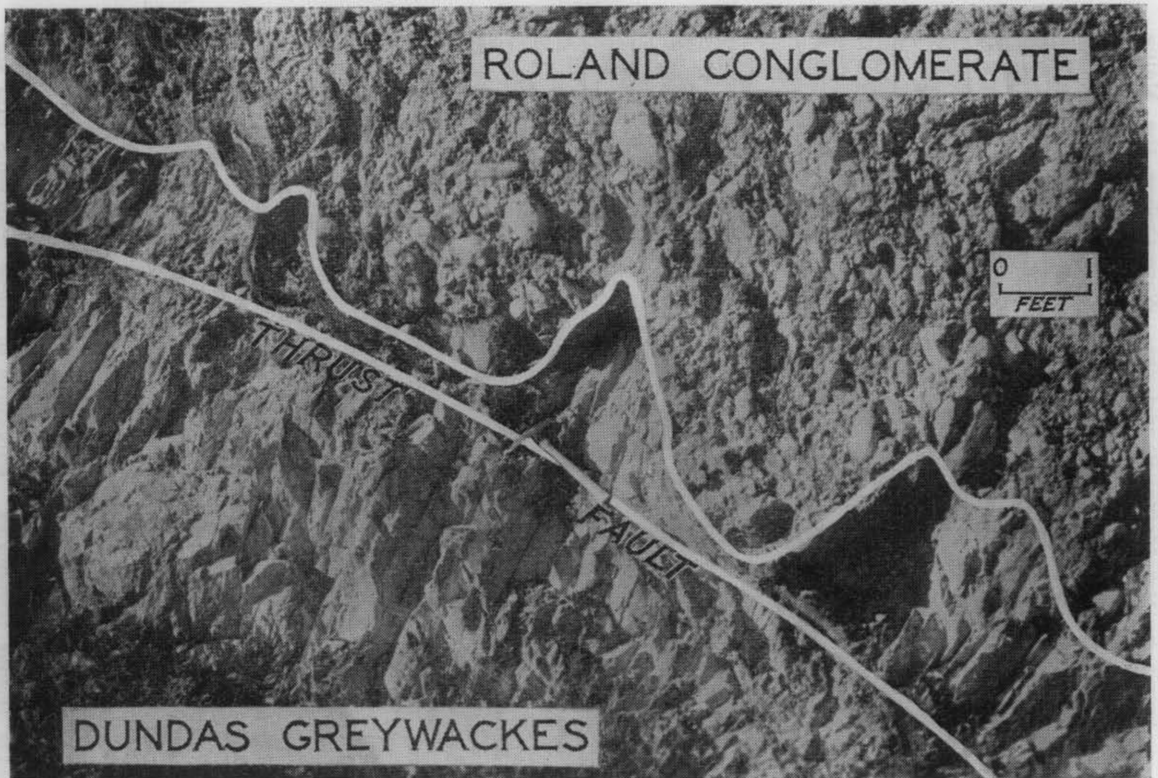


FIG. 3.—Unconformity between Roland Conglomerate and Dundas Group.

Reid described the porphyries at Tin Spur as being intrusive into the Moina Sandstones and therefore postulated a Devonian age for them. The field evidence suggests that Reid either misinterpreted the structure of the area or interpreted some of the sheared grit beds in the Moina Sandstones as porphyries.

Where partially weathered and locally sheared, some of the grit beds in the Moina Sandstones may very closely resemble weathered porphyries. For this reason great care must be exercised in mapping these rocks particularly in small outcrops. It can usually be shown that such sheared grits pass out into normal sediments away from the area of disturbance

The age and origin of the porphyritic members of the Dundas Group have been the subject of controversy for many years. The "porphyroids", as these rocks have been termed in the past, have been assigned various ages ranging from Cambrian to Lower Devonian. Since it has been misused so frequently in the literature the term porphyroid has lately been abandoned. In the sense that Twelvetrees originally used it, that is to describe sheared porphyritic rocks, it was an extremely valuable term. Indeed, anyone working continually on these rocks has difficulty in avoiding the term as it describes many of the rocks perfectly.

The early work in this field has been summarised by Carey in the Annual Report for the Director of Mines, 1945. This statement brings together the important views on these rocks up to that date. Since then Bradley, working on the West Coast Range has interpreted similar rocks there as being derived by the granitization of greywacke type sediments. This granitization is attributed to the Lower Devonian.

At about the same time, Elliston, working in the Mt. Dundas area mapped and defined a considerable thickness of Cambrian sediments with associated lavas and pyroclastics.

Thus we have a summary of the views of the Geological Survey workers to 1945 which holds that many, probably most of these porphyries and lavas are of Cambrian age but that some of them at least are later, probably Lower Devonian. Bradley, on the other hand, postulates a Lower Devonian age for most of them. That is, he considered them to be Cambrian sediments altered to porphyries by granitization processes during the Lower Devonian.

The question of the age of these rocks is therefore to some extent bound up with the problem of their origin. The study of the area around Round Mount is too localised to draw any firm conclusions as to the origin of these rocks. However, it is important from a point of view of the age of the porphyries in that area. Since the area has been referred to several times in the literature from this point of view it is desirable to discuss the validity of the points made to date.

In his report on this area Reid described blocks of porphyry up to two feet across occurring in the basal beds of the West Coast Range (Roland) Conglomerate on the western end of Mt. Claude. Later Finucane visited the area and denied this evidence. He described the blocks as being "sheared felspathic grits" and not porphyries. The writer has examined this section several times and was satisfied that porphyry pebbles do actually occur in the Roland Conglomerate at that point. However in view of Finucane's statement the area has recently been revisited in company with the Departmental petrologist Mr. G. Everard. Several pebbles were collected and a slide cut from one of these. Mr. Everard reports as follows:—

> " The following description applies to a specimen recently collected on the Lorinna Road between telephone posts 249 and 250.
>
> The specimen consists of pebble material from the conglomerate beds exposed in road cuttings. It is strongly sheared and weathered to a purplish or pinkish colour.
>
> In thin section the specimen has a fine grained quartz-felspathic matrix, the felspar being completely sericitised, in which are phenocrysts of quartz and opaque iron ore minerals. More difficult to see against the background of the matrix, but still distinguishable, are completely altered phenocrysts of felspar. Shearing has resulted in granulation of the phenocrysts, but a few remain as shattered euhedral crystals.
>
> The specimen is a sheared and altered quartz-felspar porphyry."

The fact is that in hand specimens, many of the pebbles in the conglomerate are so sheared that it is impossible to determine their precise nature. No record can be found of any slides cut by Finucane from this area.

In view of this controversy it is surprising that neither Reid nor Finucane appear to have closely examined the unconformity above the Falls Mine at Tin Spur. There the bottom bed of the Roland conglomerate contains indisputable unaltered pebbles of the underlying porphyry.

The other exposure in this area which has been cited as evidence for age of the porphyries is the outcrop of porphyry along the Cockatoo Road. This has been quoted as evidence for Devonian porphyry intrusions. Carey, quoting earlier workers, includes this as one of the apparently authenticated exposures of Devonian porphyry intrusions. In view of this a short description of the outcrop is desirable.

As shown on the geological plan the porphyry outcrops as an elongated mass trending slightly obliquely to the Cockatoo Road. It is overlain by a conglomerate, about 100 feet thick, which outcrops as a series of low cliffs and is apparently underlain by Moina Sandstones.

Actually none of these contacts are visible anywhere in the field. After a thorough search of the area the writer could find no trace anywhere of a contact between the porphyry and either of the surrounding formations.

The contact with the overlying conglomerate is concealed beneath a mantle of talus at the base of the cliffs and likewise the steep slopes below the road are covered by heavy talus accumulations.

The basal beds of the conglomerate are also concealed and a search of the conglomerate beds exposed along the cliffs has failed to reveal any pebbles of the porphyry in the conglomerate.

Thus the field relations of this porphyry mass are obscure and the record of this being a demonstrable intrusion of Devonian age should be reviewed. The evidence upon which this has been cited as a dyke is apparently its elongated shape in the field. However, the interpretation by the writer as a Cambrian porphyry unconformably beneath the Roland Conglomerate also demands an outcrop distribution similar to that found in the field. This interpretation is preferred as a similar porphyry is exposed in a similar fashion less than half a mile to the west of the Cockatoo porphyry exposure. There, if one accepts the evidence of porphyry pebbles in the overlying conglomerate, the porphyry is clearly unconformable and of pre-Tremadocian age. Since the boundaries of the Cockatoo porphyry are concealed it seems extravagant to postulate a different mode of occurrence for that mass.

A dyke hypothesis is somewhat simpler from a structural point of view but it does leave some doubt as to the stratigraphic position of the conglomerate overlying the porphyry. Hughes interpreted this formation as being a conglomerate member within the Moina Sandstones. However, after mapping the Moina sandstones over several hundred square miles surrounding this area the writer can find no evidence elsewhere for this.

As indicated on the general plan the writer has postulated a fault forming the porphyry-Moina Sandstones boundary to the north-east. This involves the presence of a fault of some magnitude which entirely obscured by talus. The only evidence for this is the shearing in the porphyry and the Moina Sandstones near the assumed position of the fault and in the general alignment of the proposed fault with the other known faults in the area.

It is interesting to speculate that this fault may in fact be portion of the upthrown block of the Tin Spur Creek Fault which has been preserved from erosion and left as a fault outlier in front of the main fault block. From the known dip of the Tin Spur Creek Fault, projecting this to the north-east onto the Cockatoo Ridge this does not appear to be likely at first sight. However, if one of the north-east trending cross structures, some of which are indicated on the plan, was a normal fault with a downthrow to the south-east of a few hundred feet it would produce this structure. As it is the precise nature and throw of these faults is not known unless one assumes the age and space relationships of the Cockatoo porphyry.

From the foregoing discussion it will be apparent, at least, that whilst the author may not be correct in this interpretation, it does fit with many of the facts established elsewhere in the area. The interpretation as a dyke on the other hand is certainly not disproven, but sufficient evidence is available to indicate that it is not indisputable.

The critical point in this whole discussion is the validity of the presence of pebbles of porphyry in the conglomerate as an indication of the age of the porphyry. Bradley interprets such pebbles as being due to preferential metasomatic alteration of existing greywacke pebbles. If this view is correct the pebbles then have no time significance and much of the foregoing argument is valueless.

This is a point upon which a great deal of discussion may revolve and involves questions as to the genesis of the "porphyroids." As pointed out earlier the area under discussion is too small to attempt to hypothesise upon that problem.

However, the writer has not followed Bradley's view on the origin of the pebbles for the following reasons:—

1. The basal beds of the Roland Conglomerate contain porphyry and greywacke pebbles side by side at the unconformity exposed in the road cuttings north of the Round Hill Mine.
2. At this exposure the Dundas Group rocks underlying the conglomerate are relatively unaltered greywacke siltstones.
3. Some, possibly all, of the quartz phenocrysts in the porphyries are of the high temperature form of quartz suggesting to the writer that either they are original igneous rocks or have been derived from igneous rocks.

If it can be demonstrated that the porphyry pebbles have in fact been formed by metasomatic alteration *in situ* then the whole question of the age of these rocks must be reviewed.

In the meantime and for the purpose of this publication the writer has concluded:—

1. That there is no conclusive evidence anywhere to indicate that the porphyries here are other than Pre-Tremadocian age.
2. That the Devonian intrusives at Cockatoo Ridge and Tin Spur previously described cannot be demonstrated conclusively in the field.

These remarks apply solely to the "porphyroids" in this area and the author certainly does not imply that he considers that such intrusives do not occur anywhere in the State.

The outcrops of Dundas Group rocks in this area are relatively small in extent. It is therefore thought desirable to postpone a full discussion of the origin and relationships of the Group until a broader study now in progress, has been completed.

The thickness of the Dundas Group in the area is probably several thousands of feet but not more than 1000 feet can be indicated on the plans. Little is known of the structure within the Group in this small area as the main outcrops lie outside the area mapped.

ii. Roland Conglomerate

Definition:—

The Roland Conglomerate is that formation of quartz conglomerate lying unconformably above Dundas Group rocks and conformably beneath the Moina Sandstones on the north face of Mt. Roland The type locality is between co-ordinates N 894.3 *to N* 894·7 *and E* 425·4 *on the western side of the walking track to the summit of Mt. Roland.*

The formation is approximately 800 feet thick in the type locality. The unconformity between the Roland Conglomerate and the Dundas Group is not visible in the type locality but may be found along a continuous exposure of Roland Conglomerate to the east of the type locality.

This formation overlies the Dundas Group unconformably and is in turn overlain conformably by the Moina Sandstones. As mentioned earlier, the formation is equivalent to part or whole of the Owen Conglomerate of Bradley and to the West Coast Range Conglomerate of earlier workers.

The age of this formation based on fossil evidence outside this area is Tremadocian. Also the overlying Moina Sandstones contain brachiopods of probable Tremadocian Age which supports this view. No fossils have been discovered in the Roland Conglomerate formation in this area.

Formation consists almost exclusively of thickly bedded quartz conglomerate but occasionally sandy lenses or thin quartzite bands may be found. These occur more frequently towards the top of the formation. A " typical " specimen of Roland Conglomerate is an exceedingly dense pink conglomerate made up of rounded and subrounded quartzite pebbles set in a fine-grained siliceous matrix. The pebbles comprising the conglomerate are overwhelmingly quartzite but some reef quartz and quartz schist pebbles are usually present. The quartz schist pebbles whilst not wholly restricted to any particular bed are usually more common in certain beds. The basal beds at Cethana and at Tin Spur contain boulders of the underlying quartz porphyries and at Cethana occasional pebbles of sheared porphyry may be found as high as 150 feet above the base of the formation. Here also the matrix of the bottom bed is somewhat argillaceous, apparently derived from the underlying sediments. Higher up in the formation the matrix consists of angular to sub-rounded siliceous grit and sand particles. In some of the higher beds at least at Cethana the overall pink colouration does not appear to be due to finely disseminated haematite right through the rock but is due to haematite staining of some of the pebbles and some of the grains comprising the matrix,

The conglomerate is thickly bedded, the beds ranging up to 30 feet in thickness and it is strongly jointed so that bedding is almost impossible to detect in small outcrops and is frequently difficult to determine even in large outcrops. In some beds there is a preferred orientation for the more tabular particles but this is not usually distinctive or reliable enough to use as a means of detecting the attitude of the bedding.

As a rule the bottom-most bed contains larger boulders than the average but throughout the formation there are rapid changes of grain size. Where the formation is thick the pebbles usually show evidence of sorting and reworking. In such areas, almost exclusively, the pebbles are in contact with one another. However in some of the occasional sandy lenses isolated pebbles may be seen.

The conglomerate is strongly jointed everywhere and in the vicinity of the Claude Creek thrust fault it is crushed and sheared. Major and minor joints alike frequently cut straight across pebbles and matrix. In the crushed zone along the Claude Creek Fault the matrix has suffered more than the pebbles and it is possible to pick the rounded quartzite pebbles out of a sheared sandy matrix by hand.

Quartz veining in the formation is fairly common. This often shows as *en echelon* tension gashes and as sheets along the bedding planes. Some of the minor quartz veins appear to start in the pebbles and extend outwards into the matrix. Occasionally pebbles may be found having original quartz veins and containing open cavities lined with quartz crystals.

A characteristic of this formation is the rapid lensing of beds and the formation may thin out over very short distances. Here it thins out from about 800 feet on Round Mount to less than 100 feet in the vicinity of Tin Spur. The change in thickness is most rapid in the short section between Round Mount and the Cockatoo Ridge. Due to the intense folding the exact distance along any bed in the conglomerate between these points is not accurately known. However by roughly unwinding the folds and faults it would certainly appear to be less than one mile. The conglomerate over this distance therefore thins out by a ratio of about 7 to 1. Further south from the Cockatoo Road the formation thins out gradually for about four miles or so before it is missing completely and the Moina Sandstones overlap onto the Dundas Group.

In the vicinity of Tin Spur the change in thickness of the conglomerate is accompanied by a change in the field characters. On Round Mount the pink conglomerate predominates and only occasional quartzite bands are present. On the Cockatoo Ridge the conglomerate contains a higher proportion of matrix to pebbles and is lighter in colour. Further to the south-west on Tin Spur the conglomerate is white and contains an even higher proportion of matrix to pebbles. The conglomerate here has suffered fairly severe induration due to the proximity of the Dolcoath Granite and this has been severe enough to mask the outlines of the pebbles. From a distance the rock appears to be a dense white quartzite. Closer inspection reveals the shadowy outlines of the original pebbles. The old name for this formation at Tin Spur " The Ghost Conglomerate " is an adequate description.

iii. The Moina Sandstones

This formation consisting of interbedded sandstones, quartzites, grits and shales conformably overlies the Roland Conglomerate. Some brachiopods have been collected from a fossiliferous horizon in the formation in the bed of Claude Creek just below the upper falls. These fossils, together with others collected from the formation where it outcrops in the Lorinna district have been tentatively identified as Tremadocian types. No fossils have been determined from the overlying limestone in Claude Creek as yet but the age of the base of the Gordon Limestone elsewhere has usually been found to be Lower Ordovician which would agree with the above.

This formation is the host rock for the ore deposits at the Round Hill Mine, Round Hill Extended and at Tin Spur. Indeed over an area of about 100 square miles surrounding Moina the big majority of the numerous known ore bodies occur within this formation. These rocks are therefore most important from an economic point of view and the structure of the formation has been closely studied throughout the area. Nevertheless, due to the tight folding and abundant minor faults no complete stratigraphic section through the formation has been measured. By reconstructing the folds throughout the area under discussion the thickness of the formation appears to be about 800 feet. This agrees with observations in the surrounding districts and with data collected on the West Coast.

The Moina Sandstones consist dominantly of thickly bedded sandstones together with white quartzites and shales, grits and occasional conglomerate beds. Since no complete sequence is available the detailed lithology of the formation cannot be given. In the Tin Spur area the Moina Sandstones have been quite strongly indurated by the nearby Dolcoath Granite. The dense white quartzites in this area may well be equivalent to some of the sandstone beds near Round Mount. It is therefore unwise to attempt to correlate within the formation even over this rather restricted area.

A few general observations can be made which may be useful locally. The effect of the changing grade of metamorphism across the area must always be borne in mind and until reliable, persistent marker beds have been found, these general observations should be treated with reserve.

