PROGRESS REPORT

ON

THE PORT DAVEY - COX BIGHT AREA

BATHURST
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INTRODUCTION

Regional Geological Survey on the Port Davey - Cox Bight Area started during October 1954 and has proceeded intermittently to the present date. The boundaries of Port Davey - Cox Bight area was defined by the then Director of Mines, Mr. W.H.Williams as follows:-

"Starting from New River Lagoon along the south coast to South West Cape and thence north along the west coast through Port Davey north up to 43° 7' 30" latitude south and thence along the above parallel to Arthur Ranges, just below Mt. Hyes and then along the western parts of the Arthur Ranges via New River to New River Lagoon, the point of commencement, a total area of approximately 850 square miles."

To present date, the south west part of the above area of approximately 230 square miles with the following boundaries:-

"Starting from Port Davey itself proceeding along the Channel to East Bathurst H. and thence along Moulter Cove, Ray River, Cox Bight - Red Point, thence along the south coast up to South West Cape and then north along the west coast up to Port Davey the point of commencement,"

has been more or less completed.

The whole area is divided into map sheets, each map squares in size (10 by yards). These are numbered and lettered according to the State Mineral investigation plan.

To make possible the above Regional Geological Survey at the S.W. part of the above area, maps have been produced from air photos by the Mines Department, with the help of old surveys and surveys done by Robinson during June, 1955. Two scale maps have been produced, one scale of 20 chains to the inch and the other 1 inch to a mile.

To enable further scientific geological surveys and mineral research, new topographical maps should be produced of the remaining area.

ACCESS

Access within the Port Davey - Cox Bight Area is confined solely to water ways, tracks and occasionally to landing strips on the beaches.

(a) Port Davey - Channel, Bathurst Harbour - Melaleuca Inlet, Long Bay and Moulter Cove are the main waterways navigable for all fishing crafts. Port Davey - Channel and Bathurst Harbour are navigable for all ocean going vessels.

(b) Bathurst Harbour Mines Department Establishment, on Melaleuca Inlet and Kings Place Tin Area on Moth Creek can be reached by fishing craft passing from Port Davey through the Channel, Bathurst Harbour and Melaleuca Inlet.

(c) All places along the sea coast, during calm sea, can be reached by fishing boats.

(d) The interior can be reached from Bathurst Harbour rivers, Inlets, by B. Moor track and from Long Bay by A. Marsden Track. The above tracks are heavily overgrown in places.

(e) The only track in use, is the 8 mile track connecting Cox Bight with Kings Place.

(f) In 1955, D. King started an airstrip at Kings Place, which should be completed by 1957.

TOPOGRAPHY

The main drainage of the northern part of the South West is effected by the four "consequent" rivers, namely the Davey River, Spring River, North River and the Old River, all flowing to the south. The southern part of the South West is drained by three smaller rivers, namely the Melaleuca, Moth Creek, and Ray River. All the rivers are flowing into Bathurst Harbour, except the Davey River, which drains into Payne Bay. The only bigger river flowing directly to the sea is the Louisa River at the South East. There are many small creeks flowing directly to the sea, mostly unnamed.

As regard to the land forms, the chief features of the South West Area are the South West Cape Ranges (two parallel running) (2,600 ft.), the New Harbour Range (1,680 ft.), Bathurst Range (2,600 ft.) Ray Range (2,800 ft.), Spero Range (2,000 ft.) and its northern prolongation separated by Old River - the Norolds Mountains (3,000 ft.) and the Iron Bound Range (4,000 ft.) At the Northern part, there are minor groups of hills and ranges like the Mt. Rugby (2,520 ft.) Range, Mt. Berry Range (2,132 ft.) and De Witt Range at the extreme North West (2,800 ft.).

The major plain like country is confined in the northern part of the S.W. to the 4 northern rivers, (Davey, Spring, North and Old Rivers) and in the southern part of the S.W. to Cox Bight - New Harbour up to Bathurst Harbour, Ray River - Moulters Cove and a small plain north to Horseshoe Inlet.

The topography has been modified to a certain extent by the "Pleistocene" glaciation. [redacted] Evidence of glaciation can be seen at the Norolds Mountains with its glacial "debris". [redacted] The most characteristic feature of this glaciation is the conglomerate, scattered around many places. [redacted] The land forms do not show any appreciable rejuvenation, as it is the case, for example, at the Zeehan - Rosebery district. However, there is evidence in many places that the land has risen, and the sea receded in recent geological times.

VEGETATION

Vegetation in general shows a direct relationship to the rock types. The quarts and quartzites covering the major part of the South West are barren, except for a few valleys and gullies which are timbered with mixed Eucalypt types almost always

associated with "Bouera" scrub. The "fluvio-glacial" plains support only button grass. In the schists, shales sandstones and softer type of conglomerate zones, we find the typical West Coast rain forest with its myrtles, eucalypts, leatherwood, occasional blackwood and wattle. Nearly the whole of the West, South and north of the South West is barren. All major vegetation is confined to the eastern parts of the South West.

MINERAL OCCURRENCES - In the Port Davey - Bathurst Harbour - Cox Bight Area.

Within the boundaries of the South West (Port Davey, Bathurst Harbour, Ray River, Cox Bight) now under investigation, the only minerals occurring in commercial quantities are tin and probably Wolfram from Buoy Creek; - recently discovered. The latter one requires further investigation to prove its commercial value.

Tin occurs as Cassiterite in the Alluvials and fluvio-glacials of the three main tin fields, namely, the Cox Bight, the Ray River and the Moth Creek. All these Tin fields and in particular Cox Bight, have been well described by four Government Geologists, namely, W.H. Twelvetrees - "Report on Cox Bight Tin Field" dated 5th December, 1906; P.B. Nye - "Report on Cox Bight Tin Field" dated 2nd February, 1927; McIntosh Reid - "Report on Cox Bight Tin Field" dated 22nd May, 1928; and by M.Z. Stefanski - "Report on Tin Deposits of the South West" dated 22nd July, 1957.

During recent geological investigations at Cox Bight area I found the Tin associated with Quartz and Quartz Mica Greisen veins, in three different formations, i.e. in the schists, quartzitic sandstones, Quartzitic schists, as well as in the Granites. As the Cox Bight, Moth Creek and Ray River Tin Fields have been already well described by the abovementioned geologists, it is therefore not proposed to describe it fully once more in this Report.

