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Preliminary Report on Structure of Western Tasmania in Relation to Mineralisation

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PRELIMINARY REPORT ON THE STRUCTURE OF WESTERN TASMANIA IN RELATION TO MINERALISATION

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To: Mr. G.F. Hudspeth. 4th November, 1958.

Preliminary Report on the Structure of

West Tasmania in relation to Mineralisation.

1. Introduction

The first worker who attempted to relate the mineralisation of the West Coast to its regional structure was S.W. Carey, in 1953. Other workers have stressed the relationship of mineralisation to one of the major north-south components of the structure as expressed in the Lyell Shear, beginning with Twelvetrees (1901), Gregory (1905), Hills (1914), Conolly (1947), Bradley (1956), Solomon (1957), Campana (1958) and Wade and Solomon (1958).

The description to follow is a preliminary report and it uses principles which were established by Carey (1953). However, since that date a large amount of additional information has become available owing to the regional mapping undertaken in the exploration campaigns of 1956-58 and his ideas have been modified and extended in the light of this new data.

2. General Geology of the West Coast

It has been an established fact for several decades that the geology of Tasmanian ore deposits is dominated by the stratigraphy and structure of the Palaeozoic rocks. Consequently, something of this stratigraphy and structure must be discussed in order to provide a

background for the next section 3, which deals with the control of mineralisation.

A summary of the stratigraphy and structure is given in Table I and presented in the accompanying plate Q17a.

The structure, which in turn controls the distribution of the various groups listed in Table I, is controlled by two directions of folding which trend north-south and north west-south east respectively. These structures have been established by two distinct periods of movement.

A. Jukesian Movement of Tyennan Orogeny

This period of folding took place at the end of the Cambrian period and at this stage only the sediments of the Dundas Group had been deposited on the Precambrian. The folding was about north-south axes, paralleling the edge of the Precambrian Tyennan Block. This Block formed a stable unit in this and later periods of folding. The folding was not severe and resulted in the establishment of an anticline (Carey's Porphyroid Anticlinorium) which is sited immediately to the west of the syncline. This former structure in the Queenstown area corresponds to the Dundas Ridge of Bradley (1956). Between this Ridge and the edge of the Tyennan Block, a broad depression was formed which Bradley (1956) called the Jukes Trough. There is evidence which indicates that there was fault/folding movement on the Lyell Shear during this period.

B. Tabberabberan Orogeny

This period of folding took place in the Lower Devonian and at this stage several thousand feet of sediments belonging to the Eldon and Junee Groups had been deposited on top of the Dundas Group.

The folding resulted in the establishment of broad anticlines and

synclines (actually anticlinorium and synclinorium) with fold axes and associated faults trending NW-SE[i]. Nearer to the edge of the Tyennan Block folding was largely influenced by the existing north-south trends which had been established in the Jukesian Movement and although NW-SE structures can be found in this zone, the major structures follow the original pattern of north-south. This resulted in the establishment of a major anticlinorium within the zone which had previously been the Jukes Trough, forming two complementary synclinoria on either side, the King-Sophia structure to the east and the Rosebery structure to the west.

The influence of the NW-SE set of folds on the north-south set is readily apparent from plate Q17a. At their intersection the latter set can be:

A. Displaced (i.e. Hibbs-Thirkell and Osmund Anticlinoriums).

It is interesting to note that not only is the main north-south fold displaced but also the accompanying north-south fault zone known as the Lyell Shear.

B. Reversed in plunge, as at the Zeehan-Jukes and Thirkell anticlinoria.

C. Changed in type of folding. This can be seen in the overturned folds of the Jukes and Thirkell structures which have accompanying low angle thrusts on the east limb. North and south of the Dundas and Hibbs structures respectively the folding is open and symmetrical with an absence of thrusting.

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i It is not necessary to require dissimilar directions of pressure for the two different regional fold trends of NW-SE and N-S. It is considered that both could be related to variations on the general theme of the two "curved" Precambrian blocks (Tyennan and Arthur) relatively moving together.

A further interesting relationship is that at three of the four intersections (there is no detailed geological information available at the area required in the fourth intersection) an east-west fault of major importance trends into the Tyennan Block, after cutting through the north-south structural elements to the west.