At least two oolitic sandstone bands occur, the oolites being composed of, or replaced by, pyrite. These bands may become important marker beds if they can be shown to persist for any distance. As yet they have not been mapped outside this area. The oolite bands are seldom more than six inches thick and are separated by a dense quartzite member usually about 30 inches thick. This member is usually stained green by the oxidation products of the pyrite. The upper oolite is overlain by a quartzite containing abundant tubicolar casts. This sequence is exposed at three points in the area and can best be seen in the road cutting through the Falls Anticline.

The rocks comprising the formation are almost invariably grey in colour when fresh but they may be locally stained brown, cream, green or pink by various iron compounds in weathered outcrops. The rocks are very strongly jointed and where massive types occur the jointing may well mask the bedding. However, the majority of the formation consists of blocky quartzites and sandstones separated by thin shaley or slatey partings. Sometimes, the sandstones are flaggy or thinly bedded. Gritty beds are common and sometimes take the form of grit particles, often angular, distributed through a fine-grained, siliceous groundmass. As mentioned previously where such beds are crushed and weathered they may locally resemble the sheared porphyries. It may be necessary to trace such beds along the strike for some distance so that their sedimentary nature may be recognised.

Near the portal of the No. 1 adit at the Round Hill Mine a thin conglomerate is interbedded with the grits and fossiliferous sandstones. This gritty facies seems to be more characteristic of the lower portion of the formation as they also occur at a similar level in the vicinity of Tin Spur.

The basal beds show some transition from the underlying conglomerate. The general sequence is from conglomerate through grits and sandstones to quartzite. The top of the formation also shows some transition from quartzites through calcareous grits to limestone. Within the formation the sediments change from fine to coarse grained without transition.

The junction between the Gordon Limestone and Moina Sandstones is exposed in the No. 3 adit at the Round Hill Mine. This contact has been described by the early workers as a fault and by Hughes and Elliston as a normal sedimentary boundary. The writer agrees with the latter view but with some reservation as the contact is far from clear due to the poor condition of this adit.

Apart from the abundant tubicolar casts which appear to be usually restricted to certain beds the formation has been thought to be unfossiliferous. However, closer inspection of the formation over a wide area has revealed several horizons yielding abundant brachiopods and occasional poorly preserved gastropods. The tubicolar organism contained in these beds is *Diplocraterion*, a dwelling pocket of an unknown animal. This fossil is useless as an age indicator as it occurs in rocks ranging from Lower Cambrian up to the Triassic. The casts are said to be useful in determining the attitude of the bedding as they are described as occupying a position normal to the bedding planes. However, similar structures lying parallel to the bedding can be found in a sandstone bed just inside the entrance of No. 1 adit and in No. 7 adit drive, Round Hill Mine. These appear somewhat similar to *Diplocraterion* but have a tendency to branching which is rarely observed in the former; they are probably *Rhyzocorallum*.

The lavas described by Hughes from this formation are interpreted by the author as attenuated drag folds containing the oolite bands described previously and the writer has found no evidence for any igneous rocks in this formation.

The Moina Sandstones formation occurs widely throughout the area mapped, and its distribution is indicated on the geological plan. In contrast to the extremely competent underlying Roland Conglomerate which behaves as a massive unit this formation is closely folded and cut by a great number of small thrust faults. The close folding appears surprising due to the apparent competence of the formation. A close study indicates that the shale members greatly facilitate this folding although they occupy a very small proportion of the stratigraphic sequence.

iv. The Gordon Limestone

The limestone occurs at two localities in Claude Creek overlying the Moina Sandstones formation. It has also been encountered in the No. 3 adit at the Round Hill Mine.

In the Lorinna area some six miles to the south-west the same limestones occur in a similar stratigraphic position. There the exposures are somewhat better and a greater thickness is exposed. Earlier workers in the Round Mount area have tended to be somewhat cautious in correlating these limestones with the Gordon Limestone formation and have referred to "limestone lenses" laid down in " hollows " in the top of the Moina Sandstones. As the structure of the area is studied it becomes obvious that this limestone is occupying its normal stratigraphic position and that there is no valid reason for assigning any other age to it.

The outcrops in Claude Creek consist of small residuals of limestone preserved as outliers in the centre of the Claude Creek Synclinorium. Here the limestone contains numerous shaley bands in which limonite has been deposited giving the outcrops a roughly banded appearance. No fossils have yet been identified from these outcrops. In the No. 3 adit at the Round Hill Mine the limestone is a dense blue rock containing numerous veins and knots of calcite. It is crushed and disturbed by the folding, and at its contact with the underlying quartzites, it is locally overturned. A close examination of the ground surface above the No. 3 adit has failed to reveal any limestone outcrops, the area being covered by glacial debris. However, the grey buff residual clays exposed in the road cuttings nearby may be the decomposition product of limestone. Such lack of outcrop in limestone areas is common throughout Tasmania.

The maximum thickness of limestone exposed in this area is of the order of 200 feet but the top of the formation is missing. Elsewhere the thickness may be in excess of 2000 feet. The age of the formation ranges from Lower to Upper Ordovician.

Just outside the area mapped, upstream of the mouth of Tin Spur Creek is a small outcrop of skarn rock, an outlier of altered limestone representing the remains of a more extensive deposit. The skarn rock is a garnet pyroxene rock brown to black in colour. The garnet is probably grossularite and the pyroxene ferroaugite. The term skarn rock is essentially a mine name and the rock is best described as a tactite. A fuller description of similar rocks which occur at Moina is given by Williams (1957).

v. Fluvioglacial Deposits

Evidence of the Pleistocene glaciation occurs at several points in the area. On top of the hill above the No. 3 adit at the Round Hill Mine is a boulder deposit consisting of blocks of quartzite, Roland Conglomerate and basalt in an indeterminable matrix. The size of the boulders, their composition and position in relation to the topography point to a glacial origin. This deposit has apparently been subjected to extensive erosion and most of the matrix has been carried off leaving only the boulders. In a road cutting near Tin Spur a similar deposit is exposed. At this point the matrix is largely composed of weathered basalt and the deposit contains numerous small basalt pebbles.

Near the junction of the Cockatoo Road with the Lorinna Road a further fluvioglacial deposit is exposed in the gravel pits. Here the fines have not been leached out and it retains its original structure. This deposit consists of rounded quartzite and conglomerate pebbles in a highly siliceous matrix of sand grade. Several pockets of sand and grit within the deposit are exposed in these workings.

Approximately a quarter mile along the Cockatoo Road and just below this road a rather unusual outcrop of glacial material occurs. Here the deposit has apparently been slightly silicified and outcrops over some distance as cliffs up to 15 feet high. From a distance this appears to be an outcrop of Roland Conglomerate but close inspection reveals quartzite blocks contains tubicolar casts within the "conglomerate". Boulders of Roland Conglomerate are numerous. The degree of lithification is somewhat surprising and it is possible that this is a relic of a Permian till. However, no evidence of Permian tills at this level occurs anywhere in this area. Known deposits of Permian tillite some miles away to the south, east and west suggest that the base of the Permian here would be very much higher. This deposit is therefore tentatively interpreted as of Pleistocene age.

vi. Residual Soils, Talus and Alluvium

Clay soils possibly derived from the Gordon Limestone have been mentioned previously. Elsewhere the soil cover is thin, sandy and of the skeletal type. Talus accumulations occur locally under favourable conditions such as the south-west facing slopes of Mount Claude, Round Mount and Brazen Nose, in the vicinity of the Round Hill Extended workings and at the base of the scarp of Tin Spur Creek Fault. In these localities the talus obscures almost all outcrops and renders detailed geology unreliable.

(c) Igneous Rocks

i. Dolcoath Granite

This granite occurs in the extreme south-west of the area as a stock about one and a half miles by one mile. Only a portion of this mass has been included in the area mapped. Typically the granite is cream to pink in colour and is composed of plagioclase and orthoclase felspars, quartz and biotite. Twelvetrees and Reid state that the plagioclase "belongs to the oligoclase-andesine series" and that the plagioclase and orthoclase are present in roughly equal proportions.

Narrow aplite veins and dykes are common within the granite itself and a few have intruded the surrounding rocks. The granite contact where exposed farther south-west of this area is greisenized and carries topaz, fluorite, wolfram and molybdenite as accessory minerals. The aplite dykes also commonly carry wolfram and molybdenite and have been actively prospected in the past. However, no deposits of economic size have yet been discovered within the granite.

The zonation of economic minerals around this granite has been commented upon by various writers. As mentioned above, the parent granite carried tungsten and molybdenum. Just outside the granite at Tin Spur small cassiterite and arsenopyrite deposits have been worked and further out again at Round Mount we have lead, silver, gold, zinc, bismuth and copper. Zonation around the granite to the south towards Lorinna has also been postulated in a similar fashion as we have on the 5-Mile Rise a roughly similar mineral assemblage to that occurring at Round Hill Mine. However, this zonation may be invalid as the minerals on the 5-Mile Rise may well be related to the nearby Dove Granite, a point which has not been stressed by earlier workers.

The metamorphism of the Roland Conglomerate, Moina Sandstones and Gordon Limestone due to the Dolcoath Granite has been mentioned previously. It seems doubtful to the writer that the induration of the Roland Conglomerate infers that wholesale addition of silica to these rocks has taken place. The Roland Conglomerate was probably originally a highly siliceous formation and the effect of metamorphism appears to be one of recrystallisation rather than metasomatic alteration. The abundant quartz veins within the Roland Conglomerate are probably secretion veins and it is interesting to note in this context that the bottom bed of this formation at Cethana has an argillaceous matrix. Also the Gordon Limestone in the No. 3 adit at the Round Hill Mine contains abundant calcite veins even within a few feet of its junction with the Moina Sandstones. This further suggests to the author that the veining in these rocks is of the secretion type.

Where the Roland Conglomerate is close to the Dolcoath Granite, as in the bed of the Forth River north of Tin Spur some alteration has taken place. Recent investigations in this area by the Hydro-Electric Commission by diamond drilling has disclosed that the Roland Conglomerate in some places has a dolomitic matrix. It also contains veinlets of blue tourmaline. This is hardly a normal type of conglomerate compared with the exposures over the remainder of the area.

The dolomite matrix may well be derived from the remobilisation of carbonates during the alteration of the limestone near the mouth of Tin Spur Creek referred to earlier. The skarn rock outcrop occurs probably within a 1000 feet of the altered conglomerate and both outcrops are probably less than 1000 feet of the granite.

ii. Tertiary Basalt

No outcrops of this rock occur in the area mapped but extensive deposits occur slightly south of Round Mount. They are important in this area as an indication of the age of the various glacial deposits some of which contains boulders of the basalt.

VI. STRUCTURAL GEOLOGY

(1) GENERAL

The general plan of the area surrounding Round Mount shows a marked orientation of the structures. All the major fold axes the minor structures and most of the faults trend about north-west. A set of smaller faults cut across this major structure at right angles.

Taking the whole area in the general plan as a unit it can be seen that it forms a major complex synclinorium. The small folds within this belt are also synclinoria and anticlinoria within which in turn are smaller folds.

From a tectonic viewpoint this major synclinorium at Round Mount is only a cross fold on an even larger structure. The area studied at Round Mount is too small to indicate these wider structural trends. The major tectonic feature of the area surrounding Round Mount is the huge east-west trending anticline the south limb of which forms Mts. Claude, Van Dyke, Roland, Gog and Magog. This great fold belt is clearly traceable for about 25 miles east of Round Mount and probably extends 10 miles to the west. This east-west fold system is cut at various points by north-westerly trending folds and break-thrust faults. Of these the Round Mount Synclinorium is by far the most profound cross structure.

Thus, the major structure within which the area under discussion is only a comparatively small unit, is only a 2nd order fold system upon an even larger feature. Since we are dealing with a small unit in comparison to the overall structures the relationships between the two major belts is not apparent from the study of this area.

Working within the Round Mount Synclinorium there is no suggestion of east-west trending minor structures paralleling the major fault systems outside the area. However, the line of thinning out of the Roland Conglomerate trends almost in this direction and locally deflects the break thrusts.

The regional geology of the area covering the intersection of these major folds, indicates clearly that the Round Mount Synclinorium is either later than, or contemporaneous with, the east-west folds. The lack of relict east-west trending minor structures within the Round Mount Synclinorium suggests that these fold systems may be contemporaneous.

Within the area under discussion the various folds fall roughly into four groups and these are tabulated below:—

Order	Name	Order of Width
1st Order	Round Mount Synclinorium	Approx. 20,000 feet
2nd Order	Claude Creek Synclinorium Cockatoo Ridge Anticlinorium, &c.	Approx. 2,000 feet
3rd Order	Main Anticline Sales Anticline Falls Anticline, &c.	Approx. 200 feet
4th Order	Small Drag Folds on 3rd order folds.	Approx. 20 feet

Only a few of the 3rd and 4th order folds have been mapped in areas of particular interest.

(2) FIRST ORDER STRUCTURES

The Round Mount Synclinorium is the name chosen to describe conveniently the major fold system lying between Mt. Claude in the north-east and the Dolcoath Granite to the south-west. Whilst the structure is complicated by a host of major and minor faults and folds it is clearly assymetrical in section.

The north-east limb is overturned and is the seat of strong thrust faulting. The Claude Creek Fault is the most profound of these faults but several others run along this limb more or less parallel to it and are indicated on the general plan. In front of the Claude Creek Fault, that is, to the south-west of it, a 3rd order syncline has been strongly compressed and attenuated and passes into another thrust to the north-west. The small 4th order drag folds on the limbs of this fold have been completely attenuated and thrust almost as detached tear drop folds, clear of the south-west limb of the fold.

In contrast, the south-west limb of the Round Mount Synclinorium has comparatively open folding with little or no overturning along this limb. The major thrust fault on this limb is the Tin Spur Creek Fault which is essentially similar to the Claude Creek Fault but dips in the opposite direction, that is, to the south-west. The synclinorium whose axis trends roughly down Magee Creek is the major fold on this limb of the Round Mount Synclinorium and is a fairly gentle fold.

The Magee Creek Synclinorium pitches much more steeply to the north-west than does the Claude Creek Synclinorium. This fold and the Tin Spur Creek Fault are thought to be associated with the intrusion of the Dolcoath Granite.

The emplacement of this granite appears to have arched up the fold belts on the south-west limb of the Round Mount Synclinorium. The evidence for this is not indisputable but over a wide area around Dolcoath Granite mass the folds plunge to the south-east and north-west away from the centre of the granite mass. Also, the Tin Spur Creek Fault has its greatest displacement opposite the centre of the granite and dies out to the north-west towards the edge of the intrusion.

The assymetry of the Round Mount Synclinorium is further evidenced by the limestone outcrops along the axis of the Claude Creek Synclinorium close up to the north-east limb of the main structure and by the overturning in the axis of this synclinorium in the No. 3 adit at the Round Hill Mine.

Of the faults which cut across the main structure at right angles some are clearly transcurrent, these are portions of the overthrust block which has moved forward more than the remainder. The structural relations of these small cross faults are discussed more fully later together with the derivation of the Claude Creek Fault.

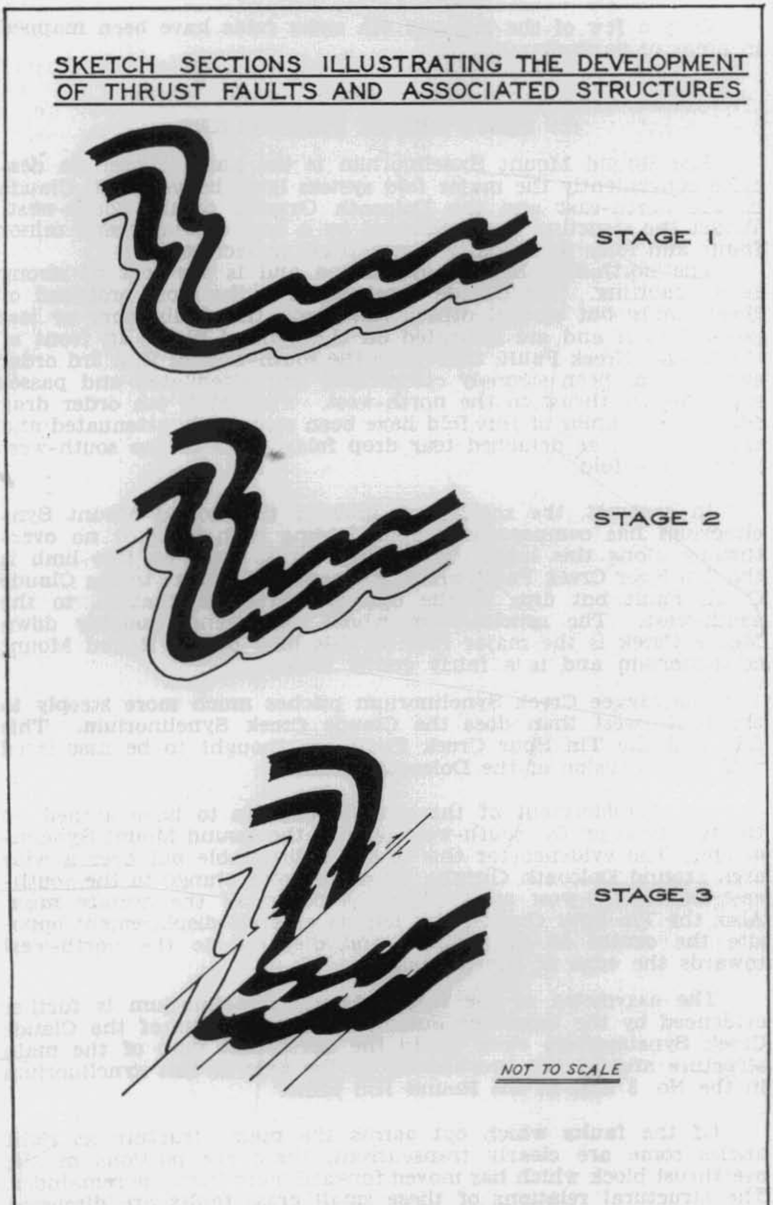

SKETCH SECTIONS ILLUSTRATING THE DEVELOPMENT OF THRUST FAULTS AND ASSOCIATED STRUCTURES
STAGE I
STAGE 2
STAGE 3
NOT TO SCALE

FIGURE 4

(3) SECOND ORDER STRUCTURES

The assymetry of the major fold belts is reflected in the 2nd order folds. The Claude Creek Synclinorium being closest to the north-east limb of the major structure is assymetrical in the same sense. That is, the north-east limb tends to be steeper and overturned locally. At its north-west extension this synclinorium passes into a north-east dipping overthrust fault.