OTHER MINERAL OCCURRENCES

Lead-Zinc and Antimony from Moth Creek area. Apart from Tin, Sphalerite, Antimony and Galena are found in small quantities in Quartz veins and veinlets, exposed over 60 - 70 ft. length in recent D. King workings. As the Moth Creek Tin Field is mineralised, so further research with diamond drilling may give some results, as the deeper rocks could prove to be a better host rock for Zn and Pb and Sb deposition.

Pyrites is found approximately ½ of a mile South of Kandall Creek on the Eastern shore of Hannant Inlet, stretched along the beach. No Pyrites has been found here in situ. A smoky Quartz is also found in the same area. The pyrites is "string-like" in appearance.

Pyrites is also found in the black schists from upper Window Pane Creek.

Pyrites has been found in small veins and veinlets in the schists and quartz veins at Black Bluff (East Cox Bight) schist formation.

Copper Pyrites is found in black schists along the eastern shore of Bathurst H. Island Bay on Fairy Tale Head peninsula. It is a small occurrence and except for scientific interest has no economic value.

Tin, in small quantities, has been found along the plains on both sides of Melaleuca Inlet, up to Bathurst Harbour southern shores.

Tin has been found also in a creek at Wilson Bight with small amounts of Molybdenite.

Wolfram. Recently wolfram has been discovered by the author and his assistant, G. Fowles, close to the confluence of Billi Archi Creek and Buoy Creek, in the adjoining hills. Here, Wolfram occurs in Quartz veins and veinlets in Quartzites interbedded with thin greenish schists, running NNE - SSW over a distance of approximately ¾ mile long and nearly a ¼ mile wide at its southern end. Further investigations are needed to prove the value of this Wolfram Field.

Molybdenite has been found in thin veinlets and specks in minute quantities in the Quartz veins amongst the Granites at Cox Bight.

STRATIGRAPHY

S. West Tasmania is built chiefly of probable Pre-Cambrian and Cambro-Ordovician (?) rocks. These have been divided into several groups locally named, including very often some stratigraphic formations of each other. The Pre-Cambrian unfossiliferous rocks are the metamorphosed and deformed siliceous and aluminous sediments, outcropping over the major part of the South West. They underlie disconformably the sandstone conglomerates along the Channel and South Bathurst Harbour.

Lithology and structures have been taken into consideration in correlation of different stratigraphic formations. Here are the groups from the oldest to the youngest as follows:-

1. RED POINT GROUP

This is defined as that group of schists, quartzites, schistose sandstones, hornblende-zoisite schists and black schists outcropping between Red Pt. and Contact Bay. It is divided into three formations: The Red Point, East Cox Bight and Ketchem Bay Formation.

(a) The Red Point Formation: Proceeding Westwards from Red Pt. there are approximately 2000 ft. (raw guess) of Quartz-Mica-Garnet with Almandine-schists and with Hornblende-Zoisite schists as intrusives. The lower limit of the above schists is not known. These schists are interbedded with lenses of grey-yellowish Quartzites. Garnet porphyroblasts are up to ¼" in size. These rocks are typical products of medium grade metamorphism. In some places (as Red Pt. itself) these rocks have been discoloured (reddish or yellowish) due to weathering of Biotite, which released oxides of Iron, thus when mixed with clayey and micaceous material in the weathered rock resulted in reddish and yellowish colouring.

(b): Upwards stratigraphically and westwards geographically, this lustrous coarse Mica-Garnet formation passes into East Cox Bight formation - more medium grained Quartz-Mica-Biotite-Garnet schists, interbedded with lenses of schistose sandstone and quartzites. In weathered and decomposed rocks, smaller garnets are often limonitised. These formations may be 300-400 ft. thick and pass into (c) Ketchem Bay Formation of black grey-greenish and black schists composed of Mica-Biotite and Graphite schists and Phyllites of some approximate 200-300 ft. thickness. At Contact Bay this formation passes conformably into so called Quartzite-Argillite formation (Contact Bay - Bridge Pt.) of Contact-Zebra Bay. At approximately ½ mile North NORTH WEST of Black Bluff, the same formation of rocks passes through grey and light grey Mica-Sericite schists into the so called "Quartzite-Argillite" formation.

The Red Pt. (Contact Bay) group could be correlated lithologically with A. Spry's probable middle and upper Joyce Group and lower and middle Franklin Group.

Similar rocks to Red Pt. (Contact Bay) Group - East Cox Bight Formation - have been found and reported from Elphinston to Earl Points (Port Davey). The same formation of rocks is well exposed from Black Bluff to Boat Harbour, with approximate thickness of at least a few hundred feet.

The Ketchem Bay formation is recognised immediately West of Black Bluff and Boat Harbour. It has been traced along the NNE running elevation from Black Bluff through Buoy Creek to Upper Lenna Creek, where there is Biotite, Muscovite and Cordierite schists and then in Cascade and Ambrose Creeks, where the schists are with Chiastolite, similar rocks are known from Central North East Moulter Cove, North of Fulton Bay, Dixon Bay, along the South Western outlet from Horseshoe Inlet, from Wilson Bight, Ketchem Bay and Hidden Bay. The stratigraphic position of the abovementioned rocks, in relation to the overlying one, is nearly almost the same.

2. WILSON BIGHT GROUP

This Group of rocks consists of two lithologically and stratigraphically different rocks, namely Phyllites and Schists, belonging to Ketchem Bay formation of the Red Pt. group and of Mica-Sericite schists, slates, argillaceous sandstones, shaly sandstones, phyllites, quartzitic schists and Quartzites (light yellow coloured) of the Contact Bay - Bridge Pt. formation of Wilson Bay Group, and of Quartzitic schists, Quartzites and Massive Quartzites of the South West Cape Ranges formation.

The Contact Bay - Bridge Pt. formation has been called by the writer a Quartzite-Argillite formation on account of its lithological composition. To this Contact Bay - Bridge Pt. formation, the Contact-Zebra Bay Quartzite Argillite formation is mentioned here as a typical one, but as the same formation occurs in so many places, often without any name, so the writer painted the above formation with light yellow colour on the geological map. The thickness of the above formation may be approximately 700 - 800 feet. The immediately overlying Quartzites, sugary quartzites to massive Quartzites, range in thickness in different places from few to over 400 ft. approximately.

7.