3. Control of Mineralisation

A. Epochs of Mineralisation (also report G66)

Two epochs of mineralisation have been recognised on the West Coast of Tasmania. Loftus Hills (1914) established an early phase of magnetite/chalcopyrite related to the Jukesian Movement at the close of the Cambrian Period. Evidence since that date has confirmed his findings and such orebodies as Prince Darwin and Tasman Darwin would be included in this group. However, the major mineral deposits were emplaced after this epoch since they are controlled in part by sediments of post Cambrian age and structures related to the Tabberabberan Orogeny.

B. Favourable Country Rock

All of the major copper, lead/zinc and lead/silver sulphide deposits of West Tasmania occur in rocks of the Dundas Group, or in the immediately overlying sediments such as in the Owen Conglomerate in the Queenstown area, and the Gordon Limestone in the Zeehan district. The major tin deposits (Razorback near Dundas, Renison Bell, and Mount Bischoff at Waratah) are commonly associated with sediments of the Carbine Group.

Within this general lithological favourability, a regional pattern of structural favourability appears to be valid, as in the following section.

C. Structural Favourability

In order to present an idea of the amount of sulphide

mineralisation within these structures the recorded mineral production from several mines/areas is given in Table II.

A. NW-SE Structures

These are made up of synclinoria and anticlinoria:

(a) Synclinoria

The wide exposures of the Junee and Eldon Groups are preserved in the Zeehan and Huskisson Synclinoria. Both appear to contain a common type of mineralisation which is distinct from that of the associated Bischoff Antinclinorium.

(i) Zeehan Synclinorium

This structure contains the important silver/lead mineralisation of the Zeehan district and the zinc/lead of the Queensbery Mine further to the south. The most southerly known example of this type of mineralisation here is the small Strahan lead/zinc prospect on the Queenstown-Strahan road, some 20 miles to the south-east of Zeehan. To the north-east of Zeehan the silver/lead mineralisation of Mount Stewart, Cleveland and Magnet would be included in this structure.

(ii) Huskisson Synclinorium

The valuable zinc/lead deposits of the Rosebery-Williamsford area would be within the influence of this fold. To the north, the silver/lead prospects at Silver Falls and Lynch Creek would be on the same structure, also possibly the zinc/lead prospect at the Pinnacles and the pyrite at Chester.

The structural control exerted by this synclinorium is complicated by its close association on its east limb with

the Rosebery syncline. It is interesting to note that the sulphide mineralisation is restricted to this east limb of the Synclinorium and is absent from its west side. The double influence of these two folds would appear to have the following control on the distribution of mineralisation:

(a) At their intersection. The zinc/lead deposits of the Rosebery-Williamsford area.

(b) At their zone of mutual influence on the east limb of the Huskisson Synclinorium. The pyrite at Chester, zinc/lead at the Pinnacles and silver/lead at the Silver Falls and Lynch Creek Prospects.

(iii) Lewis Synclinorium

A third synclinal structure is suspected immediately to the north of the Lewis River, in the sediments of the Dundas Group. Here a syncline has been traced at the coast for approximately six miles, with its west limb removed by marine erosion. The sediments on the east limb contain two interesting airborne electromagnetic anomalies which will be investigated in the coming field season.

(b) Anticlinoria

The anticlinoria are defined by the absence, due to erosion, of sediments of the Junee and Eldon Groups, and the removal of a maximum amount of the Dundas Group. In some instances this erosion level has proceeded to sufficient depth to uncover the Precambrian basement, exposing inliers of these rocks as at Waratah and Dundas. Since serpentinites are structurally associated with the unconformity between the

Cambrian and Precambrian, the anticlinoria are the structures which would typically contain these ultrabasic intrusives[1].

(i) Bischoff Anticlinorium

The Bischoff Anticlinorium extends through the two inliers of Precambrian at Waratah and Dundas. The major cassiterite deposits are located along this axis as at the Razorback near Dundas, Renison Bell, Mount Lindsay, Wombat and Mount Bischoff in the north-east near Waratah. Also associated with this structure and the serpentinites is the copper/nickel mineralisation of the Five Mile Copper-Nickel deposit, to the south of Renison Bell.

(ii) Hibbs Anticlinorium

This structure trends through S.W. Tasmania and may possibly extend further to the north-west to include the outcrop of the Dundas Group near Strahan. Recent geological and geophysical work has established in this structure the existence of a belt of ultrabasic rocks which appears to be larger than that associated with the Bischoff Anticlinorium. Therefore, whilst there appears to be several points of similarity between these two structures, the investigation this summer of the several magnetic and electromagnetic anomalies in the Hibbs Anticlinorium will help to resolve if there is a similarity of mineralisation.