The Cockatoo Ridge Anticlinorium is a somewhat more symmetrical structure and again is extensively faulted. As discussed earlier the 2nd order fold in the vicinity of Magee Creek is a fairly regular open fold, also, it is somewhat smaller than the other 2nd order folds.

Of the above 2nd order folds the Claude Creek Synclinorium has been studied in most detail. The 3rd order folds on the north-east limb of this structure are the locus of the ore deposits at the Round Hill Mine and those on the south-west limb of the Round Hill Extended. The synclinorium is a fairly tight structure and it is certainly more extensively faulted than is indicated on the plans. However, the lack of exposures renders it difficult to pick up many of the smaller faults. The structure is tight enough to have infolded the Gordon Limestone which only appears in the other structures very much farther down the pitch of the folds.

The Claude Creek Synclinorium pitches at about 15° north-west from Round Mount to a point near the No. 3 adit. Here the pitch reverses. The structure has not been studied in detail to the north-west of the western workings at the Round Hill Mine. From the regional rock distribution it would seem that the overall pitch of the structure is generally north-west with local undulations such as that seen near the No. 3 adit. These small changes in pitch may be due to both cross faulting and to the cross folding.

(4) THIRD ORDER STRUCTURES

These are the drag folds and associated faults on the limbs of the 2nd order folds. The axis of adjacent 3rd order anticlines are about 200 feet apart but they vary somewhat from place to place. The axes are frequently offset by a set of conjugate shears trending parallel to the folds. Folds of this order are exposed at many places throughout the area covered by the general plan. Of these folds only the three anticlines likely to contain ore bodies near the Round Hill Mine have been mapped in close detail. A further limited amount of work has been done on similar folds near the Round Hill Extended workings and at Tin Spur but in these localities the folds are not well exposed.

The anticlines near the Round Hill Mine have all been mineralised to some extent and may thus be the focus of further explorations in this area. The three folds mapped here have been termed:—

1. Main Anticline—this is the anticline, extensively mined in the past. Nos. 1 and 2 adits at the Round Hill Mine have been driven along its axis for about 1200 feet.

2. Sales Anticline—lies approximately 200 feet south-west of 1. (Main Anticline) and has been worked at Sales Quarry and at the Western workings.

3. Falls Anticline—adjacent to and approximately 200 feet south-west of Sales. It has been worked to some extent near Claude Creek and also in the Nos. 1a and 8 adits.

These folds have been described by various workers as being both parallel and similar type folds. This has been due to the fact that although the Main Anticline is assymmetrical in section its axial plane seems to be vertical. The three levels at the Round Hill Mine were driven along the axis of this fold and on the mine plans are roughly beneath one another as shown in fig. 8. However, if this is a parallel type fold, assymmetrical in section, the axial plane should dip away from the steeper limb and the mine plans should indicate this. On the other hand if this were a similar fold one would expect to find pronounced thickening in the apical region of the fold and in the quartzite beds, but this does not happen. These facts led the early workers to describe the folds variously as both parallel and similar types.

In drawing the geological sections of this area it has been found impossible to develop the folds accurately by either of the geometrical methods for both types of folds. The problem is that these folds are a mixture of both types so that the overall effect is somewhat complicated in detail. The reason for this lies in the extreme difference in competency between the various members of the Moina Sandstones which form the folds within the mine workings.

If we have a formation composed of massive quartzites interbedded with occasional soft shales and sandstones and these are subjected to folding, there will be a stress environment in which the quartzites will behave as competent members whilst the shales will be exceedingly incompentent. This stress environment would cover a very wide range in the case of the Moina Sandstones formation which contains members differing greatly in lithology.

This explains the apparent anomalies of these folds. In the massive quartzites where the folds are asymmetrical in section the axial planes must dip and these folds tend to be of the parallel type. Close inspection however, sometimes reveals a slight thickening of the beds in the apices of the folds so that true parallel types may seldom be developed. In contrast the softer beds behave in a most incompetent manner and flow into the axial crests tending to offset the dip to the axial planes.

This kind of behaviour is well illustrated in the sections through the Main and Falls Anticlines along Claude Creek. During the folding the harder quartzites have folded as competent beds whilst the more shaley members have been squeezed up into masses reminiscent of saddle reefs along the apices of the folds. Between these saddle reefs the competent beds form roughly parallel type folds. Therefore if the fold is asymmetrical the axial plane dips in the normal manner until an incompetent bed is met where the axial plane will be vertical until the next sequence of harder beds is encountered. This is illustrated in Figure 5.

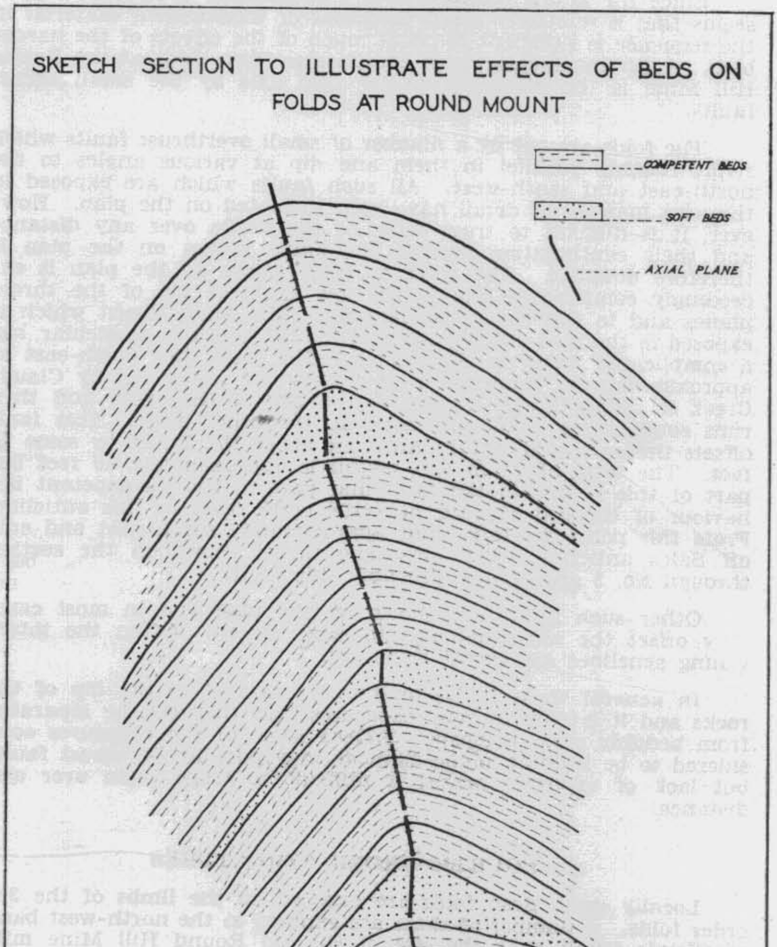

SKETCH SECTION TO ILLUSTRATE EFFECTS OF BEDS ON FOLDS AT ROUND MOUNT
COMPETENT BEDS
SOFT BEDS
AXIAL PLANE

FIGURE 5

Since the Moina Sandstones are dominantly competent beds it seems that a relatively small thickness of incompetent material in the sequence is sufficient to offset much of the effects of the harder beds. A further factor which complicates these folds at the Round Hill Mine is the offsetting of the fold axis by the small thrust faults.

The folds are cut by a number of small overthrust faults which strike roughly parallel to them and dip at various angles to the north-east and south-west. All such faults which are exposed in the area mapped in detail have been indicated on the plan. However, it is difficult to trace some of the faults over any distance and their continuation beyond the limits shown on the plan is therefore doubtful. The trace of these faults on the plan is exceedingly complicated due to the low angle of dip of the thrust planes and to the violent topography. The small thrust which is exposed in the road cutting opposite the No. 1 adit in particular, has a complicated trace on the ground. The fault dips north-east at approximately 35° and where it crosses the valley cut by Claude Creek it swings north rapidly to the bed of the creek and then runs south again as it cuts back up the other bank. This fault offsets the axis of the Main Anticline above No. 7 adit by some 20 feet. The total offset in this region is approximately 40 feet but part of this is due to the fault and part to the incompetent behaviour of the bed exposed near the creek level in this anticline. From this point the fault runs approximately south-west and cuts off Sales anticline. The low-angle thrust shown in the section through No. 3 adit is also probably this fault.

Other such faults are shown on the plan and in most cases they offset the anticlinal axis to some extent. Often the intervening synclines are thrust right out.

In general these faults tend to be parallel to the dip of the rocks and it is only in good exposures that they can be separated from bedding plane slippage. Indeed some of the exposures considered to be bedding plane slippage may possibly be thrust faults but lack of exposure makes it difficult to trace them over any distance.

(5) FOURTH ORDER STRUCTURES

Locally small drag folds are exposed on the limbs of the 3rd order folds. A number of these are exposed in the north-west bank of Claude Creek near the site of the old Round Hill Mine mill. They are about 20 feet and less across but vary in size depending upon the tectonic environment and the lithology of the rocks involved. Many folds of this size are due to drag dips against the various faults throughout the area.

(6) SEQUENCE OF EVENTS PRODUCING THE PRESENT STRUCTURE

It is important to place the various events leading up to the present structure in chronological order. The writer suggests that the Claude Creek and associated thrusts are a late phase of the movements on the following grounds:—

1. The small transcurrent faults associated with the major thrusts displace the axis of the Main, Sales and Falls Anticlines and therefore post-date these folds.
2. Two sets of slickensides in the vicinity of the Round Hill Mine mill, are normal to the minor fold axis and to the Claude Creek thrust respectively. The slickensides related to the folds (bedding plane slippage) have been dragged around by the set normal to the Claude Creek Fault.

The mineralisation at the Round Hill Mine was a relatively late process and post-dates the Claude Creek Fault. In the rises from the No. 2 adit at the Round Hill Mine, ore was stoped out up to the conglomerate lying on the upper plane of the fault. The conglomerate itself is reported to have mineralised at this point. Also some of the numerous small thrust faults (the conjugate shears) associated with the 3rd order folds are mineralised at a number of places in the vicinity of the Round Hill Mine.

The emplacement of the granite is interpreted as a late process. As mentioned elsewhere the folds at Tin Spur appear to be buckled up by the uprising granite.

The present structure has been produced by compression acting in a north-east south-west direction. First the rocks folded into a major synclinorium which with continual compression developed into something like the present complex structure. The asymmetrical shape is due to the rapid thinning out of the Roland Conglomerate near the north-east limb of the synclinorium and to the shallowing of the basement to the south-west. The basement rocks resisted the folding due to their higher degree of lithification at the time of the folding. Once the Round Mount Synclinorium had assumed something like its present shape, cotninued compression was more easily relieved by faulting. This is probably due to an intensification of the compressive forces, the rocks being unable to deform rapidly enough, yielded first through a large number of conjugate shears running roughly parallel to the fold belts and tending to dip north-east and south-west at 45°. However, this ideal state was lost to some extent by the influence of the bedding planes on the dip of the faults. Where the beds dipped at angles close to 45° the small overthrust faults tended to form parallel to the beds and run up the limbs of the fold. They then cut across the beds on the other side of the fold at an angle of more nearly 45° to the next fold. Thus a very complicated pattern of small overthrust faults were formed. Most of these have only relatively little displacement along them (20-30 feet and less). The faults appear to die out fairly quickly along the strike and to be replaced by further thrust faults in *en echelon* fashion.

Finally, as the compression intensified still further, the rocks yielded by the movement along the Claude Creek Fault. Opposite the Round Hill Extended workings this fault formed first where the Roland Conglomerate thins out rapidly from about 800 feet to less than 200 feet in thickness. The highly competent conglomerate rock to the north-east over-rode the younger rocks south-west of it.

The writer certainly does not picture this as a series of well-marked stages. The various events merged into one another as part of a single continuous process with a good deal of overlap between the various events.

(7) FAULTING

The major fault in this area is the Claude Creek thrust. The presence of this fault was recognised by many of the early workers. However, Hughes was the first to map the fault over any distance and to attempt a structural analysis of the area. The fault strikes roughly north-west and dips to the north-east at 30-35°. Although the fault can be mapped readily over some distance by means of the rock distribution the actual fault plane is exposed at only a few points. The most convenient of these is in the small open cut at the mouth of the No. 1 rise from the No. 2 adit at the Round Hill Mine. The few exposures of the fault proper, suggest that the dip and strike of the fault plane is not constant but varies through 5-10° locally.

The anomalous rock distribution between Round Mount and Claude Creek pointed to the existence of the large fault running along the south-west face of Round Mount. However, the precise nature and structural history of this fault was not fully investigated. The Roland Conglomerate forming Round Mount, stratigraphically lower than the Moina Sandstones in Claude Creek, has been elevated at least 1000 feet above the Moina Sandstones.

The upthrown block of Round Mount and Brazen Nose consists of a thick mass of competent quartz conglomerate which has been completely overturned. Without reliable marker beds in either of the formations involved it is impossible to calculate accurately the movement along the thrust plane. Nevertheless the fact that the conglomerate has been raised by at least 1000 feet by forward movement along a thrust plane dipping at about 30° indicates that the horizontal component of the movement must have been in excess of a quarter mile.

As indicated by the rock distribution on the general map of the area, the throw of this fault diminishes to the north-west and the maximum throw in this area occurs in the vicinity of Brazen Nose. It is in this locality that the Roland Conglomerate thins out rapidly. The area mapped for this publication is too small to demonstrate the actual behaviour of the fault with respect to the line along which the Roland Conglomerate thins out. However, regional work over a wide area in connection with the mapping of the Sheffield quadrange indicates the general pattern. To the south-east the break thrust first formed where the conglomerate thins out rapidly between Brazen Nose and the Cockatoo Ridge. The conglomerate thins out roughly along a line running due west while the break thrusts tend to form normal to the direction of compression, that is roughly north-west. Thus we have a pronounced line of weakness running obliquely to the preferred direction of faulting.

The result is that a fault system was formed *en echelon* fashion cutting obliquely across this line of weakness. The intersection of the Claude Creek thrust with the next thrust forming in front of it is shown on the detailed plan of the Roland Hill leases. As the throw on the Claude Creek Fault diminishes some of the movement is taken up by an overturned and attenuated syncline to the south-west of it. Tracing this syncline to the north-west we find that the attenuation increases until the north-east limb is completely overturned and breaks free along a thrust fault forming along the axis of the syncline. This is shown in Figure 6.

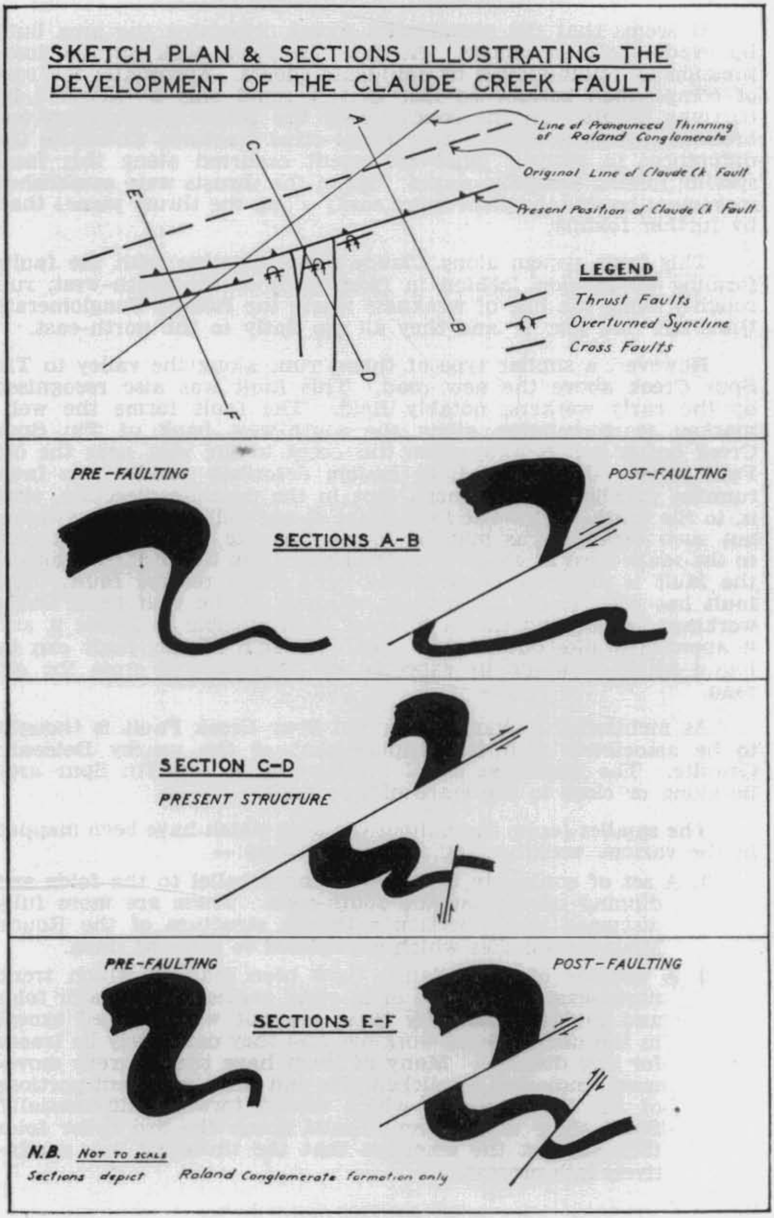

SKETCH PLAN & SECTIONS ILLUSTRATING THE DEVELOPMENT OF THE CLAUDE CREEK FAULT
Line of Pronounced Thinning of Roland Conglomerate
Original Line of Claude Ck Fault
Present Position of Claude Ck Fault
A
B
C
D
E
F
LEGEND
Thrust Faults
Overturned Syncline
Cross Faults
PRE-FAULTING
POST-FAULTING
SECTIONS A-B
SECTION C-D
PRESENT STRUCTURE
PRE-FAULTING
POST-FAULTING
SECTIONS E-F
N.B. NOT TO SCALE
Sections depict Roland Conglomerate formation only

FIGURE 6

It seems that the compressive forces deforming the area built up gradually to a climax. At first the rocks took up the compression by folding, later by conjugate shears. Eventually the rate of compression became so fast that it could only be satisfied by outright failure. In the zones where the throw passes from one break-thrust to another a few minor cross fractures distribute the differences in throw. Once movement occurred along this fault system, folding virtually ceased. When the thrusts were established movement could take place more easily along the thrust planes than by further folding.