This Contact Bay - Bridge Pt. formation and the S.W. Cape Range formation of the Wilson Group could probably be correlated with the upper Franklin group and with the whole of Spry's Mary Group, on lithological grounds only. The Wilson Bight middle and upper formation shows only a low grade metamorphism and much less deformation.

The lower Contact Bay - Bridge Pt. formation consists usually of light coloured Quartz schists, light to dark grey fine grained soft lustrous phyllites, with strong cleavage, generally parallel to bedding which is rather poorly developed. Phyllites are often invariably crenulated with white Quartz lenses along cleavage. In thin sections the replacement nature of the Quartz lenses can be observed. It is very likely that the Quartz schists have been formed by silicification of Phyllites, as they are not persistent and disappear rapidly along the strike. There is a possibility that some of the massive Quartzites and Quartz schists may result from silification.

There are also argillaceous sandstones and quartzites interbedded with slaty phyllites and thin beds of Mica-Sericite schists. Sandstones are chiefly micaceous. In some places with ripple marks.

A porphyritic dolerite (Hornblende Lamprophyre) intruded the Ketchem Bay formation of the Red Pt. Group and also the Contact Bay - Bridge Pt. formation of the Wilson Bight group.

The S.W. Cape Range formation consists chiefly of fine grained massive well-bedded quartzites and quartzitic schists. Quartzites show often cross bedding and ripple marks. Some massive quartzites are nearly pure quartzites, showing a little muscovite and Iron ore. These are very little contorted.

3. THE VARVOID BAY GROUP

This group of rocks is represented by a similar formation of rocks from two different places, one from Finger Peninsula - Clyte Bay area and the other from South Bathurst - Varvoid Bay.

The South Bathurst - Varvoid Bay rocks are faulted slightly across the strike on its eastern side, and lie disconformably over the Contact Bay - Bridge Pt. formation on its western side. This group of rocks consists of grey to ash grey slaty shales with mud cracks interbedded with argillaceous sandstones and conglomerates towards the top of the formation, probably disconformably. It is well folded, forming tightly folded synclines and anticlines, with steep easterly dips and southern plunge under the overlying sandstone - conglomerate. The slaty shales here resemble Varvoids, due to their very fine stratification.

There is a similar formation to the above at the Finger Peninsula and Clyte Bay area. Here lithologically the argillaceous rocks contain a bit more arenaceous material and some pebbles (up to 1" in diameter), have been found among the slaty shales, suggesting glaciation during that period. Here again the upper horizon is interbedded with coarse conglomeratic sandstones and conglomerates in places disconformable with the slaty shales.

This group of rocks could probably be correlated with the King Island - Zeehan and South Australian Tillites. It is probably the same stratigraphic equivalent as the Archer Creek siltstone (Cowrie). Stratigraphically, this group of rocks may be placed towards the top of Wilson Bight group, Contact Bay - Bridge Pt. formation, and probably (bottom) to the base of S.W. Cape Ranges formation, as it overlies the Contact Bay - Bridge Pt. rocks.

4. FAIRY TALE HEAD GROUP

This group is divided stratigraphically into Lower "Beattie" formation and upper Fairy Tale Head, coarse conglomerates and Breccia conglomerates. The lower Beattie formation of Fairy Tale Head and Mt. Beattie itself consists of sandstone-conglomerates very often with stretched pebbles, where the upper Fairy Tale Head formation, of Balmoral Hill, Mt. Rugby, Berry, and North Western parts of Fairy Tale Head, consists mostly of coarse conglomerates often forming breccia conglomerates.

These conglomerates are either soft or well silicified in places and hard, softer argillaceous conglomerates occur North of Balmoral Hill and East of Mt. Beattie. The harder silicified conglomerates occur at Balmoral Hill and between Horn peninsula and Dixon Bay and have more regular strikes than the softer ones. The whole series of sandstone-conglomerates and coarse conglomerates is plunging in general to the North West and so, "eo ipso" are thickening in that direction. Mt. Rugby, Mt. Berry, and Mt. Misery, North of the Channel and Mt. Beattie and Balmoral Hill South of the Channel are built of conglomerates.

SUMMARY

The rocks of Port Davey - Bathurst Harbour, South West and Cox B.. area range in age, from probable Middle Pre-Cambrian through Ordovician to Devonian and include both sedimentary and igneous rocks. Four distinct groups of Sedimentary rocks with two or possibly more disconformities have been recognised:-

1. The Red Point Group
2. The Wilson Bight Group
3. The Varvoid Bay Group
4. The Fairy Tale Head Group
5. The Granites
6. Alluvium and Diluvium

1. The oldest Pre-Cambrian rocks are represented by the Red Pt. (Contact Bay) Group of rocks, with its three distinct formations. These rocks consist of impure sandstones and shales regionally metamorphosed to a medium grade. There are two outcrops of probable basic igneous intrusions metamorphosed to Hornblende-Zoisite schists intruded into Red Pt. formation and East Cox Bight formation; one cropping out at two places between Red Pt. and Contact Bay and the other ones found as boulders and pebbles on both sides of Eric Pt. (see maps). The basic metamorphosed rocks found on both sides of Eric Pt. are more or less hybridised by granitic intrusions and probably by siliceous sediments. Here, they intruded the East Cox B. formation and probably the lower part of Ketchem

9.

Bay formation. (Judging from samples found along the beach on kelp).

The East Cox B. formation of rocks have small intercalations of Quartzites and schistose sandstones. It is anticipated that a weak orogeny occurred towards the end of Ketchem Bay formation, as the overlying rocks are less folded and crumpled than the underlying. A minor unconformity is suspected between Ketchem Bay formation and Contact Bay - Bridge Pt. Formation.

2. The next group of rocks, the Wilson Bight, consists of Ketchem Bay formation of the previous group, of Contact Bay - Bridge Pt. Formation called the Quartzite-Argillite Formation, and of South West Cape Ranges formation. The Contact Bay-Bridge Pt. formation is called by the writer the Quartzite-Argillite formation, as it is built of phyllitic shales, slaty shales interbedded with bands of Quartzites and Micaceous Quartzitic schists interbedded occasionally with thin mica-sericite and chlorite schists.

Morphologically this formation builds usually foothills of mountains, hills and undulating plains.

Along the East and West Cox B. beaches there are pebbles and boulders of porphyritic Dolerite (called by Twelvetrees and G. Everard Hornblende Lamprophyre) intruded into the Quartzite Argillite formation?

