

TR10-26-40

6. THE GEOLOGY OF THE HEAZLEWOOD - GODKIN AREA

by D. I. Groves

ABSTRACT

In the Heazlewood-Godkin area, numerous small silver-lead-zinc ore bodies occur along structural surfaces intersecting Cambrian sedimentary and igneous rocks and the unconformably overlying Silurian (?) sedimentary rocks, on the NW flank of the Meredith Granite mass of Devonian age. A genetic relationship between the deposits and granite emplacement is suggested. Small copper, nickel and osmiridium deposits are confined to the ultrabasic complex at Heazlewood and are apparently related to emplacement of the ultrabasic magma.

The deposits are small, irregular and low grade and in general do not warrant further investigation. The Godkin and Mt Stewart silver-lead-zinc and the McCormick-Miller nickel deposits appear the most promising prospects for future exploration.

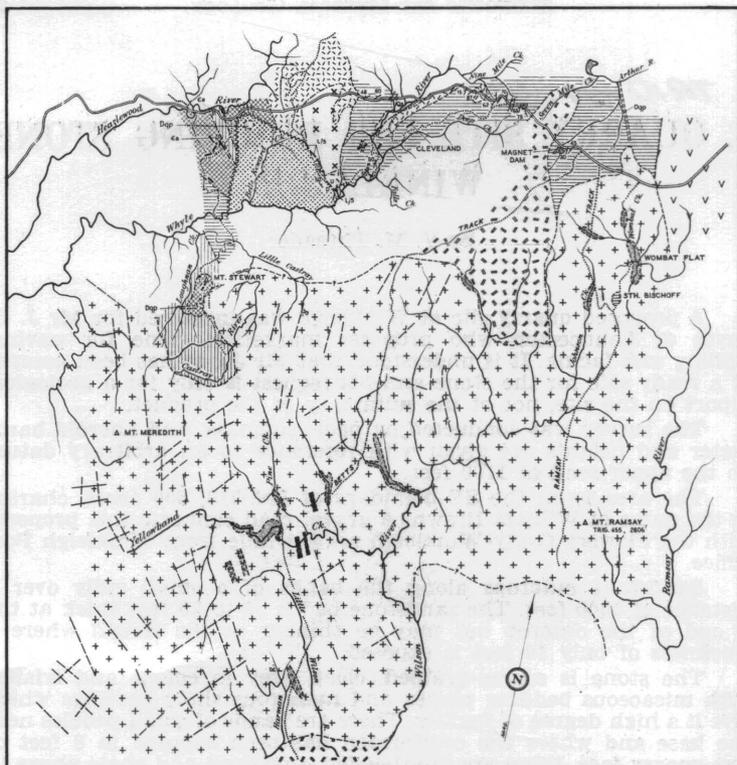
INTRODUCTION

During January and February, 1964, a preliminary examination of the area between the Waratah-Corinna Road and the Little Wilson River was carried out to assess the potential of tin-bearing deposits within the Meredith Granite mass (Jack and Groves, 1965). In January to March, 1965, a further geological examination was made to the north of the granite in the Mt Stewart, Heazlewood, Godkin and Whyte River districts, to extend the previous mapping and investigate the small but numerous ore deposits in the area.

Access to the area is provided by several pack tracks and logging tracks from the Waratah-Corinna Road (Figure 8). The area south of the main road is accessible by the Mt Stewart and Godkin tracks, and the area to the north by several logging tracks.

The Mt Stewart area is reached by means of a well graded walking track from the Heazlewood River via the Jasper Mine, Whyte and Castray Rivers. It is a good walking track for the first 4 miles, but is overgrown with bauera for the final mile. The track extends southwards past the Mt Stewart Mine for at least 1½ miles but is overgrown in places and becomes impossible to follow past the Castray River.

The Godkin area is connected to the main road by a well-graded, wide, walking track which turns off the Waratah-Corinna Road about 13 miles from Waratah. It extends SE for about 2½ miles to the Godkin Mine and then swings NE via the Confidence Mine, Whyte River and Washington Hay Mine, joining the road to the Mt Cleveland Mine about ½ mile from the main road at the Whyte River Bridge.