This fault system along Claude Creek together with the faults forming *en echelon* fashion in front of it to the south-west, run roughly along the line of weakness where the Roland Conglomerate thins out (see Fig. 7) and they all dip flatly to the north-east.

However, a similar type of thrust runs along the valley to Tin Spur Creek above the new road. This fault was also recognised by the early workers, notably Reid. The fault forms the well marked scarp running along the south-west bank of Tin Spur Creek but it swings away from this creek to the west near the old Falls Mine. Unlike the fault system described earlier, this fault running parallel to the others, dips in the opposite direction, that is, to the south-west. The fault plane is not well exposed anywhere, but such exposures as may be found, indicate that the fault dips to the south-west at about 30°. Obviously from the rock distribution the fault is either a break-thrust or a steep reverse fault. The fault has been traced by surface mapping to the vicinity of Duff's workings but beyond this it has not been possible to locate it and it apparently dies out in that area. No sign of this fault can be found where it would be expected by projection to cross the old road.

As mentioned previously the Tin Spur Creek Fault is thought to be associated with the emplacement of the nearby Dolcoath Granite. The numerous small tin deposits in the Tin Spur area lie along or close to the trace of this fault.

The smaller faults throughout the area which have been mapped in the various workings fall into two classes:—

1. A set of conjugate shears trending parallel to the folds and dipping north-east and south-west. These are more fully discussed in connection with the structure of the Round Mount ore bodies which are related to some of them.
2. A number of small faults have been mapped which trend north-east, south west or at right angles to the major folds and faults. Generally these are not well exposed except in the underground workings and they can rarely be traced for any distance. Many of them have transcurrent movement, indicated by slickensides and these represent portions of the thrust blocks which moved forward differentially. Since these transcurrent faults break the 3rd order folds they support the assertion that the thrusting was a relatively late process.

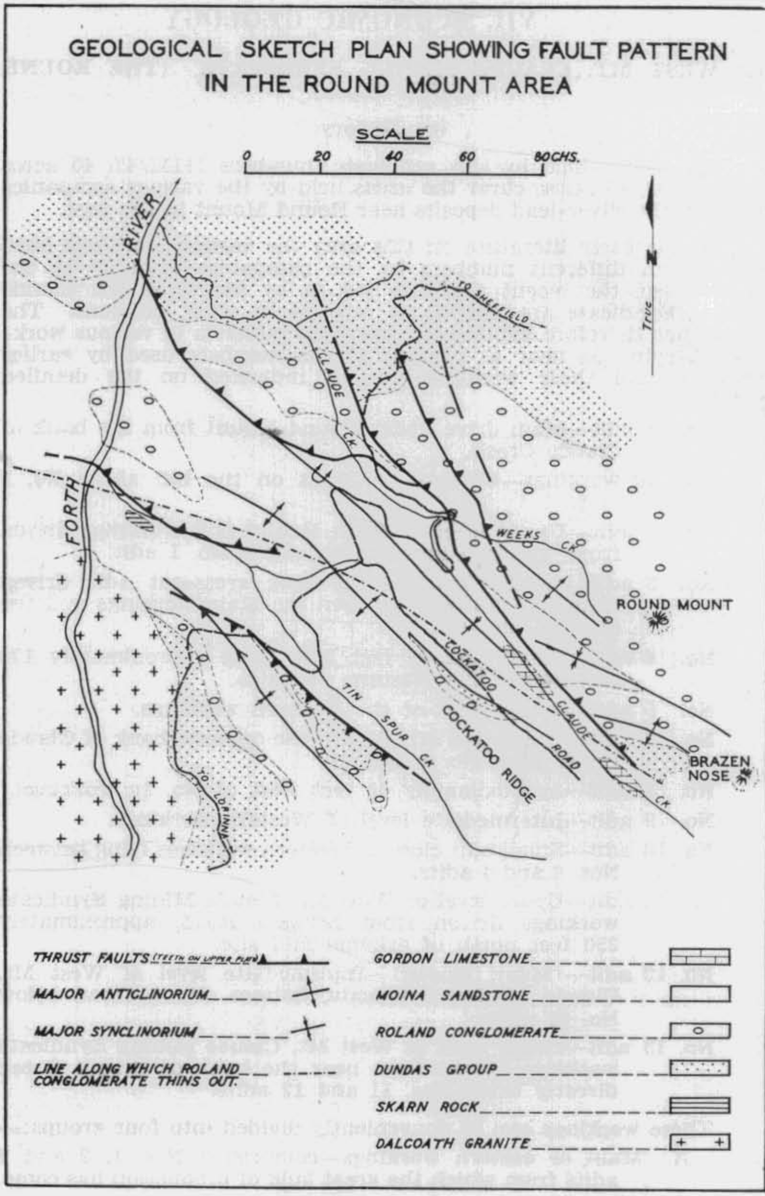

GEOLOGICAL SKETCH PLAN SHOWING FAULT PATTERN IN THE ROUND MOUNT AREA
SCALE
0 20 40 60 80CHS.
N
TRUE
FORTH
RIVER
CLAUDE CK
TO SHEFFIELD
WEEKS CK
ROUND MOUNT
COCKATOO
CLAUDE
ROAD
CK
TIN
SPUR
CK
COCKATOO RIDGE
BRAZEN NOSE
TO LORINNA
THRUST FAULTS (TEETH ON UPPER PLATE)
MAJOR ANTICLINORIUM
MAJOR SYNCLINORIUM
LINE ALONG WHICH ROLAND CONGLOMERATE THINS OUT.
GORDON LIMESTONE
MOINA SANDSTONE
ROLAND CONGLOMERATE
DUNDAS GROUP
SKARN ROCK
DALCOATH GRANITE

FIGURE 7

VII. ECONOMIC GEOLOGY

(1) WEST MT. CLAUDE MINING SYNDICATE (THE ROUND HILL MINE)

(a) History

The leases held by this syndicate, numbers 111M/47, 40 acres and 4M/49, 40 acres, cover the areas held by the various companies working the silver-lead deposits near Round Mount in the past.

In the early literature on this area the various workings have been given different numbers by the companies engaged in the area. Also, the recent workings put in by the West Mt. Claude Mining Syndicate are difficult to refer to by their locations. The writer has therefore allotted the following numbers to various workings, keeping as near as possible to the numbers used by earlier workers. All these workings are all indicated on the detailed plan:—

No. 1 adit—Main drive under Round Mount from the bank of Claude Creek.

No. 1*a* workings—Shallow workings on the hill above No. 3 adit.

No. 2 adit—Upper level of Main Round Hill workings driven from the road immediately above No. 1 adit.

No. 3 adit—(water tunnel)—the long cross-cut adit driven from the tramway between the Main workings and the original mill site.

No. 4 adit—Small adit 45 feet long lying approximately 130 feet east of the Western workings.

No. 6 adit—Lower level of the Western workings.

No. 7 adit—(magazine drive)—On the opposite bank of Claude Creek from No. 1 adit.

No. 8 adit—Approximately 60 feet west of No. 1*a* workings.

No. 9 adit—Intermediate level of Western workings.

No. 10 adit—Small adit close to Western workings lying between Nos. 6 and 4 adits.

No. 11 adit—Upper level of West Mt. Claude Mining Syndicate workings driven from Lorinna Road, approximately 250 feet north of original mill site.

No. 12 adit—(Maori Queen)—Intermediate level of West Mt. Claude Mining Syndicate, bottom side of road below No. 11 adits.

No. 13 adit—Lower level of West Mt. Claude Mining Syndicate workings driven from near the bank of Claude Creek directly below Nos. 11 and 12 adits.

These workings can be conveniently divided into four groups:—

A. Main or eastern workings—comprising Nos. 1, 2 and 7 adits from which the great bulk of production has come.

B. Central Workings—Nos. 1*a*, 3 and 8 adits. Little or no ore has been produced from these workings.

C. Western Workings—Nos. 4, 6, 9 and 10 adits from which a small quantity of ore was obtained in the early days.

D. West Mt. Claude Mining Syndicate Workings—Nos. 11, 12 and 13 adits, only about 20 tons of ore has been produced from these adits.

The original discovery in this area was made by Weeks and Shepherd about 1878. In 1880 the Mt. Claude Silver-Lead Mining Co. was formed and commenced driving the No. 3 adit, reaching 593 feet. They also commenced working in the vicinity of the Main workings before closing down in 1884. In 1890 B. L. Thomas and Thos. Terry continued this work until the Southern Cross Proprietary Silver Mining Co. took over. They continued the No. 3 adit to 650 feet and carried out other small exploratory works at No. 12 adit and on the main workings. In 1893 the Kentish Proprietary Silver Mining Co. N.L., carried the driving of the No. 3 adit to its present face and operations were again suspended in 1907. In this year the Round Hill Silver and Lead Mining Co. N.L. commenced operations. This company opened up the property and prospected extensively until 1912 when the mine was let on tribute. During this period the western workings reached their present stage of development, producing 67 tons of ore in the period 1907-8. The tributors continued driving No. 1 adit and had reached 190 feet in 1913 when Twelvetrees visited the mine. At that time they had encountered a further ore body and were producing high grade ore. In 1915 the Round Hill Silver Lead Mining Co. N.L. recommenced work and by 1918 when Reid examined the area mining operations were in a flourishing condition. Hughes report gives the following description of the developments from 1918-1927. I quote him:—

> "The Main workings, in 1918, consisted of two levels 70 feet apart, both adits, but connected with each other and the surface by a series of rises. The lower or main tunnel was driven for 545 feet on a lode formation containing a series of ore shoots which pitched to the north-west and had been stoped up from this level. At 545 feet the adit branched, one drive following to the south-east a formation carrying much quartz but little galena, and the other an indicator vein to the east. At 144 feet in this latter drive, a cross cut was put into the north-east and at 30 feet cut a strong lode. At the end of the year this lode had been driven 51 feet north-west and 57 feet south-east from the cross cut and showed an average width of 12 feet of ore, concentrates from which gave a bulk assay of 3 dwt. gold, 85 ozs. silver, and 42% lead per ton. Meanwhile the No. 2, or Upper adit, which at the time of Reid's visit was in 500 feet, had been further advanced and found to contain a fair quantity of ore in a crushed formation as far as the conglomerate wall which was encountered in rises. 1919 saw the first development of the new formation. It was driven on a further 286 feet south-east and 21 feet north-west over an average width of 16 feet of ore, and five stopes were opened up. Development continued over the next few years and by 1921 the adit was in 1420 feet including 700 feet on the new development. In this year a commencement was made to test this lode at a lower level, and at about 700 feet from the entrance an internal shaft was commenced. The next year, 1922, saw a

level 80 feet below the main adit opened out and the lode was driven on 137 feet to the south-east vertically below the main adit.

From 1922 to 1927 when the mine closed, most development was undertaken from this shaft level. From the shaft, drives had been extended 600 feet to the south-east and 700 feet to the north-west. More stoping was done south-east of the shaft where the lode averaged four feet in width.".

In 1948 the present syndicate was registered and commenced operations. The No. 7 adit was developed further for a few feet and the No. 12 adit cleaned out and extended. An upper and lower level Nos. 11 and 13 were opened up above and below the No. 12 adit. This work was abandoned by 1950 and a programme of diamond drilling carried out in search of further ore. Following the survey of the leases in 1954 the Company recommenced operations driving the No. 7 adit drive for about a further 18 feet.

(b) Development

i. Main Workings

The No. 1 adit is blocked by a fall approximately 100 feet from the entrance. To this point the drive is roughly along the axis of the Main Anticline. The anticline is rather broad and has a small drag fold along the apex. The exposures in this adit are poor as a good deal of the ground surrounding the adit has been stoped out. A few small galena veins are showing on the north wall of the drive 20 to 30 feet from the entrance. They are only an inch or two wide. At 60 feet a cross-cut 15 feet long has been put into the south-west with the intention of intersecting the small galena lode which crosses Claude Creek just above the small falls. However, nothing is showing in the face and the cross-cut should have been continued a further 15 feet to cut this lode. At 55 feet a cut in the north side of the drive leads into an old stope above the drive. The stope is now partially collapsed. However, it does show that the ore body mined was more or less parallel to the bedding planes and plunged north-west at about 15°. An ore pass leads from this stope to the entrance of No. 2 adit on the edge of the road above. No. 2 adit is completely collapsed at the entrance and as far as is known is inaccessible. The writer has examined the No. 1 rise but this simply leads into an old stope and does not give access to the workings beneath. The No. 2 rise could be accessible but this is 150 feet deep and no equipment was available to explore this.

No. 7 (magazine adit) has been driven for 57 feet along a bearing of 208 degrees. The adit commences on the north limb of the Main Anticline and passes through the axis of this fold at 20 feet. At 39 feet some galena veins have been driven on for 73 feet. These veins are confined to the bedding planes on the south limb of the anticline. The veins pinch and make along the drive but may be as much as six inches in width. The present lessees have recovered about four tons of ore from the last 18 feet of this drive. Samples of selected ore from this drive assayed:—

Sample No.	Lead %	Zinc %	Gold per ton Oz.	Gold per ton dwts.	Gold per ton grs.	Silver per ton Oz.	Silver per ton dwts.	Silver per ton grs.
171	54·3	....		trace		3·8	....	....
486	10·2	1·5	0	0	18	2	15	16
487	61·2	....	....	....	....	6	14	0
488	59·8	....	....	....	....	4	....	....

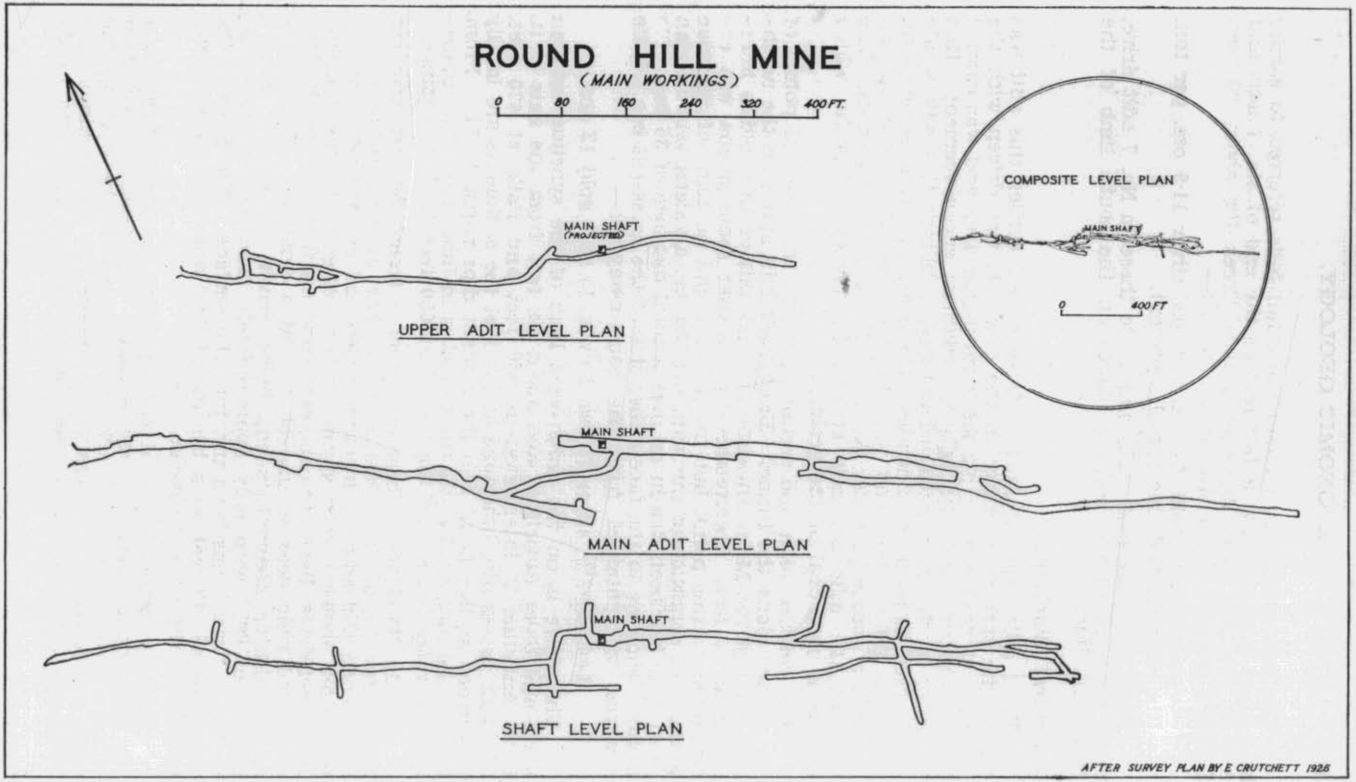

ROUND HILL MINE
(MAIN WORKINGS)
0 80 160 240 320 400 FT.
MAIN SHAFT
(PROJECTED)
UPPER ADIT LEVEL PLAN
COMPOSITE LEVEL PLAN
MAIN SHAFT
0 400 FT
MAIN SHAFT
MAIN ADIT LEVEL PLAN
MAIN SHAFT
SHAFT LEVEL PLAN
AFTER SURVEY PLAN BY E CRUTCHETT 1926

FIGURE 8

5 cm

The galena veins just above the small falls referred to earlier have been driven on for a few feet at the end of No. 7 adit and also on the south-east bank of Claude Creek for about 30 feet. Selected material from this vein assayed:—

Lead 57·1%, gold ·04 ozs. per ton, silver 11·9 ozs. per ton. Copper and zinc are also present.

These veins are essentially similar to those in No. 7 adit drive, being confined to the bedding planes on the south limb of the Main Anticline.

ii. Central Workings.

No. 3 adit (water-tunnel). As described earlier this adit was one of the earliest workings in the area. It was driven with the intention of cross-cutting all the lodes in the area and was carried out courageously but with only the slightest encouragement. Had the lodes in this area been normal fissure fillings this adit would have served its purpose admirably. However, it provides some useful geological information and was for many years boarded up and provided a source of water for the mill during dry periods. The walls of the adit are now covered by limonite deposits which obscure a good deal of the geology.