On the eastern part of the Melaleuca peninsula there is a small outcrop of sheared feldspar porphyry intruded into Contact Bay - Bridge Pt. formation. By analogy with similar rocks from the West Coast this intrusion should be of probable Cambrian age. The (Quartzite-Argillite formation) Contact Bay - Bridge Pt. formation passes into S.W. Cape Ranges formation built of Quartz-schists often micaceous Quartzites and massive Quartzites. The boundaries are very difficult to recognise as very often the Mica-sericite schists and phyllitic schists pass along the strike into silicified rocks, forming siliceous phyllites and micaceous Quartzites, often fine banded (platy appearance). The S.W. Cape Ranges formation builds the highest mountain ranges in the S. West of Tasmania. It is the most siliceous one and probably the most silicified formation of rocks in this district. Both upper formations of the Wilson Group are mountain building, and are well recognised as a distinct group of rocks in the relief of the country. They cover the largest parts of the South West of the Island.

The South West Cape Ranges formation is overlain here by few dispersed patches of conglomerates, right at the top of the mountains. Further investigations are needed to explain their stratigraphic position and origin.

It is interesting to note that there are many rock formations and, in particular the South West Cape Ranges formation, which have been partly or totally silicified over considerable areas, as well as over appreciable vertical distance. There is a probability that the big covers of conglomerates preserved still in patches over the South West Cape Ranges were supplying silica downwards.

3. Varvoid Bay Group (South Bathurst H.). The so-called varvoid or varved shales, slaty shales, interbedded with argillaceous sandstones, sandstones and conglomerates at its higher stratigraphic horizon, overlie disconformably the Argillite-Quartzite formation at Varvoid Bay, between Moulter Cove outlet and the Horn peninsula. On geological maps this formation is coloured light yellow with parallel purple lines. This formation is tightly folded with steep eastern dips, plunging southwards under the sandstone conglomerates. There are beautiful mud cracks in this formation.

A similar formation of rocks occurs on the southern side of the Channel Narrows, opposite Ila Bay at Clyte Bay and Finger Bay. Here the upper part of this formation is interbedded with slaty shale argillaceous sandstones and sandstone-conglomerates. Few pebbles have been found in the slaty shales and argillaceous sandstones, suggesting a glacial period (Tillite).

4. Fairy Tale Head Group is represented by sandstone conglomerates overlying the Quartzites and Quartzitic schists of the S.W. Cape Range formation and the schists of the Ketchem Bay formation at Fairy Tale Head peninsula, at Fulton Hill and Mt. Beattie. These rocks are folded forming Synclines and Anticlines. They are overlain disconformably by coarse breccia conglomerates and conglomerates forming hills and mountains, like Mt. Rugby, Berry, Misery and Balmoral Hill. As the sandstone conglomerate and coarse conglomerates plunge in general to the North West, so they "eo ipso" are thickening in the above direction. As the conglomerates are lithologically similar to the Owen ones, so it is possible that they may be of the same age? Up till present, no other sedimentary rocks except Diluvials and Alluvials are known from this district.

5. Pleistocene-Fluvio-Glacials. Gravels and boulders forming terraces of different levels are known from North-Eastern part of Cox Bight. They form the plains between Cox Bight New Harbour and Bathurst Harbour, they form the Ray River Valley, Horseshoe Valley, and valley East of Hannant Inlet and also smaller terraces like that at Falls Creek, Window Pane Creek and many other unnamed places, marked on the geological maps. The thickness of the terraces ranges from a few inches to as much as 30 ft. The age of the Fluvio glacials is regarded as Pleistocene.

6. Recent. Recent deposits consist of Alluvial gravels, sands along the courses of the streams and rivers and sand dunes along parts of the West and South coasts of "Eolic" origin, some occurring at a height of 900 ft. a.s.l. (like that East of Window Pane Bay).

IGNEOUS ROCKS

(a) Sequence of Igneous Rocks

SYSTEM	FORMATION
Devonian	Cox B. Granite S.W. Cape Granite
Cambrian?	Feldspar Porphyry
Upper Pre-Cambrian?	Porphyritic Dolerite (Hornblende Lamprophyre)
Middle Upper Pre-Cambrian?	Hornblende-Zoisite Schists
Middle Pre-Cambrian?	

(b) Granites

There are two kinds of Granites occurring within the district. One of these is that known long ago from Cox Bight. This is a medium grained Palingenetic granite, containing Quartz, Felspar (Plagioclase and Orthoclase) and Biotite. The peripheries of this Granite are soft due to weathering and possibly also-to mineralising solutions. They are granitic apophyses intruded into the Quartz schists, on the western side of Eric Peninsula. Veins of Quartz and Greisen carrying Molybdenite and Tin have been found. It is possible that this Granite is intrusive into Quartzites, Quartzitic schist and blackish grey schists and may be of Devonian age.

The other Palingenetic Granite occurs at the S.W. Cape peninsula. The intrusive nature of this Granite into schists and schistose Quartzites has been proved by my recent investigations. It is a very coarse Granite of pegmatitic nature, containing Quartz, Felspars, Biotite and Muscovite. The latter one especially close to the contact with the schistose rocks is known. This Granite resembles the Granite from Zeehan district - The Heemskirk Granite. The S.W. Cape Granite contains nodules of Tourmaline and Quartz veins. In this Granite, it can be seen, even far from the contact, the partly digested and undigested schists (green, black and grey schists) as inclusions of neighbouring rocks. It is rather interesting to follow the contact with the schistose silicified or partly silicified rocks. Where the Granite flowed over the schistose rocks, there is no wide effect of silicification or mineralisation at all, but where the Granites underly the above rocks a classical example of silicification can be observed for a short distance only from the Granites, and Pyritisation with other minerals can be observed at a much greater distance from the contact.

Further, it is also interesting to note that the granite has all the main cleavages observed in the Quartzite-Argillite formation of the adjoining rocks, suggesting an intrusion prior to the last orogenies. As there are no younger rocks anywhere than the Quartzite Argillite formation of rocks into which the Granite intruded, it is difficult to state the age of this Granite. However, a Devonian age is assumed. This Granite extends Northwards up to Rocky Pt. and probably under the shallow sea up to Port Davey and further as granitic rocks have been found attached to the kelp at Window Pane beach and further North on the two mile beach.

No tin mineralisation has been found so far in the immediate vicinity of this Granite.

(c) Porphyritic Dolerites (Hornblende-Lamprophyre).