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[1] Two periods of intrusion of the ultrabasics have been recognised in Central & Western Tasmania. An early one which was associated with the Jukesian Movement at the end of the Cambrian Period and these are structurally emplaced near or along the Cambrian-Precambrian contact. A later one of post Lower Devonian age caused the migration of these serpentinites to a stratigraphically higher position, with their appearance in the sediments of the Lower Eldon Group.

B. North-South Structures

The close relationship of sulphide mineralisation to the Lyell Shear has been accepted for many years. Recent work has traced this shear from Elliott Bay in the south to Mount Darwin, its northerly continuation from this point is well known, through Queenstown, to the west of Lake Margaret and, after Carey (1953), northwards into the Stirling and Mackintosh River valleys. The shear is associated with a complex north-south trending anticlinal structure, as has already been discussed on page 3. The distribution of mineralisation along this shear/structural direction appears to be controlled by the NW-SE, and associated east-west, structures as follows:

(i) Copper mineralisation only is limited to the south of Red Hills, that is to the south of the intersection with the NW-SE Huskisson Structure. North of this structure the mineralisation becomes subsidiary copper with the major silver/lead, as at the Stirling Valley Mine and in the Mount Farrell field.

(ii) The areas at the intersection of these two structural trends are zones of particular interest, as follows:

(a) Intersection of Huskisson Synclinorium and Rosebery Syncline

As has already been stated the important zinc/lead deposits of Williamsford-Rosebery are considered to be in this zone.

(b) Huskisson Synclinorium - North to South Anticline[i].

At this intersection is the interesting prospect of Red Hills.

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[i] This structure in the past has been called the West Coast Range Anticlinorium (Carey, 1953). Recent work has demonstrated that this structure cannot

(cont. on p.9)

(c) Bischoff Anticlinorium - North to South Anticline

The copper deposits of Comstock and Queenstown are at this intersection. The associated east-west structure which trends into the Precambrian to the east is the Linda Disturbance.

(d) Zeehan Synclinorium - North to South Anticline

This intersection occurs in the lower part of the Gordon River valley, to the west of Eagle Creek. Since the north-south structure is in a plunge depression in this location, the rocks exposed are the upper Junee-lower Eldon Groups and direct observations on the favourable Dundas Group, which would lie at several thousand feet below the surface, is impossible. However, it is interesting to note the occurrence of the pyrite/hematite mineralisation in the associated east-west Eagle Creek Fault zone, which could be a leakage pattern from a more deep seated mineralisation.

(e) Hibbs Anticlinorium - North to South Anticline

This association is the structural, and lithological, counterpart of the similar intersection with the Bischoff Anticlinorium. This area, known as Moore's Valley, is covered with Tertiary sediments but the results of the recent airborne magnetic survey has demonstrated the presence of previously suspected NW-SE and E-W structures beneath this cover. The associated E-W structure is the Moore Fault zone.

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[i](cont.) be as continuous or as extensive as was originally thought and that the north-south anticlinal zone resulting from the Tabberabberan Orogeny is as shown on Q17a. At this stage it is not intended to give this structure a specific name. However, a name is desired which includes in its definition the north-south folding and north-south faulting (i.e. Lyell Shear).

In summary, on this section, there are five known points of intersection of the two regional trends. Two are the location of active mines (Electrolytic Zinc Co. of A'asia Ltd. and Mount Lyell Mining & Railway Co. Ltd.), two will be the locations of active prospecting this summer and the fifth is effectively covered by several thousand feet of sediments of the Junee/Lower Eldon Groups.

4. Summary and Conclusions

An attempt has been made to present the mineralisation of the West Coast in a regional structural setting. In summary, remembering the north-south influence of the Lyell Shear, it can be presented in terms of the NW-SE structures as follows:

Anticlinoria	Synclinoria	
Bischoff	Zeehan	Huskisson
Copper/tin/nickel	Silver/Lead	Zinc/Lead

This must not infer that lead/zinc mineralisation does not occur in anticlinoria nor tin in synclinoria for it does. An example of this is the galena/stannite (a tin/copper/iron sulphide) in the Oonah Mine at Zeehan, and the Comet Mine with lead mineralisation in the Bischoff structure near Dundas. However, it is considered that this limited overlap does not detract from the regional picture which has been presented.

Geologist-in-Charge.