The detailed plan and sections indicate the essential points of the geology along the tunnel. Briefly, the adit starts on the north-west limb of the Main Anticline and the axis of this fold is intersected at 84 feet. Twelvetrees reports that some galena was encountered at this point, but the writer found no signs of this due to the poor condition of the wall. At 180 feet a galena vein an inch or so wide has been driven on over a total distance of 35 feet. No metal is showing in the face either side of the cross-cut but a little material was obtained from the back assaying:—

Lead 21·6%, silver 12 ozs. 5 dwts. 15 grs., gold 12 grs.

This drive is on the north-west limb of the syncline between Main and Sales Anticlines and about six feet from the axis of it. Sales Anticline is intersected at 280 feet and Falls at 470 feet. The adit passes into limestone at 520 feet the sediments are locally overturned at this point and the contact dips north at 70°. From here to the face at 820 feet the tunnel is in limestone. The underground water issues into the tunnel at 650 feet from two joints.

No. 1a Workings.—These consist of a trench 50 feet long, cut along a bearing of 182 °, passing into a short adit from 50 to 59 feet. The trench and adit are in over-burden and decomposed quartzite, the latter showing very strong iron staining and close jointing. At 45 feet drives have been run east and west from the trench along a crushed zone near or on the axis of a syncline. The drive is an astonishing accomplishment, being driven for 45 feet along a bearing of 095° with only approximately four feet of backs. At 41 feet a " rise " has been put into the surface. The drive to the west proceeds 13 feet on a bearing of 290° and then swings south parallel to the main cross-cut.

Some gossanous material can be found on the surface above the adit and apparently these workings were designed to explore any ore body beneath this. No ore is exposed in the workings but some encrustations of cerussite have formed in the workings since work was suspended indicating the presence of lead ores in the vicinity. The gossan is apparently the remnants of an ore body the bulk of which has been removed by denudation.

No. 8 adit.—This lies 60 feet east of and 30 feet lower than the No. 1*a* workings. The adit was apparently designed to test the gossanous formation at a lower level again than the No. 1*a* workings. The adit is driven approximately south (bearing 186°) for 150 feet. At 34 feet drives have been put in east and west along some thin galena veins which seldom reach two inches in width. The east drive is 33 feet long on a bearing of 095°. The west drive commences on a bearing of 285° but swings north-west at 40 feet for 20 feet and then back on to a bearing of 290° for a few feet. At 50 feet along this drive a strong fault is encountered which cuts off the galena veins. The main crosscut intersects a synclinal axis at 70 feet and the fault encountered in the west drive at 100 feet. At 105 feet the axis of Falls Anticline is cut.

The workings are driven in hard, grey, blocky quartzite containing a few sandy and shaley bands. The fault zones are filled with a grey, clay gouge. The rocks in these workings are quite highly disturbed by the various faults. No records are available of production from either this or the 1*a* workings but it is doubtful if any significant production was achieved.

iii. Western Workings

These workings consist of three open-cuts one above the other from the lower two levels of which drives have been put in along a strong fault dipping north at 63° and striking 295°. Other small faults dipping south at 60° and 35° are intersected by the main fault. The larger thrust fault exhibits considerable brecciation. These workings are reported to have produced 67 tons of ore and at one time an aerial ropeway was put in to carry the ore to the mill site.

The lower adit, No. 6, is 86 feet long and was driven along the northerly dipping fault which forms the hanging wall of the drive. At 34 feet a crosscut has been put in to the south but this is now inaccessible, it is reported to be 40 feet long. At 54 feet the ground on the south wall of the drive has been stoped out for about 20 feet above the drive and at 75 feet a further small cut has been made in the south wall of the drive.

The upper adit, No. 9, has been driven 44 feet along the same fault as No. 6 adit. This drive is in flaggy quartzites with a shale band forming the back. No stoping has been done from this drive and apparently the production has been small.

The highest level of the western workings consists of a small open-cut about 20 feet high from which only a little ore has been obtained. This ore contains arsenopyrite and sphalerite. The arsenopyrite is in silvery crystals giving good tests for iron, arsenic and sulphur. This was previously reported as jamesonite by Hughes but no positive tests for antimony or lead could be obtained.

The ore at the western workings, generally, consists of fine veins of galena and sphalerite and pyrite in the country rock. The main ore body was apparently on the hanging wall of the north dipping fault, possibly in the shale band, but some veins penetrated into the country rock along bedding and joint planes and have replaced the country rock in some instances. The workings are situated on the south limb of Sales Anticline close to the axis of this fold. However, the faults offset the axis of this fold somewhat so that it is difficult to fix the axis precisely in the immediate vicinity of the workings. Ore from the western workings yield the following assays:—

Sample 1 (15 feet along south wall of No. 9 adit): Lead 31·6%, gold ·04 ozs., silver 10 ozs. plus zinc.

Sample 2 (from dump outside No. 9 adit): Lead 28·5%, gold trace, silver 5·1 ozs. plus zinc and molybdenum.

One hundred feet east of the Western workings two further adits, Nos. 4 and 10 have been put in in an endeavour to crosscut to the axis of the anticline in search of further ore bodies. However, a south-westerly dipping thrust fault which is also exposed in the Western workings has offset the axis of this fold here. Although the anticline is clearly exposed on the hillside above these adits they lie beneath the fault plane and have either not been driven far enough or else the fault at this point has thrust out the anticline. The adits commence in flaggy quartzites and run into sheared, grey shales with thin quartzite bands. No ore is exposed in these workings.

iv. West Mt. Claude Mining Syndicate Workings

No. 11 *adit.*—This adit is driven on some small galena veins exposed in the road cutting. It is an extremely irregular drive along a general bearing of 125° and 64 feet long. The drive is parallel to the bedding which here dips vertically or is slightly overturned. The rocks here are massive, well jointed quartzites containing a few thin, slatey bands. Several thin galena veins have been cut in the drive and driven on for a few feet. In the face, four such veins are exposed. They vary in thickness along the drive, but the total average thickness would be less than six inches. The ore consists of coarsely crystalline galena with some chalcopyrite, sphalerite and pyrite contained in thin partings along the bedding planes. Several other such veins are exposed at various points along the drive but all are thin and patchy.

At 47 feet along the drive a crosscut has been put in along a bearing 027° for 69 feet. This crosscut quickly crosses the anticlinal axis and enters thinly bedded sandstones and shales dipping northwest. At 38 feet a small thrust fault, also exposed in the road cutting outside, is crossed. Against this fault the beds are highly contorted and dragged. At 48 feet the crosscut intersects a synclinal axis and from there to the face it is in broken quartzite with strong quartz veining.

According to Mr. A. G. Rowe in charge of operations for the syndicate, about five tons of ore were obtained from those workings. Hughes report quotes an assay cut across six feet of the mineralised zone. This contained:—

Lead 5·4%, zinc 2·7%, silver 4·6 ozs. per ton, gold 4·5 dwts.

A selected sample of vein material collected by the writer assayed lead 42·5%, silver 33·5 ozs. per ton, gold trace, plus copper and zinc.

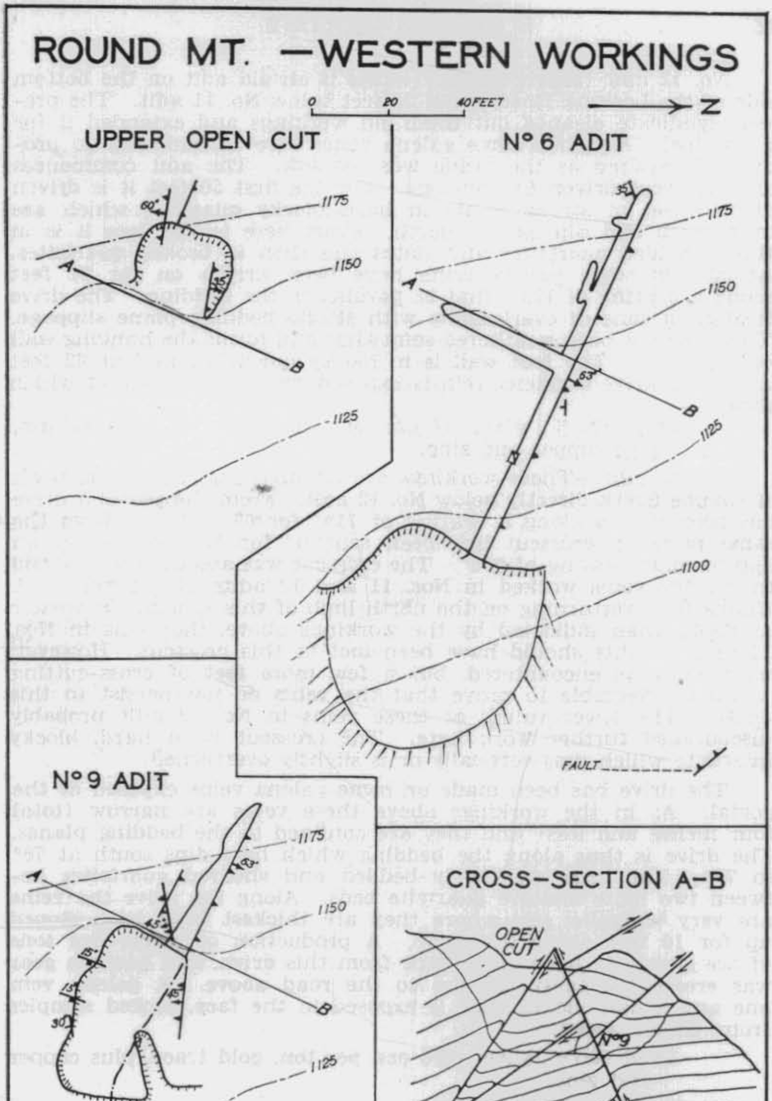

ROUND MT. —WESTERN WORKINGS
0 20 40 FEET
Z
UPPER OPEN CUT
Nº 6 ADIT
Nº 9 ADIT
CROSS-SECTION A-B
1175
1150
1125
1100
A
B
FAULT
OPEN CUT
Nº9
Nº6

FIGURE 9

No. 12 adit (Maori Queen).—This is an old adit on the bottom side of the Lorinna Road about 25 feet below No. 11 adit. The present syndicate cleaned out these old workings and extended it for a few feet. Although some galena veins were encountered no production resulted as the grade was too low. The adit commences as a crosscut driven 61 feet long. For the first 50 feet it is driven along a set of strong joints in hard blocky quartzite which are overturned and dip steeply north. From here to the face it is in thinly bedded quartzites and slates and then in broken quartzites. At 53 feet some galena veins have been driven on for 71 feet along a bearing of 119°, that is, parallel to the bedding. The drive is along a zone of overturning with strong bedding plane slippage. This zone has been weathered somewhat and forms the hanging wall of the drive. The foot wall is in blocky quartzites and at 62 feet along the drive a galena vein is exposed, selected samples of which assay:—

Lead 52·3%, silver 37 ozs. per ton, gold ·12 ozs. per ton, plus copper and zinc.

No. 13 adit.—These workings are situated just above the bank of Claude Creek directly below No. 12 adit. From the portal a drive has been put in along a bearing of 119° for 67 feet and from the same portal a crosscut has been sent in for 150 feet along an approximate bearing of 060°. The crosscut was apparently designed to cut the veins worked in Nos. 11 and 12 adits at a lower level. Unless the overturning on the north limb of this syncline is greater at depth than indicated by the workings above, the veins in Nos. 11 and 12 adits should have been met in this crosscut. However, no metal was encountered, but a few more feet of cross-cutting would be desirable to prove that the veins do not persist to this depth. The lower values of these veins in No. 12 adit probably discouraged further work here. The crosscut is in hard, blocky quartzite which dips vertically or is slightly overturned.

The drive has been made on some galena veins exposed at the portal. As in the workings above these veins are narrow (total four inches and less) and they are confined to the bedding planes. The drive is thus along the bedding which here dips south at 70° to 75°. The beds are thinly bedded and sheared quartzites between two more massive quartzite beds. Along the drive the veins are very irregular and where they are thickest have been stoped up for 10 feet above the drive. A production of about five tons of ore is said to have been made from this drive, and haulage gear was erected to carry the ore to the road above. A galena vein one and a half inches wide is exposed in the face, picked samples from which assay:—

Lead 76·1%, silver 44·8 ozs. per ton, gold trace, plus copper and zinc.

v. Smaller Workings

On the west bank of Claude Creek just below the waterfall a short adit has been put in very close to the axis of the Falls Anticline. The adit is in closely jointed quartzite showing pronounced bedding plane slippage. No ore is exposed in these workings at present but a small lode is reported to be visible in the bed of Claude Creek at this point during periods of low flow.

Sales workings are located on the top of the hill above Claude Creek 180 feet south of No. 7 adit. The workings consist of some trenches and a small quarry near the axis of Sales Anticline. Some ore is reported by Twelvetrees to have been obtained from here in the early days. The ore is described as being in small veins generally parallel to the bedding but branching somewhat.

Several other small adits and numerous trenches in the area have been mapped and are indicated on the detailed plan. No ore is visible in any of these workings.

(c) Structure of the Various Ore Bodies

The study of this area and of the literature reveals that there are two distant types of ore bodies present. First the thin galena veins lying parallel to the bedding and secondly the large deposits mined in Nos. 1 and 2 adits. Examples of the first type are exposed in many of the workings, e.g., adits Nos. 3, 7, 11, 12 and 13. Characteristically these veins are thin and irregular but usually contain clean ore which may be hand picked. Where such veins are sufficiently wide they could be profitably worked but their irregularity renders any operations based on such veins alone a doubtful venture.

Examples of the second and more important ore bodies are no longer exposed since the main workings have collapsed. The writer is therefore forced to turn to the old literature for descriptions of these ore bodies. Reid visited the area while such lodes were being worked and his description of them (in part) is as following:—

> "The ore bodies follow the pitch of the fold and as they are brought down they are carried north-west. The principal mineralisation has taken place at the apices of the anticline but solutions have migrated also along the bedding planes. Deposition has taken place in the weaker beds . . . . . . As these layers are rarely more than 20 feet thick the depth of the ore shoot is limited to this extent. The ore bodies are thus contained in shoots about 25 feet wide and 20 feet deep (measured at right angles to the pitch) and of (as yet) indeterminate length along the pitch. Mineralisation has also taken place to a minor extent along cleavage and bedding planes . . . . . but the main channel of access was along the flowage planes of the crushed beds.".

All writers agree on the localisation of these bodies in the axis of the Main Anticline and that mineralisation if it occurs in the intervening syncline is slight and unimportant. Two of the old stopes of the main workings are still accessible, the first from No. 1 adit and the other from the No. 1 rise of No. 2 adit. Both these stopes bear out Reid's description of the ore bodies. They indicate that the ore bodies were roughly conformable to the bedding and pitched north-west along the axis of the fold. This explains the failure of the No. 3 adit as an exploratory measure. The soft beds in which the ore is likely to be contained would be carried at least 150 feet beneath this adit from the known pitch of the fold.

Reid gives the dimensions of the ore body as 20 feet deep at right angles to the pitch. He also states that the first ore shoot came in at 57 feet along the drive and continued for 75 feet. From these dimensions the ore shoot must pitch north-west at 16°. Measurements of the pitch of the Main Anticline in this locality indicate a pitch of 15°.

Reid's description of the ore bodies emphasises the importance of the softer beds in localising the ore shoots. Clearly, from the description above the ore bodies were confined to favourable bands within the quartzite beds. The structure of such soft beds is shown plainly in the sections through both the Main and Falls Anticlines along Claude Creek. The soft beds have flowed up into the anticlinal crest forming roughly saddle-like bodies having similar dimensions to the ore bodies described by Reid. It should be noted that the true thickness of such beds would be very much less than 20 feet but they are exaggerated in the anticlinal axis by their incompetent behaviour. Thus we have two clues to the structure of these ore bodies. (*a*) The anticlinal crest; and (*b*) The behaviour of the incompetent beds. However, obviously there are further controlling factors since the two exposures noted above show soft beds localised in the anticlines but with no ore of importance contained in them.

A further factor in the formation of these ore bodies lies in the small thrust faults. The Main Anticline is cut by at least three such faults which run up the north limb of the fold nearly parallel to the bedding and then cut across the crest of the fold. Where these faults encountered the beds on the south limb of the fold the beds are rolled back and overturned. Two exposures of this overturning effect are recorded on the detailed plan. These thrust faults (or some of them) act as the channels for the ore bearing solutions and where they encounter a soft bed at the crest of the anticline an ore body has been formed. As the fault cuts across the beds on the south limb of the fold, these have been opened up slightly and thin veins of ore have been deposited along the bedding planes.

This interpretation explains several features of the ore bodies at Round Hill Mine:—

1. The ore shoots are confined to soft beds which pitch north-west at about 15°. However, the mineralisation does not extend indefinitely along the beds as evidenced by the smaller size of the lodes in the shaft level. This is due to the fact that since the folds pitch appreciably the soft beds are only cut for portion of their length. Mineralisation extends out from this zone but becomes weaker and eventually dies out unless the beds are cut by another such mineralising fault.

2. The lack of major ore bodies on Sales and Falls Anticlines. As indicated on the sections and shown by the regional structure of the area there is a regional dip south from the Main Anticline to the centre of the Claude Creek Synclinorium. Therefore the soft beds which may carry the ore bodies are approximately 130 feet beneath Claude Creek of Sales Anticline and 200 feet beneath the creek at the Falls Anticline.

3. The failure of the drilling carried out by the West Mt. Claude Mining Syndicate. Since the ore bodies are only aproximately 20 feet deep it would be difficult to locate such lodes by horizontal drill holes across the structure however well sited.