Some boulders on the Western side of Eric Pt. peninsula, resembling porphyritic Dolerites are found. No outcrop has been found as yet. It is very likely that they intruded into the Quartzite-Argillite formation. W.H. Twelvetrees and G. Everard described the above rocks as Hornblende-Lamprophyre. W.H. Twelvetrees suggested a Devonian age. It is probable that the age of intrusion may be Lower Cambrian.

(d) Felspar Porphyry

Some sheared Felspar Porphyry a few feet wide has been found on the eastern side of Melaleuca peninsula, interbedded with the sandstones. It is suggested a Cambrian age for the above rock.

GEOLOGICAL STRUCTURES

Folds: These have been well defined on a regional basis from the produced geological maps and the two schematic cross sections, one along 648000N and the other one along 662000N parallel. The Red Point and Wilson Bay Group of rocks are isoclinally folded, especially the synclines with western dips in the South West Cape Ranges than over the two major anticlines - New Harbour - Melaleuca and New Harbour - Cox Bight - Black Bay, the dips are West and East and again in the synclines of New Harbour and Bathurst Harbour Ranges the prevailing dips are westerly, suggesting isoclinal folding. Most formations here show tight recumbent isoclinal folds and crenulations. It is characteristic for the South West that the synclines form the Major Ranges and the anticlines the major valleys and plains. The oldest rocks (Red Pt. Group) occur as cores to the folds, while the area is chiefly occupied by the Wilson B. group of rocks on the flanks.

There are two major underground elevations, probably cores of old mountain ranges running more or less parallel to each other in the direction, South West to North East. The first one starts from Open Bay through Canyon Creek, upper Melaleuca Creek, South of Moth Creek Tin Field along middle and upper run of Passage Creek and then along Fault Creek through Ray River, further to the North East; the second one starts from Window Pane Bay, runs through South Western part of Window Pane Creek, runs through Upper Alexander Creek, then through Lagoon Creek, Moulters Cove and then further to the North East. These two major underground elevations of a North Easterly direction disturb horizontally as well as vertically the regularity of the North-North-Western trend of the major synclinal and anticlinal axes, west of the line Cox Bight - Moth Creek - Melaleuca Inlet and the North North Easterly trend of the synclinal and anticlinal axes East of the above line. On both sides of the above underground elevations there are underground depressions which cause the synclinal basins to extend laterally (Eastwards in the South West Cape Ranges). These features can be seen well developed on both sides of each of the abovementioned underground elevations.

Only the massive Quartzites of the Wilson B. Group of rocks lack the cleavage which is developed usually parallel to the bedding of Quartz schists, mica schists, mica quartzites, phyllites and slaty shales.

There are different kinds of lineations developed in this area, which may be divided into two genetic groups - the older one, general lineation, and the younger one, the superficial lineation. The fine crenulation in phyllites, slaty shales, and mica schists, ribbing in quartzites, parallelism of hornblende laths in hornblende-zoisite schists and of muscovite flakes in mica quartzite are quite constant in directions throughout the area. In general this lineation is parallel to the axes of the isoclinal folds and also with the axes of the Anticlines.

Cross beddings and ripple marks are prominent features in the Wilson B. Group of rocks. In some cases it is rather difficult to ascertain whether the ripple marks are of sedimentary or tectonic origin. The massive Quartzites show distinct corrugation, where the ripple marks have been parallel to the lineation direction. All the Pre-Cambrian rocks here show abundant faulting, with several distinct sets of faults. In the majority of cases the displacements cannot be determined as the stratigraphic sequence is not known. The majority of faults shown on the maps has been recognised first on the air photos. Most difficult to prove are the strike faults which show no displacement in plan. They could be proven if the detailed stratigraphy was known. These faults appear to be quite common in the Pre-Cambrian rocks. To prove the presence of faults very often the minor structure, like contortion, drag dip, slickensides and crush breccias are only of a limited use, as first of all the rocks and in particular, the oldest one (Red Pt. group) are so contorted that contortion and drag in a fault zone is not often recognisable with certainty. Usually fold breccias are found in Quartzites, along small faults. Major faults in general, cannot be observed as there is no outstanding contortion, drag, slickenside or brecciation. Strike faults often separate beds dipping in opposite directions or the same direction, but in different amounts and so resembling an unconformity. A number of different faults are shown on the maps but only the more important ones are described below.

The whole country of the South West has two patterns of major faults. One type of fault is the one more or less parallel to the already mentioned underground elevations and depressions. These faults are the oldest ones and the deepest in nature. They are seldom well exposed in the younger formations of rocks and if well recognisable then they are usually the youngest one (renewed). These were the main faults which conducted mineralisation upwards in this country. One of the major faults is the South West Cape, New Harbour -Moulter Creek Fault running S.W. to N.E., but less exposed and the evidence of its existence can be seen from the courses of the creeks mainly. The next most important fault is that one running through Window Pane Creek, Alexander Creek, Melaleuca Lagoon Creek, and through an unnamed Inlet to Moulters Cove, S.E. of Ray River.

The other kind of fault is the younger set, more superficial, running often parallel to the strike of the main cleavage. As all of them are well marked on the geological maps it is needless to mention them in this report. Attention should be drawn to the places where the two kinds of faults are crossing each other in

favourable rock formations as such places could be usually more favourable for mineral deposition.

SEQUENCE OF GEOLOGICAL EVENTS

As the Cambro-Ordovician? sediments (varvoid slaty shales, sandstone conglomerate) and the Wilson B. - S.W. Cape Ranges formation of rocks are in this area folded and as the Pre-Cambrian rocks are here similarly folded, but to some higher degree, and as there is no evidence of a strong unconformity, it is therefore probable that the major part of the folding is Tyennian and Tabberabberan. The earliest sediments during Pre-Cambrian time were here under considerable load and were first subjected to horizontal forces acting in a couple, which resulted in an overthrust to the S.E. and underthrust to the North West. This resulted in folded and mildly metamorphosed beds, with schistosity parallel to the bedding and regional lineations. It is anticipated that a mild weak orogeny occurred during the end of Red Pt. - Ketchem Bay formation, as the underlying rocks are more contorted and folded than the overlying rocks of the next group.

About the definite age of the two types of faults already described above, again at this stage of work not much can be said, except that the older faults have been renewed several times during the time of different Orogenies and the younger one has been produced probably during the time of the two latest Orogenies (Tyennan and Tabberabberan).