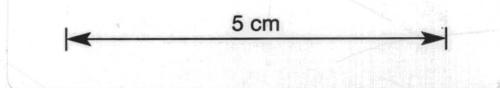
LEGEND

QUATERNARY	Qa	ALLUVIUM	---	GEOLOGICAL BOUNDARY (POSITION APPROX.)
		TIN BEARING GRAVEL	- - - -	GEOLOGICAL BOUNDARY (POSITION INFERRED)
TERTIARY	V	BASALT	- - - -	GRADATIONAL BOUNDARY
		BASALT DYKE	~~~~~	UNCONFORMITY (INFERRED)
	+ +	MEREDITH GRANITE (ADAMELLITE)	—+—	FAULT SHOWING RELATIVE MOVEMENT
DEVONIAN		TOURMALINE NODULE ZONE	—+—	REGIONAL JOINTING
		PEGMATITE	---	LODE
	/// Dip	QUARTZ PORPHYRY DYKE	---	BEDDING
SILURIAN	L/S	LIMESTONE & CALCAREOUS MUDSTONE	---	CLEAVAGE
		QUARTZ SANDSTONE & QUARTZITE	---	
		MUDSTONE, SANDSTONE, CHERT & BASIC LAVA	---	
	X	INTERMEDIATE IGNEOUS SUITE	---	
	/// Ca	ALBITE QUARTZ-SYENITE DYKE.	---	
CAMBRIAN		BASIC IGNEOUS SUITE	---	
		ULTRABASIC IGNEOUS SUITE.	---	
		SERPENTINITE	---	
		UNDIFFERENTIATED IGNEOUS ROCKS	---	