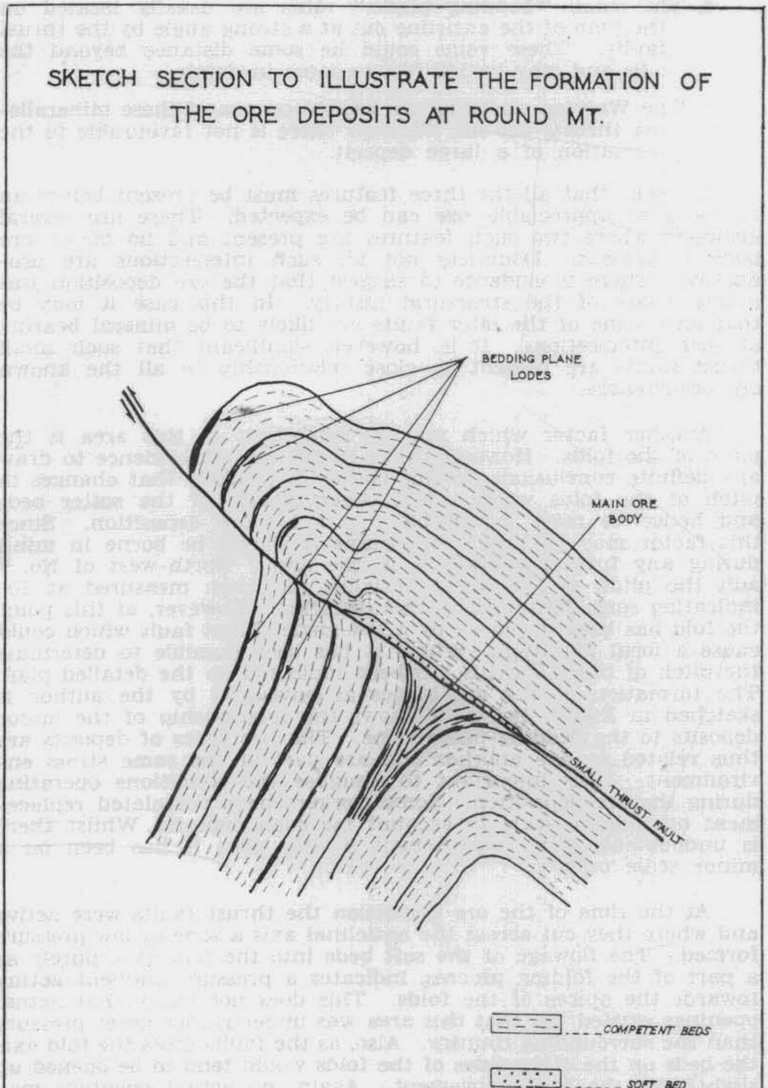
4. The small "bedding plane" veins are usually located on the limb of the anticline cut at a strong angle by the thrust faults. These veins could lie some distance beyond the axis and may be 100 feet or more in depth.

5. The Western workings are located on one of these mineralising thrusts but the lithology there is not favourable to the formation of a large deposit.

It seems that all the three features must be present before an ore body of appreciable size can be expected. There are several instances where two such features are present and no major ore body is present. Doubtless not all such intersections are productive. There is evidence to suggest that the ore deposition was a late phase of the structural history. In this case it may be that only some of the later faults are likely to be mineral bearing at such intersections. It is, however, significant that such small thrust faults are present in close relationship to all the known ore occurrences.

Another factor which may be important in this area is the pitch of the folds. However, there is not enough evidence to draw any definite conclusions on this point. It is likely that changes in pitch of the folds would affect concentration of the softer beds and hence be more favourable points for ore deposition. Since this factor may be highly important it should be borne in mind during any further operations in the area. North-west of No. 1 adit the pitch of the Main Anticline has been measured at 10° indicating some flattening in this direction. However, at this point the fold has been displaced by a low angle thrust fault which could cause a local variation. Where it has been possible to determine the pitch of the folds this has been indicated on the detailed plan. The formation of the ore bodies as envisaged by the author is sketched in Figure 10. This shows the relationship of the major deposits to the bedding plane veins. The two types of deposits are thus related to one another and are part of the same stress environment. It is important to visualise the conditions operating during the ore deposition. Some workers have postulated replacement on a large scale to account for such deposits. Whilst there is undoubtedly some replacement in this area it has been on a minor scale only.

At the time of the ore deposition the thrust faults were active and where they cut across the anticlinal axis a zone of low pressure formed. The flowage of the soft beds into the fold axis, purely as a part of the folding process, indicates a pressure gradient acting towards the apices of the folds. This does not imply that actual openings existed but that this area was under rather lower pressure than the surrounding country. Also, as the faults cross the fold axis the beds on the other sides of the folds would tend to be opened up slightly by the fault movement. Again, no actual openings may have been present. Fluids travelling along the thrust planes would naturally migrate to these areas of lower pressure depositing metal and gangue minerals from solution due to the lower pressures prevailing. Since the fluids themselves were under pressure also there is no reason to postulate that openings ever existed but rather low pressure areas or "potential openings".



SKETCH SECTION TO ILLUSTRATE THE FORMATION OF THE ORE DEPOSITS AT ROUND MT.

FIGURE 10

(d) Mineralogy

The mineralogy of the bedding plane lodes is relatively simple. The ore is massive and consists of galena and pyrite with subordinate sphalerite and occasional blebs of chalcopyrite. The gangue, if present, is dominantly quartz, usually milky but sometimes iron stained and rarely crystalline. The galena may be fine-grained or coarsely crystallised.

The mineralogy of the major deposits has been described by Reid. Briefly these ore bodies consist of galena, both fine-grained and coarse, with abundant chalcopyrite, a little pyrite, sphalerite and siderite, together with small amounts of bismuthinite, pinite and quartz. The gangue is never abundant and the quartz usually opaque. Pyrite tends to be deposited first but in general the deposition was contemporaneous.

The silver values are variable being as high as 900 ozs. per ton in some cases. However, generally speaking, they average about 1 oz. of silver per unit of lead. Similarly the gold values are erratic but are said to average 2 to 3 dwts. per ton in ore containing 50% lead.

(e) Production

Incomplete figures of production for the period 1908-1927 are given by Hughes as:—

Lead	4,700 tons
Gold	1,500 ozs.
Silver	370,000 ozs.

Since 1948 approximately 20 tons of lead have been produced containing small amounts of gold and silver.

(f) Diamond Drilling

The following holes have been drilled by the West Mt. Claude Mining Syndicate. No complete logs are available for this drilling and the core has not been preserved in order. In any future drilling programme care should be exercised to preserve the core in order, and to prepare accurate detailed logs of the core.

The following descriptions of bores are based mainly on the driller's reports:—

Bore No. 1.—A horizontal hole along a bearing of 028° drilled from the end of No. 11 adit crosscut, this hole is 204 feet deep. The bore commenced in quartzites and remained in quartzites with minor slate bands to 164 feet where the Roland Conglomerate was encountered.

Bore No. 2.—Drilled from a cutting on the edge of the Lorinna Road opposite the No. 3 adit, depth 361 feet, bearing 024°, approximately horizontal.

This hole was in quartzite with some shaley bands and frequently encountered tubicolar casts. Apart from one thin galena vein in the run between 46 feet and 69 feet no mineralisation was encountered. However, towards the bottom of the hole the quartzites often carried minute flecks of pyrite.

Bore No. 3.—Drilled from near the mouth of No. 1 adit along a bearing of 167° and depressed at 20°. From 52 feet 6 inches to 69 feet 8 inches a lode was encountered. This is the extension of the first lode which was cut in the No. 1 adit at 57 feet. The hole intersected this ore body 62 feet from the portal and 20 feet below the adit. Assuming the ore body to be conformable with the surrounding rocks its true width would be between five and nine feet depending upon the assumptions made in reconstructing the fold. Assays of the relevant portions of the core are:—

Core Lengths	Lead %	Silver Ozs. per ton
52′ 6″		
	0·4	0·2
53′ 8½″		
	Trace	Nil
54′ 9″		
	0·3	0·1
57′ 8″		
	15·1	2·0
59′ 2″		
	11·6	3·8
60′ 0″		
	0·4	0·5
60′ 6″		
	28·0	8·6
61′ 0″		
	3·5	2·0
62′ 6″		
	0·6	0·9
63′ 5″		
	24·8	9·7
64′ 6″		
	1·2	0·7
65′ 5″		
	15·8	6·0
66′ 7″		
	19·1	7·4
68′ 10″		
	0·1	0·3
69′ 8″		

Bore No. 4.—Drilled from the cutting outside the No. 7 adit along a bearing 200°, depressed 60°. This bore is reported to have encountered mineralised material between 76 feet and 81 feet but no assays or core is available to substantiate this. The hole would probably pass over the lode encountered in No. 3 bore if that lode persists to this point. This drill hole was designed to intersect the lode exposed in the No. 7 adit at depth but was abandoned before achieving its object.

Bore No. 5.—Drilled from outside No. 7 adit drive to test for extensions of the small galena veins there. The hole was 30 feet long and encountered the lode between two and three feet which assayed:—

(1) Silver 42 oz./ton, lead 57·4%

(2) Silver 4·9 oz./ton, lead 28·3%

Bore No. 6.—Similar to No. 5 to test for extensions of the same lode. Depth 14 feet, lode between 9′ 3″ and 11′3″. Assay:—Silver 1·1 oz./ton, lead 28·2%.

(g) Conclusions

1. The various small silver-lead veins at present exposed in the Round Mount area do not constitute a reliable mining proposition.

2. The revival of serious mining operations in this area can only be expected if further large ore bodies of the kind worked in Nos. 1 and 2 adits are located.

3. It is reasonable to expect further such ore bodies along the axis of the Main Anticline to the north-west and vigorous prospecting in this area is recommended. The ore bodies in this fold would be located closest to the surface.

4. This prospecting should be carried out by means of vertical diamond drilling along the axis of the fold. The drill core should be carefully logged and faithfully preserved.

5. No explorations have yet been carried out to test the Main Anticline beneath the shaft level. At least one deep drill hole to search for the further " ore horizons " at depth is warranted.

6. There are at least three factors controlling the ore deposition of the large ore shoots:—(*a*) the anticlines; (*b*) the soft beds; and (*c*) the small thrust faults. Where these three factors are localised an ore body may be expected. Of these factors, points can be selected where the soft beds are in the axis of the folds. However, the distribution of the various thrust faults and the character of these faults individually is such that intersections of the faults with the fold axis cannot be predicted reliably. The drilling must therefore explore the axis of the folds at the " ore horizons " thoroughly enough to isolate any such intersections.

7. Following a thorough search of the Main Anticline several other areas warrant investigation. In order of importance these are:—

(*a*) Sales Anticline.—The beds containing the ore shoots at the Main Anticline are located at least 130 feet below the bed of Claude Creek where the fold axis crosses it. The level of these ore bodies will fall to the north-west to beyond the No. 3 adit and will rise to the south-east with the pitch of the fold.

(*b*) Falls Anticline.—Similar remarks apply to this as to Sales. However, the known favourable beds here are located at least 200 feet below Claude Creek.

It should be noted that some mineralisation is present on both of these folds at various points. Therefore, if suitable host rocks are cut by a mineralised thrust fault in the anticlinal axis further important ore bodies may be found in these folds.

(*c*) Further 3rd order folds on the north-east limb of the Claude Creek Synclinorium, if they can be located accurately under cover of scree or glacial till.

In this connection it should be noted that the crosscut from No. 11 adit intersects both an anticlinal axis and a small thrust fault. This fault would cut the axis of the fold above the adit and the veins worked in this adit may be connected with this since they appear to die out at depth. The rocks here are mainly massive quartzites and therefore unlikely to contain a major ore body, but they may contain some useful ore. Since the area is readily accessible it should be explored by means of a short diamond drill hole from the surface above the adit or by an inclined rise from the adit itself.

8. The areas in which the best prospects for ore exists are such that any ore bodies located will have to be developed from shafts.

9. Although the limestone is the most favourable host rock for major ore deposits in this area there is at present no indication of mineralisation in this formation. Future prospecting should always bear in mind the structural position of this formation in relation to any ore bodies located.

10. If further ore bodies are located the syndicate should thoroughly explore the Main Anticline at depth before capitalising for the erection of plant. The possibility of a change in mineralogy perhaps to tin, tungsten, bismuth and arsenic at depth should always be considered.

11. The relation of the bedding plane lodes to the major ore bodies is worthy of consideration. The veins may contain useful quantities of ore capable of development in conjunction with the larger deposits. Exploration for these smaller lodes could easily take place from workings designed to develop the major ore bodies.

12. Whilst drill holes can be carefully sited on the anticlinal axis at the surface, the slight off-setting effects of the soft beds and thrust faults may cause deviations in the axial planes of the folds. These may be sufficient to cause the drill holes to miss ore bodies which after all are only 25 feet wide in plan. If possible, the holes should be surveyed and failing this a close check should be kept upon the core to determine its relation to the bedding planes. It may be necessary to drill two or three holes across the axis of the anticlines.

13. Although no major ore bodies are at present exposed in this area the geological structure favours further ore deposits at the points indicated above. A careful and thorough exploration programme to test the Main Anticline at depth and to the north-west along its axis is justified. Further explorations to test the other anticlines should be based upon the results of this initial work. Any company operating in this area will require a thorough knowledge of the structural geology.

(h) Recommendations

1. A vertical hole should be drilled on the axis of the Main Anticline from either just outside the No. 1 adit or if convenient, in the No. 7 adit. This hole should be carried to 300 feet to test the formation at depth and to locate any extension of the lode encountered in the previous No. 3 bore. The hole will also provide a stratigraphic sequence of the beds in the vicinity of the ore body. If the conglomerate is encountered before this depth is reached the hole should be immediately abandoned. Care should be taken in

the drilling to obtain the best possible core recovery.

2. A vertical drill hole (or series of holes) should be drilled on the axis of the Main Anticline south-east of the cross fault near the No. 3 adit. Whilst some footage could be eliminated here by drilling an angle hole from the tramway below, this is definitely not recommended as such a hole would only intersect the axial plane over a short distance. This hole will have to be drilled to a level of at least 150 feet beneath the No. 1 adit but the exact depth should be determined by the results of the first drill hole. If further ore shoots or promising horizons are located in the first hole then this hole should be drilled deep enough to intersect these also.

3. A vertical hole on the axis of the Main Anticline from the hill above the old mill site would intersect the axial plane in a favourable area. Here the pitch of the fold changes and a number of small thrust faults are present. The depth of this hole cannot be calculated from the pitch of the fold due to the various cross faults and the change in pitch. The depth must therefore be determined by stratigraphic means using the core from the No. 1 hole above.

4. A hole should be drilled on the axis of the Main Anticline near the No. 3 adit (or from inside this adit if a suitable machine is available). Since this is in a downthrown block between two faults the depth of this hole will again be determined by comparing the stratigraphy of the core with that from the No. 1 hole.

5. If any ore bodies are located by the above drilling then intermediate holes as required should be drilled to delineate these ore shoots.

6. Exploration of Sales and Falls Anticlines should follow the above drilling. Initial drilling on these anticlines should be vertical holes sited on the axis of the folds as near as possible to the bank of Claude Creek.

7. The anticlinal axis above the No. 11 adit should be explored.

(2) ROUND HILL EXTENDED

(a) History

This property lies approximately half a mile south of the main workings of the Round Hill Mine and on the south bank of Claude Creek. The original discovery is said to have been made about 1890. Developments in the area are limited and no work has been done here for at least 30 years. The ore bodies occur on the south limb of the Claude Creek Synclinorium and although the lessees at one time considered the property sufficiently attractive to warrant the construction of ore bins, no production is recorded from here.

(b) Development

No. 3 Adit.—This adit was put in by the original syndicate about 60 years ago. It is driven for 81 feet along a bearing of 211° in flatly dipping, grey, blocky quartzites with interbedded, puggy shales and sandstones. All these rocks are extensively weathered and closely jointed. At 41 feet from the portal a small drive consisting only of one round from either side of the adit has been put in. The adit is now in very poor condition and no ore can be seen in the drive. Reid, however, reports that a lode striking north-west and dipping flatly south-west, composed of galena, sphalerite, pyrite and chalcopyrite was encountered here. A few lumps of ore consisting of small blebs of galena in hard, grey quartzite can be found on the dump and were doubtless derived from the drive. The lode does not appear to have been at all promising judging by the amount of work done on it.

Open Cut Workings.—The only production of note in this area came from these workings. They consist of a trench 30 feet long from the end of which a short drive was put in. The trench is in rather disturbed, fine-grained, yellow sandstone and grey quartzite all very weathered. The drive is along the same faulted anticline as that in which the ore body at No. 3 adit was contained. The quartzites in the drive have behaved as competent units during the faulting whilst the shaley beds beneath these are crushed, brecciated and mineralised. The puggy, mineralised, fault zone itself forms the main ore body but ore deposition has also extended into the softer beds on either side of the fault. This fault zone has been stoped overhead for a short distance and a winze 25 feet deep has been put in in the centre of the drive. A few tons of ore are stacked outside, samples of which assay:—

		Zinc %	Lead %	Silver			Gold		
				Ozs.	dwts.	grns.	Ozs.	dwts.	grns.
Average Ore	(1)	2·2	4·0	5	8	10	0	0	6
	(2)	2·6	3·2	3	19	17		trace	
Selected Galena	(3)	0·5	34·8	54	16	0	0	0	12

Samples (2) and (3) contain traces of copper.

No. 2 *Adit*.—This has been put into explore the ore body encountered in the open cut workings at a greater depth. It commences on the hillside 40 feet vertically beneath these workings and has been driven for 124 feet along a bearing of 229°. At 80 feet the drive has been put in along a bearing of 297° for 40 feet, directly beneath the open cut As far as the drive the adit is in grey-green argillites overlain by quartzite and dipping north at about 15°. From here to the face it is in hard, blocky quartzite dipping steeply south. The drive is along the axis of the faulted anticline exposed in the workings above and No. 3 adit. No ore is exposed in the drive but Reid reported " very little galena between the bedding planes ".

No. 1 *Adit*.—This lies 180 feet vertically beneath the No. 3 adit and has been driven from near the south bank of Claude Creek along a bearing of 220° to intersect the No. 3 adit ore body at depth. The adit is 302 feet long and is in hard, blocky quartzite throughout, except for a few thin slate brands. Near the face of quartzite is somewhat shattered and carries numerous quartz veins. The quartzites are gently undulating to 290 feet where an anticlinal axis is crossed. A few shears cut the adit and have been indicated on the plan. The adit has not been driven far enough to intersect the mineralised fault zone in the open cut workings at No. 3 adit. No other mineralisation has been encountered in this adit.

(c) Conclusions

Summarizing the important points in this area we have:—

1. All the mineralisation is related to the same faulted anticline which appears to plunge gently north-west (approximately 5°).
2. The deposits worked in the open cut and intersected by the No. 3 adit apparently represent the remnants of more extensive ore bodies which have been largely removed by denudation.
3. The beds beneath the No. 3 adit are dominantly massive quartzites and are not favourable host rocks. Both the low level exploratory adits have failed.
4. To prospect beds higher in the formation it would be necessary to explore the anticline further to the north-west.
5. The geological structure in that direction is concealed beneath extensive talus accumulations.

Hence, the prospect of further ore bodies to the north-west should not be discounted but it is considered that the area does not offer sufficient encouragement to warrant exploration as a separate venture.