CORRELATIONS

The Red Pt. group of rocks, comprising lower part of Wilson B. group, could be correlated on lithological grounds, with the A. Spry's - Joyce and Franklin groups.

Here there are similar basic intrusions, namely the Hornblende- Zoisite schists corresponding probably to the Amphibolite schists in the Joyce - Franklin groups. From A. Spry's description of Joyce group it is evident that the Red Pt. group would correspond only to the middle and upper parts of Joyce group and probably to Franklin group up to Raglan Quartzite, which will probably be a lower part of A. Spry's Mary group and middle part of Wilson Bight group (Quartzite - Argillite formation). The Joyce and part of Franklin group of rocks are better developed than the Red Pt. Group. As regards Spry's Mary Group it is probable that this group could be correlated with middle and upper Wilson Bight group. Here again it is obvious that the Wilson Bight group of rocks is better developed than the Mary group. The Wilson B. group occupies major areas in the South West. The Mary Group apparently lacks to a certain extent the middle formations of the Wilson B. group (Argillite - Quartzite form.), which is well developed at Cox Bight - Bathurst Harbour - Port Davey districts.

The Dolerites intruding the Franklin garnet schists along Bradshaw timber track are related to the Cooee Dolerites intruding the Cave Quartzites, Bluff Quartzites, Slate and Quartzite at Rocky Cape. These Rocky Cape formations may correspond probably to the Wilson Bight Contact Bay - Bridge Pt. formation (Spry's Mary Group). It could be probable that the Cooee Dolerite magma may be related with the Cox Bight Porphyritic Dolerites (Hornblende Lamprophyre)

(Twelvetrees probable Devonian age) intruded into Argillite-Quartzite Formation. On the eastern side of Melaleuca peninsula, there is a Feldspar-Porphyry intrusion. As this Felspar Porphyry is similar to that at Queenstown and Rosebery, the probable age of intrusion could be Cambrian.

Correlating A. Spry's stratigraphy of the Pre-Cambrians with the Pre-Cambrian stratigraphy of the South West (230 sq. miles) it is rather interesting that so many formations could be correlated on lithological grounds only. As in general, the lithology of metamorphic rocks have a wide extension, so here is the lithological similarity between Mt. Mary and the south west formations. It is rather strange that rocks with low grade metamorphism are in between medium grade metamorphic rocks - like the Mary group of rocks, which lies in between lithologically similar Joyce and Franklin groups, having also similar basic intrusions and the same degree of metamorphism. Further, there is no evidence of similarity to Joyce and Franklin basic intrusions in the Mary group, which is above Joyce and under Franklin groups. Taking into consideration the above facts and the similarity of formations between the South West and Mt. Mary area, I would like to suggest the revision of A. Spry's stratigraphy and place the Franklin group as a part of Joyce and Mary groups, as shown on my stratigraphic table.

Comparing A. Spry's Joyce-Franklin and Mary groups, with the Red Pt. and Wilson B. groups of the South West, it is obvious that the Franklin, and Joyce group in particular, have better exposed and developed its lower formations, than the Red point group, which has only its upper formations exposed and less developed. On the contrary, the Mary group seems to be less developed than the corresponding Wilson B. group, Contact Bay - Bridge Pt. and S.W. Cape Ranges formations of the South West, which have much better horizontal and vertical extensions.

<u>The Varvoid Bay Group</u> of rocks is rather unique. At present the stratigraphical position is still not well determined. This group of rocks overlies disconformably the Contact Bay - Bridge Pt. formation. It could be also possible, that the above group may overlie the S.W. Cape Ranges formation. As this formation has pebbles embedded in the slaty shales it suggests a glacial period. It could be correlated with probably the Cowrie Siltstone. This group vertically passes into sandstone - conglomerates and breccia conglomerates of the Fairy Tale Head group.

The Fairy Tale Head coarse breccia conglomerates resemble lithologically the Jukes breccia, and the conglomerates resemble the Owen conglomerate. Too little so far has been done to correlate the two above formations on lithological grounds only. It is rather probable that the Breccia conglomerates could be of upper Pre-Cambrian or Lower Cambrian age.

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2nd October, 1957.

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PETROGRAPHIC DESCRIPTIONS OF ROCKS BY G. EVERARD, MINERALOGIST & PETROLOGIST

7.12.56 - Specimens collected at Port Davey:

No. 5 East Melaleuca Peninsula, Bathurst Harbour:

Greenish-grey leucocratic or mesocratic rock. White euhedral phenocrysts of felspar up to 3 mm. long are plentiful, also anhedral dark green crystals and aggregates of ferromagnesian mineral. The texture is porphyritic, and the rock is somewhat sheared.

In thin section texture has been almost obliterated by alteration. The groundmass is a fine grained quartzo-felspathic mosaic in which the felspar has been completely altered to sericitic aggregates.

The felspar of the phenocrysts has been altered in the same way, so that only the outline of the original crystals is preserved.

The dark green aggregates consist of chlorite, but here alteration is incomplete, and occasional stronger birefringence and pleochroism indicate uralite. The acicular habit of many of these aggregates suggests that the original mineral was hornblende, and there is some evidence of ophitic texture in the unaltered rock.

The rock is a sheared felspar porphyry.

No. 9 Elphistone Point:

Dark greenish schistose rock with porphyroblasts.

In thin section the schistose texture is very marked, the oriented minerals being white mica, biotite and a black opaque substance that may be graphite. Lenticular aggregates of minute magnetite crystals are aligned with the platy minerals.

Porphyroblasts consist of quartz and garnet. The garnet is pale pink and typically cracked and shattered. It may be surrounded by quartz to form a lenticular aggregate.

Quartz also occurs in lenses that may be cracked, but the whole lens extinguishes simultaneously. Dark inclusions in the quartz are lineally arranged, and these lineations may be at an angle to the direction of orientation of the platy minerals in the rock, thus showing that the quartz crystals have been rotated. The garnet crystals also show signs of rotation. Plications occur in the laminations of the rock, which may be the foci of development of porphyroblasts.

The rock was a carbonaceous shale which has undergone intense thermo-dynamic metamorphism to a garnetiferous graphitic mica schist.

12.9.57 - Specimens collected at Cox Bight:

In general the series consists of siliceous and aluminous sediments, such as impure sandstones and shales, etc. that have been regionally metamorphosed. Nos. 11, 15 and 18, 19 are the basic igneous rocks forming part of the metamorphosed series; No. 1 is an igneous rock which intruded the series after metamorphism. There is some evidence of silicification in quartz veins and minute quartz stringers in some specimens.