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TABLE 1

SUMMARY OF THE PALAEOZOIC - PRECAMBRIAN GEOLOGY OF S.W. TASMANIA

PERIOD	GROUP	FORMATION	TECTONIC	LITHOLOGY	IGNEOUS	ECONOMIC
			Tabberabberan Orogeny			
LOWER DEVONIAN TO SILURIAN	ELDON GROUP			Miogeosynclinal. Alternating shales & orthoquartzites.	Granite	Copper, lead, zinc sulphide mineralisation
ORDOVICIAN	JUNEE GROUP	Gordon Lst. Owen Congl.	Owen Transgression	Limestone & fine to coarse conglomerate		
UPPER - MIDDLE CAMBRIAN	DUNDAS GROUP		Jukesian) Movement))) Tyennan)) Orogeny) Stichtan) Movement	Eugeosynclinal. Greywackes, tuffs, basic lavas, shales, & siltstones.	Serpentinite, lavas & Darwin granite	Hematite/ magnetite, sulphide mineralisation? Osmiridium
LOWER CAMBRIAN TO PRECAMBRIAN	CARBINE GROUP	Dolomite (Jane and Stephens)	Carbine Transgression	Dolomite, slates, conglomerates, quartzites & cherts	Basic dykes (later igneous group)	
PRECAMBRIAN	DAVEY GROUP	Scotchfire Franklin Mary	Frenchman Orogeny	Phyllites, garnet-mica schists, quartz schists.	Basic dykes (older igneous group)	
		Joyce	Unconformity?	Garnet-mica schists		

TABLE II

RECORDED MINERAL PRODUCTION - WEST COAST MINES[i].

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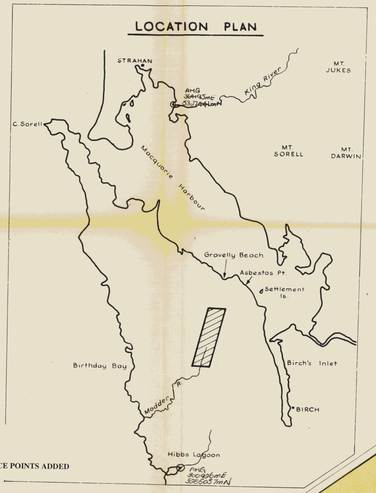
Mine/Company	Mineralisation	Tonnage	Grade	Period	Source
Electrolytic Zinc Co. of A'asia Ltd.: Rosebery and Hercules	Zinc/lead	3,330,000 (500,000 tons also produced 1900-1930)	20% Zn. 6% Pb. 0.5% Cu. 7 ozs. Ag/ton	Feb.1936-June 1957	Handbook issued by the Company in 1958
Magnet Mine, Magnet.	Silver/Lead	620,000	5.7% Pb. 11¼ ozs. Ag/ton	1895-1940	Geology of Australian Ore Deposits, Vol.I, 1953.
Zeehan District.	Silver/Lead	?	?	1887-195	
Mount Farrell Mines.	Silver/Lead	600,000	13% Pb. 10-12 ozs. Ag/ton	To 1953	Geology of Australian Ore Deposits, 1953
Mount Lyell Mining & Railway Co. Ltd., Queenstown.	Copper	40,759,445	1.4% Cu. 0.446 ozs. Ag/ton	1892-June 1957	Handbook issued by the Company in 1958.
Mount Bischoff Mine, Waratah.	Tin	5,500,000	1% Sn.	1893-1953	Geology of Australian Ore Deposits, 1953.
Renison Bell.	Tin	4,300 of concentrate (70% tin)	1% Sn.	1890-1956	Dept. of Mines booklet, 1957
Dundas District (Razorback)	Tin	2,000 tons of tin	?	1890-1910	Pres. Address A.I.M.M. March, 1958
Five Mile Copper/Nickel Deposit, near Renison Bell.	Copper/Nickel	(a) 4,038 tons of "ore" (b) 222 tons of nickel	?	(a)Before 1914 (b)1927-1938	Dept. of Mines booklet, 1957

i This list is not intended to be exhaustive.

Sections not to scale



Legend

- A.E.M peak with ratio ●
- Fault ——
- probable fault ···—···
- ultrabasic intrusion
- Cambrian
- Precambrian

Note

1. Diagram not to scale.
2. Strike of outcrops distorted.
3. A.E.M. peaks positioned correctly in relation to geological features.
4. This is only an interpretation. The writer has carried out no field work.

PART OF THE MODDER-BELT LOOKING NORTH

A GEOLOGICAL INTERPRETATION BY M. AUDLEY-CHARLES

5 cm

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