(3) THE TIN SPUR AREA

(a) History

The sections originally worked in this area have long been abandoned. Apart from some desultory prospecting no serious work has been done here for about 35 years. When Twelvetrees and Reid visited the area a good deal of work was being carried on at the various leases and Reid, in particular, in a subsequent type-written report was impressed with the possibilities of the area. The area has hardly seemed to have justified his enthusiasm.

Since many of the workings which were open at the time of Reid's visit have since collapsed it is not possible to re-examine the area as critically as one would like. The lodes which Reid referred to in several of the sections now appear difficult to visualise.

From a geological point of view the area is of great importance. Reid described porphyry intrusions into the "pipe stem" (Moina) Sandstones. If this is correct then these porphyries must be of post-Ordovician and presumably Lower Devonian age. This is contrary to some of the recent findings with regard to these rocks and it is desirable to clear up this problem. However, whilst the writer disagrees with Reid in this matter it should be realised that at the time of his visit the area was opened up much more thoroughly and that Reid had access to exposures which are now obliterated.

(b) Geology

The Moina Sandstones, here consisting of dense, white quartzites and friable sandstones, often packed with tubicolar casts, occupy the majority of this area. The remainder is occupied by Roland Conglomerate except for the small patch of Dundas Group porphyry exposed beneath the scarp of the Tin Spur Creek Fault.

Over a good deal of the area the bed rock is concealed beneath extensive soil, talus and fluvioglacial deposits. Outcrop generally is poor and the detailed structure is difficult to interpret.

The main fault is the Tin Spur Creek Fault. This is a large thrust fault trending north-west and dipping south-west at 30° to 35°. The rocks are folded along north-west trending axis into a series of fairly sharp anticlines and synclines. A major synclinorium with its axis roughly along Magee Creek is the main fold, the others being essentially drag-folds on the limbs of this major structure and drag dips up against the Tin Spur Creek Fault. In general there is comparatively little folding in the rocks on the upper plane of this fault but the rocks lying beneath the thrust plane are much more disturbed.

In his reports on this area Reid referred to porphyry sills within the Moina Sandstones. After a careful examination of all the accessible workings and outcrops throughout the area the writer can find no evidence for such sills. As mentioned earlier, grit beds in the Moina Sandstones sometimes resemble sheared porphyries and it seems likely to the author that these porphyry sills of Reid are in fact such grit beds.

Reid (page 117) says that the " greyish porphyry, . . greatly resembles sandstone at first sight ". Also in an earlier inspection of the field Twelvetrees (page 95) stated " The country rock is the pipe-stem sandstone, sometimes indurated at other times quite friable. In its white, granular condition it has been taken for an igneous rock and has received the local name of porphyry ".

A careful examination of the outcrops combined with the fact that fragments of the Cambrian porphyries may be found in the base of the Roland Conglomerate has convinced the writer that Reid misinterpreted these rocks.

The occurrence of skarn rock in this area has been referred to earlier. This garnet-epidote rock or, perhaps more correctly, tactite, certainly does occur near the mouth of Tin Spur Creek. Reid also reports that it is present in this locality in association with some of the ore bodies. The present study of the area has revealed no trace of this. The point is discussed more fully in connection with the description of the lower workings.

(c) Mining Properties

Since most of the old workings are now in poor condition it is convenient to group these into two sets of workings; (i) those at the Falls Mine; and (ii) the workings around Gorey's Tunnel, Duff"s shaft and Ashworth's workings; here called the Lower Workings.

i. Falls Mine

The discovery of tin at this locality was made by R. Magee and B. L. Thomas about 1918. The mine is situated just above the road cutting of the present Lorinna Road a few chains west of Tin Spur Creek. The original outcrop as described by Reid was of " a lode consisting of gossanous material carrying tinstone in considerable quantity ". The original lode has since been removed in the open cut workings.

The property was originally worked by driving a crosscut adit for about 25 feet under the gossanous material and driving along the lode for about 40 feet. Only a few feet of these workings are now visible in the open cut. The rocks in the cut are deeply weathered and covered by the toe of extensive talus accumulations from the scarp of the Tin Spur Creek Fault which lies about three chains up the hill south of the open cut.

The lode material was described by Reid to "contain a good deal of silica and undecomposed porphyry". The rocks now found *in situ* in the cut at the Falls Mine consist of deeply weathered, ferruginous sandstones and siltstones, but numerous porphyry boulders are present in the overlying talus. Some of these porphyry boulders are quite large and in small exposures could have been taken for *in situ* outcrops. Since all the rocks are so deeply weathered and covered by extensive superficial deposits it is difficult to pick up any reliable structure in the open cut. However, no porphyry *in situ* can be found in this cut or in the road cuttings in this vicinity. The only porphyry occurring in place in this area is that lying unconformably beneath the Roland Conglomerate and exposed by the upthrown block of the Tin Spur Creek Fault.

Small quantities of cassiterite can be washed from the material forming the face of the open cut but none of this is in commercial quantities. The two "lodes" in this cut are separated by a barren zone and on sampling were both found to contain only traces of tin.

After a thorough search of the area no commercial deposits of tin were located although small tails of tin can be obtained by washing the detritus from many parts of the hill-side. In the road cuttings between the Falls Mine and the Dolcoath Granite, a distance of over half a mile, cassiterite can be seen at many points. The tinstone is almost exclusively found as tiny black crystals associated with quartz in facing along the major joints. None of these occurrences in the cuttings show the slightest possibility of being a commercial proposition. There is a tendency for the tin to be concentrated along the strong joints associated with the Tin Spur Creek Fault on both the upthrown and downthrown side of it.

The concentration of tin which led to the establishment of the Falls Mine has probably been due to simple gravity concentration of the metal in the detritus below the scarp of the Tin Spur Creek Fault. The Moina Sandstones on the downthrown side of the fault at the mine have been slightly mineralised and carry pyrite, cassiterite and quartz in friable sandy beds. However, this mineralisation on its own is not a commercial proposition and it is only when the weathering products of these rocks have been concentrated in talus accumulations that they become payable. Such concentrations are extremely erratic and unlikely to be of large scale economic importance.

ii. Lower Workings

The majority of work carried out at Tin Spur was in connection with these deposits. A number of lodes were worked in the vicinity of the old road on the western side of Tin Spur and also on the nose of Tin Spur itself between the old and the new roads.

The original discovery of tin in this vicinity was made by T. L. Johnston and Jordan about 1889 and the ore bodies were explored sporadically for about 35 years or so before being finally abandoned. The lodes have been regarded as an extension of the Falls line of lode. However, it is unlikely that those lodes persist for this distance. The deposits are more likely to be isolated ones associated with fractures and brecciation close to the Tin Spur Creek Fault.

The workings have been abandoned for so long that they are now in very poor condition. Ashworth's shafts and the West Tunnel have collapsed and are no longer accessible. Duff's shaft is partially filled with water and is also inaccessible. Gorey's tunnel was blocked by a fall at the entrance but was cleared out and re-examined.

Reid reported skarn rock in this tunnel but a close examination has failed to reveal this although the tunnel is still in fairly good condition at the point where this rock is reputed to occur. A sheared quartzite fairly heavily iron-stained is present which may superficially resemble skarn rock. A sample of this was examined by the petrologist Mr. G. Everard and he reports:—

> " The specimen is a fine grained, greyish-brown sheared rock. The colour is somewhat blotchy and irregular, weathered surfaces are fairly heavily iron stained.
>
> In thin section the granularity is not uniform, one part having an average grain size of ·25 mm. and another ·02 mm., while another part is intermediate. The texture in each part is granular, and the minerals present are quartz, biotite and sericite. The quartz grains of any part are equidimensional, anhedral and interlocking. Biotite is present interstitially and as veinlets and irregular patches; it is very fine grained. Sericite occurs as shreds and patches of small size.
>
> The rock is a quartzite.".

The presence or absence of skarn rock in this tunnel is most important from a structural point of view. If it were present it would require an extremely complicated structure to account for its presence in Gorey's tunnel. After re-examining the tunnel the writer is satisfied that the rock does not occur in these workings.

Since most of the workings in which the lodes occured are now inaccessible it is impossible to comment upon them. Reid (page 114) quotes assays from Duff's shaft and Ashworth's workings which appear attractive, but these workings have since been abandoned. It seems likely that the ore bodies were rich in the detrital material at the surface but that at depth they were unpayable. Such tin as can be found around Duff's shaft and the nearby sluicings consists of very fine grained cassiterite along joints and fractures. However, these " lodes " are extremely erratic and are quite unpayable.

As with the Falls Mine the only payable tin recovered in this area was probably concentrations in the superficial deposits formed by the weathering of the quartzites and sandstones. The parent rocks carry small quantities of disseminated tin and pyrite in certain beds. Similarly to the Falls Mine there is a fairly persistent zone near the Tin Spur Creek Fault where primary tin occurs along joints. These primary " ore bodies " are not payable but where concentration of the weathered sandstones occurs, reasonably rich pockets of tin could occur locally.

iii. General Remarks

As it stands, the known workings of Tin Spur are not payable. Nevertheless there is a fairly persistent zone of tin bearing rocks in the area paralleling the Tin Spur Creek Fault for over a mile.

As mentioned earlier the actual fault plane is not well exposed anywhere. However, in mapping the fault over some distance it has been possible to locate it within a few feet at most points. There is no evidence as to whether the fault zone has acted as a lode channel or whether payable deposits of primary ore may be found within the fault zone itself.

This theory is attractive due to the associated disseminations in the rocks near the fault but cannot be suggested with confidence. Of all the workings in this area Duff's shaft is the only opening which could pierce the fault zone. Since this shaft is inaccessible it cannot be demonstrated that it does in fact intersect the fault. However, it would be expected to on structural ground. The records contain no reference to any enrichment of ore at the point where Duff's shaft would be expected to intersect the fault.

The tin which has been produced in this area has been very largely derived from secondary deposits. Such deposits may be easily worked by prospectors and the area may well repay serious prospecting by small parties in search of rich pockets of detrital material. The old water races put in by the original companies to the Falls Mine and to the Lower Workings could be fairly easily restored and water could therefore be diverted from Tin Spur Creek to the ground lying below the Falls Mine.

The thickest superficial deposits are those lying below the scarp of Tin Spur Creek Fault. The majority of this deposit has not been tested and it is therefore possible that further small enriched patches may occur to the north-west and south-east of the Falls Mine. The search for this kind of deposit is essentially a prospector's proposition and may pay well for single men or very small parties but is of little interest to large concerns since such deposits are likely to be very small in extent.

To seriously test this area for further primary tin deposits it would be necessary to drill the area thoroughly along the Tin Spur Creek Fault. Any drilling there should commence on the upthrown (south-west) side of the fault and penetrate well into the brecciated sandstones on the lower plane of the fault.

Although no payable primary ore bodies of any size have been found in this area the widespread minor occurrences of tin suggest that it would be unwise to ignore the possibility of payable deposits occurring in this area.

(d) Conclusions

(1) No payable deposits of tin are at present exposed in this area.

(2) Most of the tin won in the past has come from detrital deposits.

(3) The primary tin is present as disseminations with pyrite in friable beds in the Moina Sandstones and as facings along joints in the denser quartzites.

(e) **Recommendations**

(1) Prospecting by small parties in the detrital deposits may reveal further small enriched pockets of cassiterite.

(2) Any company willing to prospect the area thoroughly for primary tin deposits should concentrate on drilling along the line of the Tin Spur Creek Fault.

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FIG. 11

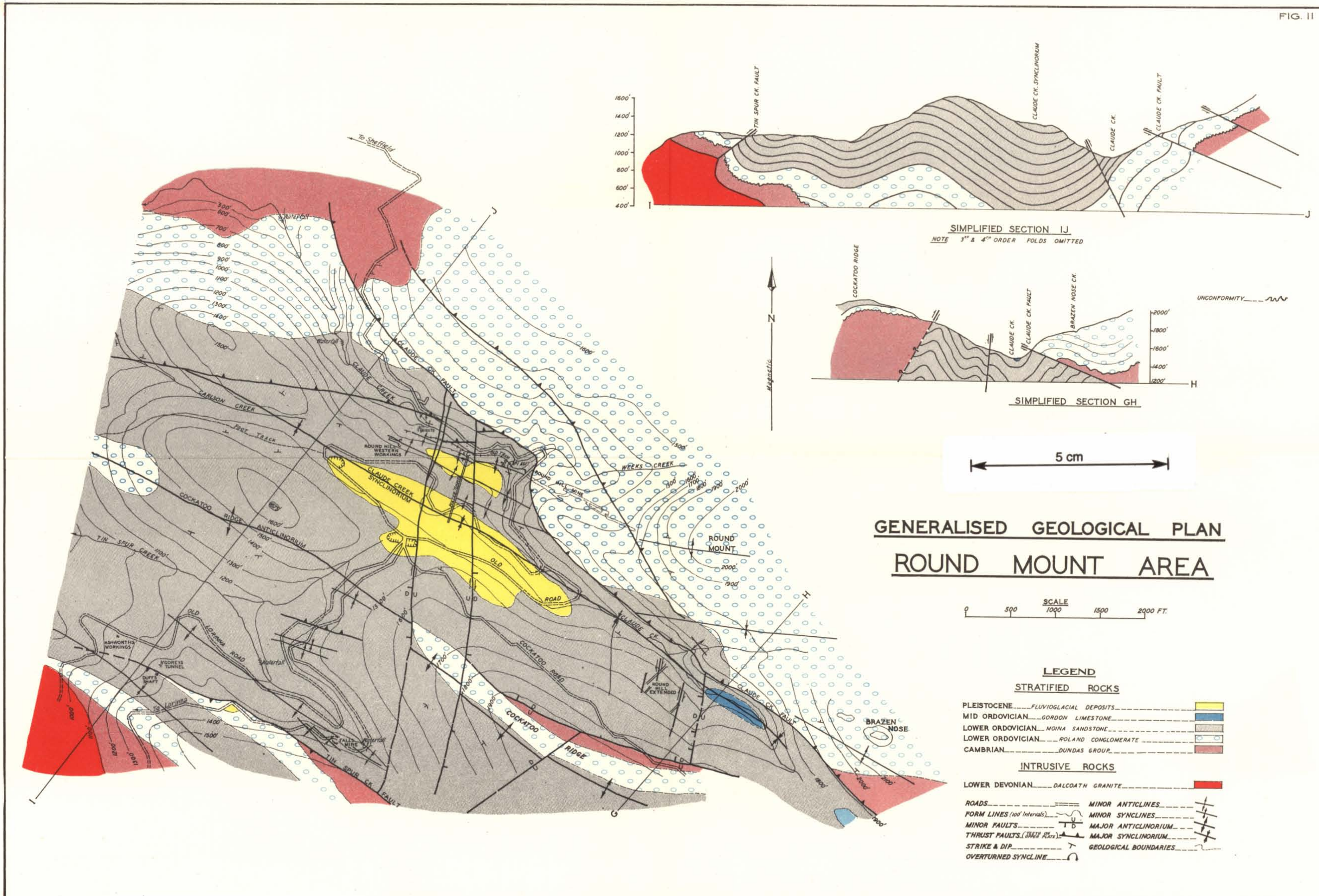
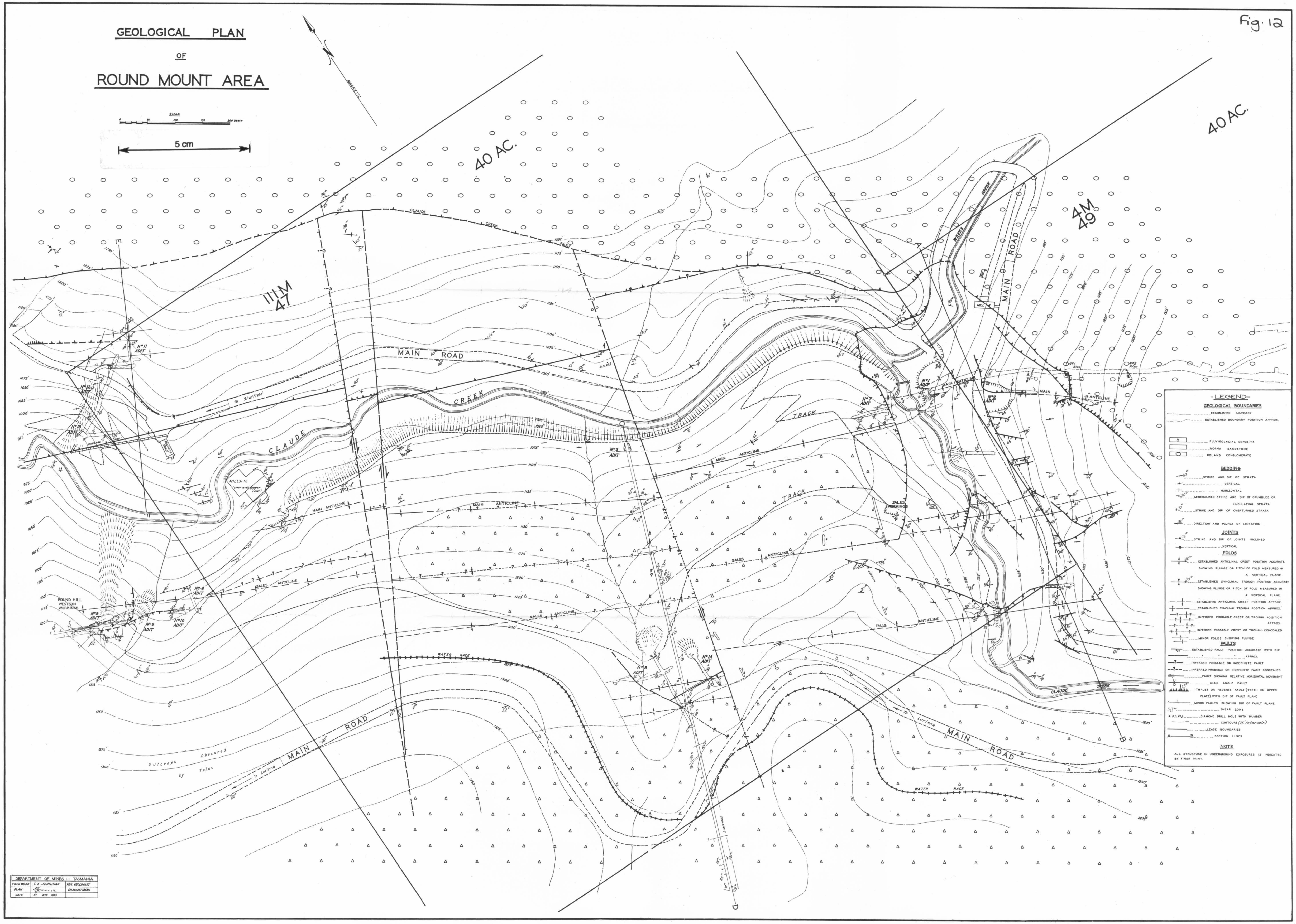