No. 1 S.E. beach, W of Eric Point, opposite Cox Bight Camp:

Medium grained grey rock with felspar phenocryst up to 10 mm. across. A few irregular masses of quartz of similar size are visible together with dark needles of hornblende.

In thin section the groundmass has panidiomorphic texture and consists of minute needles and wisps of hornblende in a mass of felspar crystals. The felspar crystals are of two kinds, some lathlike with lamellar twinning identified with andesine, others stumpy with simple or no twinning and zoned so that the extinction angle gradually increases from the periphery to the centre.

Phenocrysts are of hornblende and felspar, the latter so altered to opaque material that further identification fails.

The rock is a hornblende lamprophyre.

No. 2 Boat Harbour, East Bay Cox Bight, metamorphosed contact along fault:

Fine grained white quartzite. An effect of fine bedding is given by thin bands of sericite, which show crumpling and are not actually continuous. A little biotite is also present. The quartz is completely recrystallised and there are small short quartz veins (say a centimetre long and a millimetre wide) that cut across the lineation and suggest silicification.

The rock is a metamorphosed arenaceous sediment.

No. 3 Scrub Point, Cox Bight. R2/892:

Finely banded fine grained, pale greyish quartzite. The bands are apparently flat and continuous.

In thin section the rock is seen to consist of fine bands of sericite and graphite separating coarser bands of interlocking angular quartz grains. The quartz grains may be separated by thin interstitial layers of muscovite or muscovite and graphite. Many quartz grains seem to have grown by the peripheral crystallisation of additional silica.

Extreme crushing and mylonisation followed by recrystallisation is indicated by the flat banding. The rock was originally a siliceous sediment with some clayey and organic matter.

No. 4 Interbedded with black schists, Boat Harbour, Cox Bight:

Weathered pale greenish or brownish rock with abundant mica and lenses of quartz.

In thin section quartz is more abundant than would appear in hand specimen. The rock is strongly sheared and plates of mica wrap themselves around lenses consisting of grains of recrystallised quartz. Both muscovite and biotite are present, the latter somewhat altered to chlorite.

The rock is a quartz-mica schist and results from the dynamo-thermal metamorphism of an aluminous and arenaceous sediment.

No. 5 East Beach, Cox Bight:

Pale grey, fine grained quartzite, very similar to No. 3; but graphite is comparatively rare, and although the rock is finely banded in a similar way, it is more massive and less apt to cleave along the bands. Jointing is more conspicuous in hand specimen than with No. 3.

The rock is of similar origin to No. 3 but contains less organic and possibly more clayey material.

No. 6 Travers Creek, Cox Bight:

Very fine grained pale gray foliated rock, with fine banding.

The rock consists of quartz and muscovite, together with a little biotite slightly iron stained and rarely altered to chlorite. It contains micro-augen of recrystallised quartz grains.

The rock is a fine grained mica schist, developed by dynamo-thermal metamorphism from a fine grained aluminous sediment containing a few sand grains.

No. 7 Scrub Point, East Bay, Cox Bight:

Another variant of the rock formation represented by specimens 3 and 5. In this example muscovite is almost as plentiful as quartz and renders the rock soft and friable on weathering. Fine white clay must have been present in considerable amount in the original siliceous sediment.

No. 8 Micaceous Sandstone in Black Schist, Boat Harbour, Cox Bight:

Pale greyish quartz mica schist. The mica is either colourless or somewhat reddish brown and pleochroic.

In thin section the rock is seen to contain about equal amounts of quartz and mica.

The specimen probably represents a variant of the rock of which Nos. 3, 5 and 7 are facies. However, the specimen is much weathered and mega structures are difficult to see in hand specimen.

No. 9 Scrub Point:

Gray schistose rock. In hand specimen the rock consists of elongated lenses of quartz 1 mm. or more, in thickness, between masses of mica.

In thin section the quartz lenses are seen to consist of masses of minute grains of quartz. However, some small lenses are flattened single crystals. Some andalusite occurs particularly associated with mica, as rounded grains showing cleavage and twinning. The muscovite plates are bent and folded on a minute scale. A few very small flakes of graphite occur in the masses of mica plates and give a dark colour to the rock.

The specimen is a quartz-mica schist. It illustrates the extreme dynamo-thermal metamorphism of a sediment containing about equal amounts of argillaceous and arenaceous material.

No. 10 Fault Zone, East Cox Bight:

Pale greenish grey foliated rock but stained brown with iron oxides.

In thin section the rock has a schistose structure with lenses of quartz mosaic and lenses consisting of single crystals of andalusite, wrapped round by muscovite mica, usually stained brown with iron oxides, together with a little biotite and chlorite.

The rock is an andalusite schist, and results from the metamorphism of siliceous and aluminous sediments.

No. 11 Cox Bight on route to Camp:

Medium to fine grained greenish gray rock with euhedral pink garnets about 1 mm. across. The rock is somewhat sheared.

Thin section shows porphyroblasts of garnet and zoisite in a fine grained granular ground mass of zoisite and hornblende. Quartz tends to be associated with garnet, and some garnets are associated with biotite. Possibly the garnet has been altered to chlorite and the biotite formed from chlorite, by further metamorphism.

The rock is a fine grained garnetiferous zoisite-hornblende schist formed by the metamorphism of a basic igneous rock, and hybridised by siliceous sediments.

No. 12 Stinking Bay, East Cox Bight:

The rock is a fine grained white quartzite with fine gray bands.

Besides quartz the specimen contains white mica and a little graphite, the alignment of which gives the finely banded appearance. This banding is due to metamorphic action rather than original bedding. The rock has been developed from a siltstone containing some organic and carbonaceous material.

No. 13 East Cox Bight Range:

Quartz sericite schist and quartzites.

These rocks are examples of the development of different types of rock from almost identical sediments under metamorphism. They contain quartz and sericite in pretty much the same proportions but in specimen 1 the laminae are crumpled whereas in specimen 2 they are almost planar. Specimen 3 is a coarser grained rock.

No. 15 Beach near mouth of Lagoon Creek Inlet, Cox Bight West:

This specimen is similar to No. 11, but has been weathered and exhibits shearing to a greater extent.