GENERALISED GEOLOGICAL PLAN
ROUND MOUNT AREA
SCALE
0 500 1000 1500 2000 FT.
SIMPLIFIED SECTION IJ
NOTE 3rd & 4th ORDER FOLDS OMITTED
SIMPLIFIED SECTION GH
TIN SPUR CK. FAULT
CLAUDE CK. SYNCLINORIUM
CLAUDE CK.
CLAUDE CK. FAULT
COCKATOO RIDGE
BRAZEN NOSE CK.
UNCONFORMITY
N
Magnetic
LEGEND
STRATIFIED ROCKS
PLEISTOCENE ... FLUVIOGLACIAL DEPOSITS
MID ORDOVICIAN ... GORDON LIMESTONE
LOWER ORDOVICIAN ... MOINA SANDSTONE
LOWER ORDOVICIAN ... ROLAND CONGLOMERATE
CAMBRIAN ... DUNDAS GROUP
INTRUSIVE ROCKS
LOWER DEVONIAN ... DALCOATH GRANITE
ROADS
FORM LINES (100' Intervals)
MINOR FAULTS
THRUST FAULTS
STRIKE & DIP
OVERTURNED SYNCLINE
MINOR ANTICLINES
MINOR SYNCLINES
MAJOR ANTICLINORIUM
MAJOR SYNCLINORIUM
GEOLOGICAL BOUNDARIES
To Sheffield
CLAUDE CREEK
CLAUDE CK. FAULT
CARLSON CREEK
FOOT TRACK
ROUND HILL WESTERN WORKINGS
CLAUDE CREEK SYNCLINORIUM
WEEKS CREEK
COCKATOO RIDGE ANTICLINORIUM
TIN SPUR CREEK
ROUND MOUNT
OLD ROAD
OLD LORINNA ROAD
ASHWORTHS WORKINGS
McGOREYS TUNNEL
DUFFS SHAFT
To Lorinna
COCKATOO ROAD
COCKATOO RIDGE
TIN SPUR CK. FAULT
ROUND HILL EXTENDED
BRAZEN NOSE
5 cm

Fig. 12



GEOLOGICAL PLAN
OF
ROUND MOUNT AREA
SCALE
5 cm
40 AC.
40 AC.
111 M 47
4 M 49
CLAUDE CREEK
MAIN ROAD
To Sheffield
To Lorinna
MAIN ANTICLINE
SALES ANTICLINE
FALLS ANTICLINE
TRACK
WATER RACE
MILLSITE
SALES WORKINGS
ROUND HILL WESTERN WORKINGS
Outcrops Obscured by Talus
No 1 ADIT
No 1A ADIT
No 3 ADIT
No 4 ADIT
No 6 ADIT
No 7 ADIT
No 8 ADIT
No 9 ADIT
No 10 ADIT
No 11 ADIT
No 12 ADIT
No 13 ADIT
No 2 Rise
-LEGEND-
GEOLOGICAL BOUNDARIES
ESTABLISHED BOUNDARY
ESTABLISHED BOUNDARY POSITION APPROX.
FLUVIOGLACIAL DEPOSITS
MOINA SANDSTONE
ROLAND CONGLOMERATE
BEDDING
STRIKE AND DIP OF STRATA
VERTICAL
HORIZONTAL
GENERALISED STRIKE AND DIP OF CRUMBLED OR UNDULATING STRATA
STRIKE AND DIP OF OVERTURNED STRATA
DIRECTION AND PLUNGE OF LINEATION
JOINTS
STRIKE AND DIP OF JOINTS INCLINED
VERTICAL
FOLDS
ESTABLISHED ANTICLINAL CREST POSITION ACCURATE SHOWING PLUNGE OR PITCH OF FOLD MEASURED IN A VERTICAL PLANE.
ESTABLISHED SYNCLINAL TROUGH POSITION ACCURATE SHOWING PLUNGE OR PITCH OF FOLD MEASURED IN A VERTICAL PLANE.
ESTABLISHED ANTICLINAL CREST POSITION APPROX.
ESTABLISHED SYNCLINAL TROUGH POSITION APPROX.
INFERRED PROBABLE CREST OR TROUGH POSITION APPROX.
INFERRED PROBABLE CREST OR TROUGH-CONCEALED
MINOR FOLDS SHOWING PLUNGE
FAULTS
ESTABLISHED FAULT POSITION ACCURATE WITH DIP
APPROX.
INFERRED PROBABLE OR INDEFINITE FAULT
INFERRED PROBABLE OR INDEFINITE FAULT CONCEALED
FAULT SHOWING RELATIVE HORIZONTAL MOVEMENT
HIGH ANGLE FAULT
THRUST OR REVERSE FAULT (TEETH ON UPPER PLATE) WITH DIP OF FAULT PLANE
MINOR FAULTS SHOWING DIP OF FAULT PLANE
SHEAR ZONE
D.D. No2 DIAMOND DRILL HOLE WITH NUMBER
CONTOURS (25' Intervals)
LEASE BOUNDARIES
A—B SECTION LINES
NOTE
ALL STRUCTURE IN UNDERGROUND EXPOSURES IS INDICATED BY FINER PRINT.
DEPARTMENT OF MINES — TASMANIA
FIELD WORK
I. B. JENNINGS
REG. GEOLOGIST
PLAN
DRAUGHTSMAN
DATE
31 AUG. 1955

CROSS SECTIONS ROUND MOUNT AREA

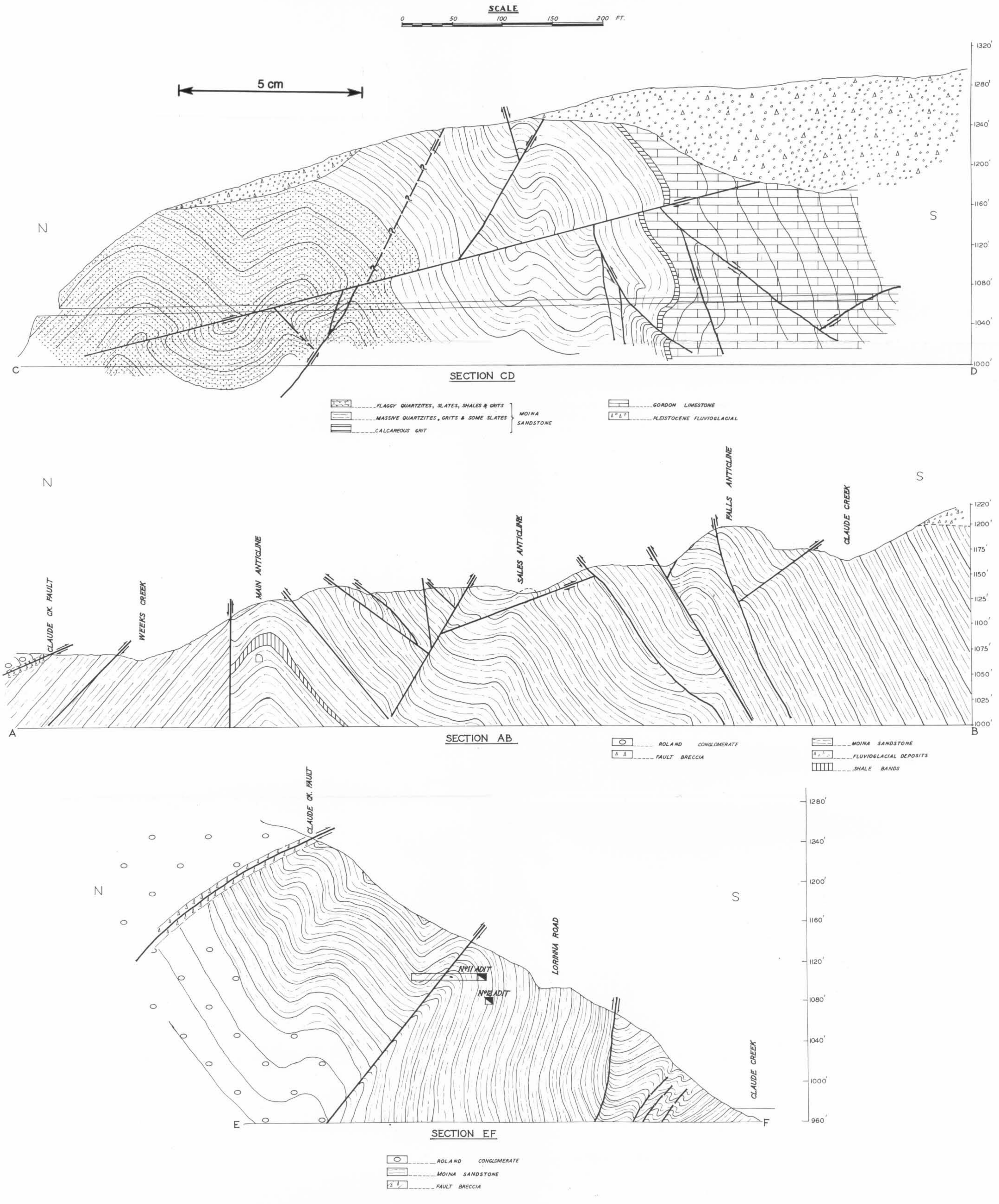


FIG. 14

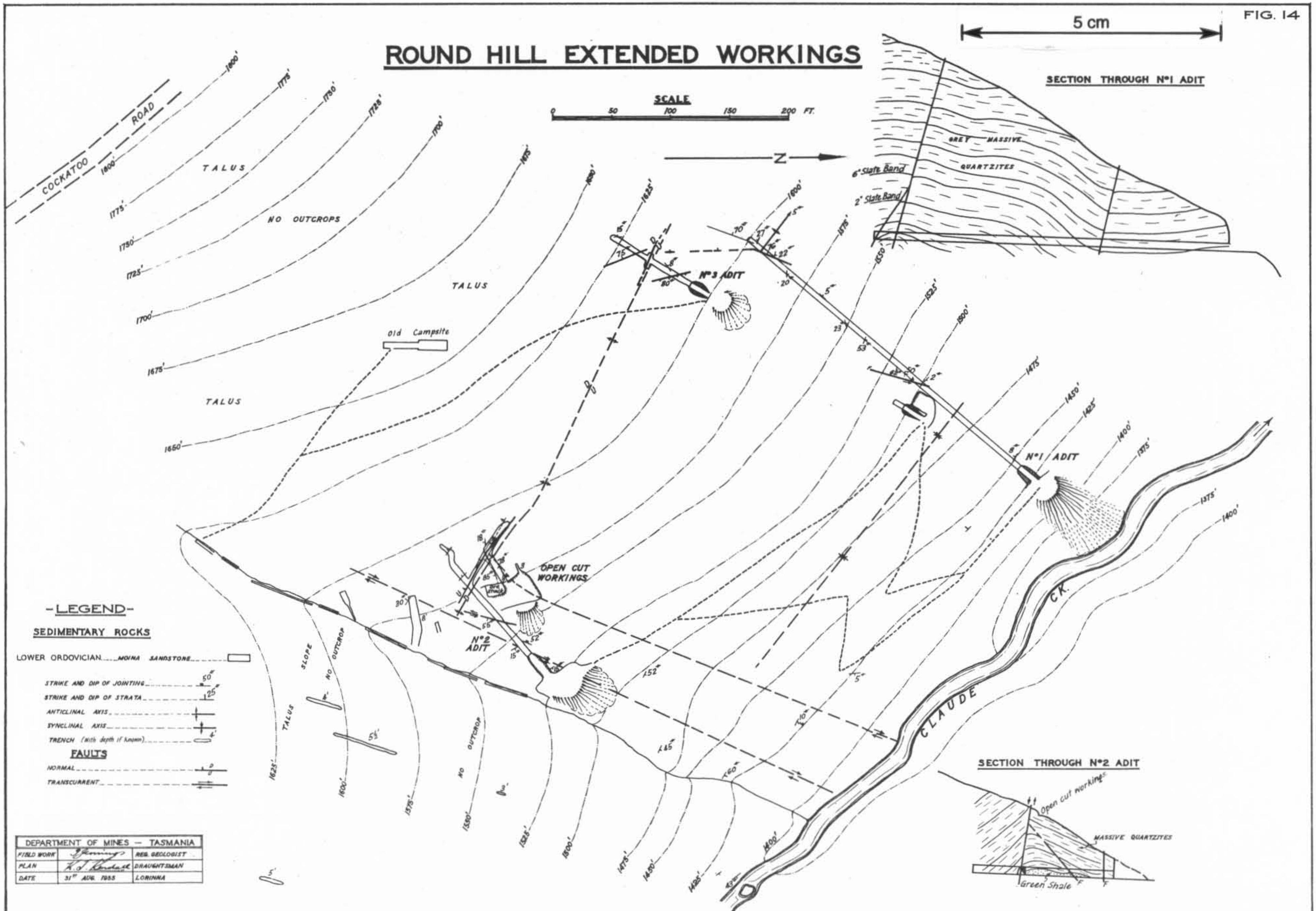
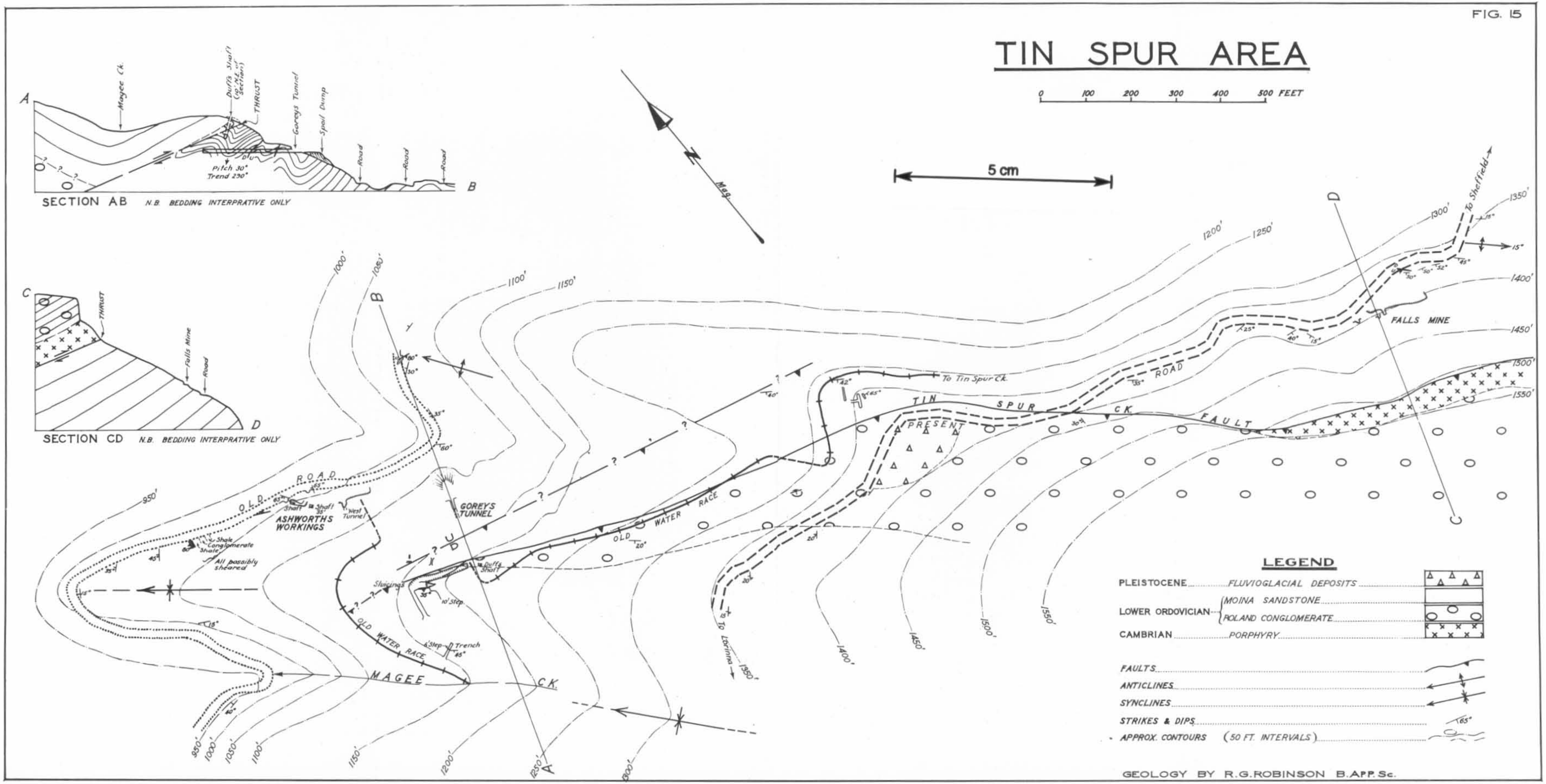

ROUND HILL EXTENDED WORKINGS
5 cm
SCALE
0 50 100 150 200 FT.
Z
COCKATOO ROAD
TALUS
NO OUTCROPS
Old Campsite
N°3 ADIT
N°1 ADIT
N°2 ADIT
OPEN CUT WORKINGS
CLAUDE CK.
SLOPE
NO OUTCROP
SECTION THROUGH N°1 ADIT
GREY MASSIVE QUARTZITES
6" Slate Band
2" Slate Band
SECTION THROUGH N°2 ADIT
Open cut workings
MASSIVE QUARTZITES
Green Shale
-LEGEND-
SEDIMENTARY ROCKS
LOWER ORDOVICIAN MOINA SANDSTONE
STRIKE AND DIP OF JOINTING
STRIKE AND DIP OF STRATA
ANTICLINAL AXIS
SYNCLINAL AXIS
TRENCH (with depth if known)
FAULTS
NORMAL
TRANSCURRENT
DEPARTMENT OF MINES — TASMANIA
FIELD WORK
REG. GEOLOGIST
PLAN
DRAUGHTSMAN
DATE
31ST AUG. 1955
LORINNA

FIG. 15

TIN SPUR AREA



GEOLOGY BY R.G.ROBINSON B.APP.Sc.