No. 16 North of Cox Creek:

The rock is a quartzite containing pyrite and arsenopyrite. There is a little pale yellow staining on the rock; but this seems to be due to oxides of arsenic.

No. 17 Black Bluff:

Grayish rock with shining flakes of muscovite, lenses of quartz, and black laminae of graphite. The specimen is covered with small holes whence crystals have been weathered out, iron oxides sometimes remaining.

In thin section the texture is typically schistose and tightly folded on a minute scale. Muscovite stained with iron oxides and darkened by laminae of graphite is the most prominent mineral and encloses lenses of recrystallised quartz grains. Neither ilmenite nor rutile were observed.

The small holes filled with opaque limonite enclosing occasional minute grains of quartz, judging from their shape, must have contained crystals of garnet.

No. 18 Basic dyke, South East of Contact Bay:

Schistose greyish green rock, with white patches up to 5 mm. long which appear to be weathered crystals of felspar. Green crystals of amphibole showing lustrous cleavage faces, are of about the same size and render the rock rather coarse grained.

In thin section the texture is xenoblastic. The large felspar crystals are weathered to opacity; but smaller irregular crystals and grains are quite fresh. Hornblende appears in laths and irregular distorted crystals pleochroic in green to brown. There is a little garnet in irregular grains and zoisite or clinozoisite is fairly common.

The rock is a hornblende-zoisite schist, and is probably a metamorphosed basic igneous rock.

No. 19 Basic dyke halfway between Contact Bay and Red Pt:

Medium to coarse grained greyish green schistose rock, containing bladed crystals of hornblende.

In thin section a poikiloblastic texture is shown, with large crystals of hornblende containing inclusions of zoisite, epidote, felspar and garnet. Veins of zoisite or clinozoisite cut through the large crystals of hornblende, otherwise the texture is a confused granoblastic aggregate. Garnet is xenoblastic.

The rock is a garnetiferous hornblende zoisite schist and has probably originated as a basic igneous rock.

No. 21 Red Point:

The rock is a garnetiferous mica schist. It has been much weathered and discoloured. Both muscovite and biotite are present, but biotite has suffered alteration in weathering, releasing oxides of iron. These when mixed with clayey and micaceous material in the weathered rock result in a reddish powder. The rock itself is probably the result of dynamo-thermal metamorphism of iron bearing sediments, such as an impure ferruginous sandstone.

No. 22 Red Point, West:

Mica schist containing almandine. No magnetite was found.

No. 23 Scrub Point:

White finely banded quartzite. White mica appears on flat cleavage planes forming the top and bottom of the specimen, and the banding results from a small amount of white mica in the quartzite itself, aligned under directed pressure.

No. 24 Ray River tin workings:

Quartz vein in quartzite mineralised with iron pyrites. The pyrite has been oxidised in places leaving brown limonite, but in most instances the pyrite has been completely weathered out leaving negative cubes and boxworks of silica.

No. 25 Upper Lenna Creek:

Dark grey banded rock, with crumpled bands, showing mica and quartz.

In thin section the rock shows foliation and crenulation. Lighter coloured bands consist of recrystallised quartz. The grains are angular, slightly elongated and aligned. Darker bands consist of biotite, muscovite and cordierite.

The rock is a schist which has been regionally metamorphosed, with development of foliation and recrystallisation, possibly followed by contact metamorphism and development of cordierite.

No. 26 Upper Lenna Creek:

Dark grey foliated and banded rock.

In thin section the specimen shows schistose structure with biotite and muscovite in a groundmass of recrystallised quartz. The banded appearance is due to graphite, and in the black bands are rounded crystals of chiastolite with graphitic inclusions.

The rock has been formed by metamorphism of an arenaceous rock, with carbonaceous and aluminous material included in it.

The rock is a graphitic schist.

No. 27 Umbrose Creek, North East of Ray River:

Two weathered and iron stained specimens, apparently of rocks represented by specimens 28 and 28a.

No. 28 Umbrose Creek:

Sheared, foliated greenish banded rock.

In thin section the specimen has a groundmass of fine grained recrystallised quartz, with aligned masses of bent plates of muscovite and biotite, partly altered to chlorite and stained with iron oxides. Rectangular somewhat rounded crystals of chiastolite up to ¼ mm. across are plentiful. Some graphite is also present within the mica plates.

The rock is a chiastolite schist.

No. 28a Umbrose Creek:

Similar to No. 28, but without chiastolite.

Locality - East of South East Bathurst Harbour:

White quartzite with a great number of fairly evenly spaced holes up to 1 cm. long. They are placed so that the longest and shortest direction are the same for each hole. When the rock is cut through some holes are seen to be still completely filled with a fine granular material somewhat darker than the rest of the rock.

In thin section the rock has the structure of a sheared quartzite. There is a fine grained groundmass of quartz grains in which are porphyroblasts of quartz all oriented the same way as the holes. Where these holes still contain material it is of the same texture as the rest of the rock; but contains in addition dark carbonaceous material. These carbonaceous masses are softer and more susceptible to weathering than the rest of the rock.

20.9.57 - Specimens collected at Port Davey:

No. 1 From Pebbly Beach:

Light grey, fine grained, sheared rock exhibiting faint banding. Minute shining flakes of mica are visible on cleaved surfaces, and the rock is soft and slightly friable.

In thin section a fairly uniform granular texture is given by grains of quartz and felspar .01 to .02 mm. across. The felspar grains tend to be elongated in a constant direction. The most prominent mineral is sericite, in aligned masses of minute flakes, which have a cloudy appearance due to close spacing of fine cleavage lines. Biotite is fairly common in scattered irregular masses of small flakes.

The rock is an arkositic greywacke.

No. 2 From Pebbly Beach:

Pale grayish-brown weathered, showing shearing and banding. Phyllitic Shale.

In thin section strong lineation is shown by bands of sericite and lesser biotite enclosing granoblastic quartz and felspar elongated in the shearing direction.

8.

No. 3 From Woody Island:

Pale brown, fine grained, sheared weathered rock, with shining flakes of mica on cleaved surfaces. The rock is finely banded and the bands are somewhat disturbed. One side of the specimen is slickensided.

In thin section the specimen is a mass of equidimensional grains of quartz and felspar up to .04 mm. across. The section is rendered cloudy by irregular masses of sericite which include the grains of quartz and felspar, and are stained brown by oxides of iron.

The rock is a more weathered and slightly coarser grained variant of No. 1.