— ROAD
 - - - - PACK TRACK

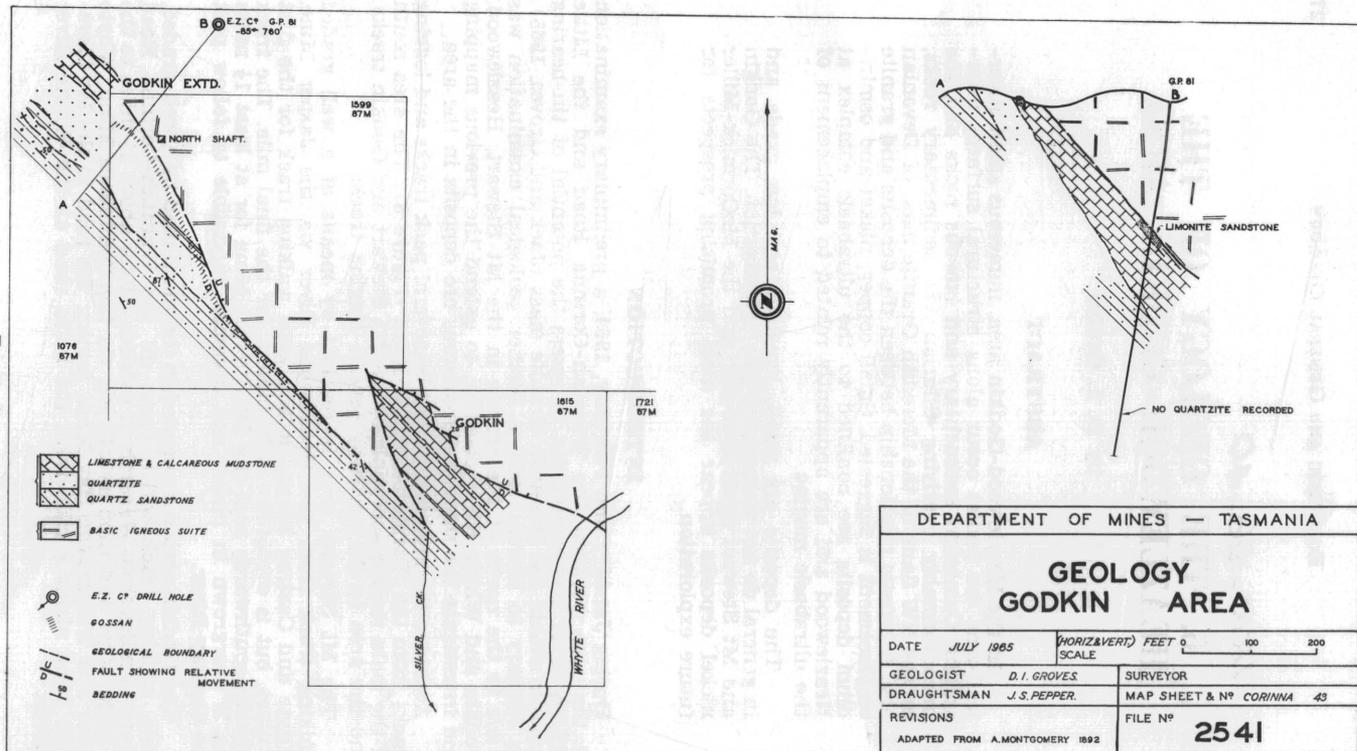
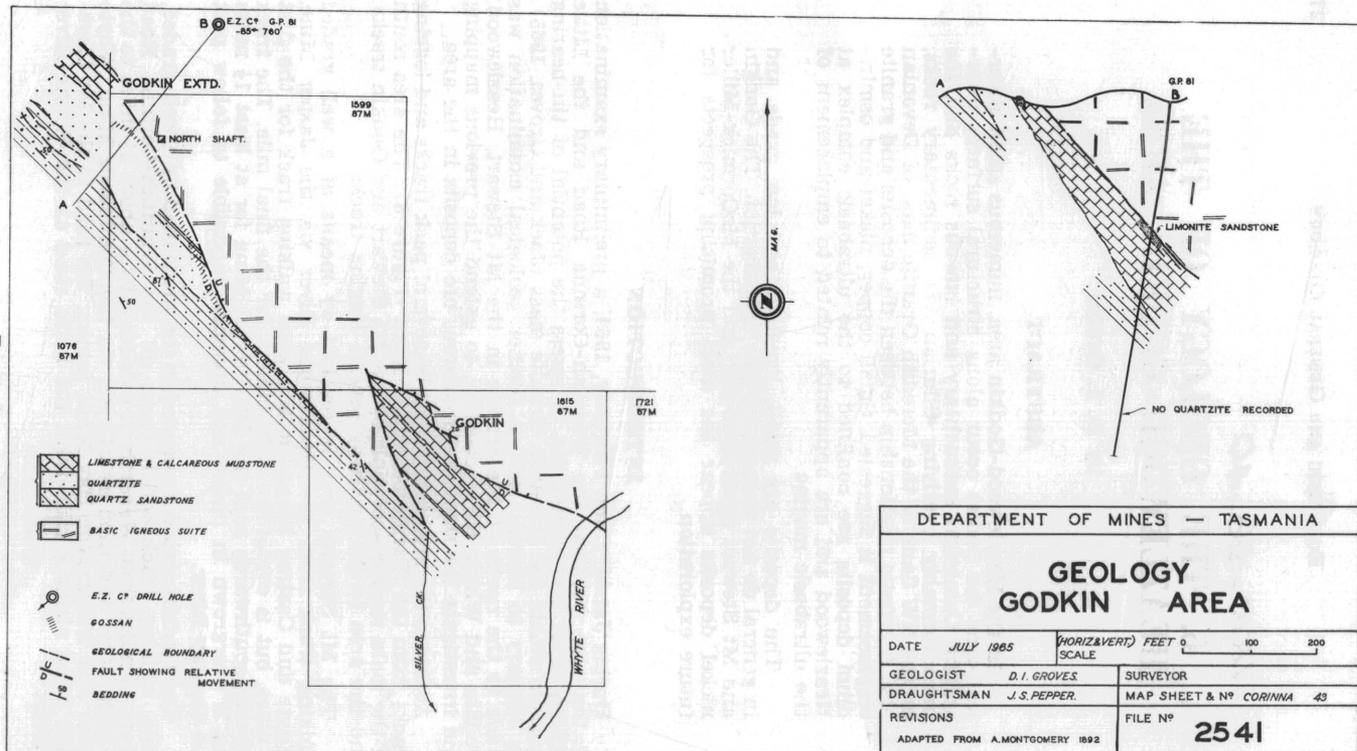
DEPARTMENT OF MINES — TASMANIA	
GEOLOGY MT. MEREDITH AREA	
DATE MAY 1965	MILES SCALE 0 1 2 3
GEOLOGIST — D. I. GROVES	SURVEYOR —
DRAUGHTSMAN — P. B. MANKIVELL	MAP SHEET & NO CORINNA 43
REVISIONS —	FILE NO — 2523

FIGURE 8.



5 cm

FIGURE 9.



The area N of the main road in the Godkin-Heazlewood area is accessible by a network of logging tracks which extend around the foothills of Mt Cleveland. These provide easy access and a high percentage exposure in an area where exposure is generally limited. Logging activities have recently been extended to the S of the main road and may provide better access and exposure in this area in the near future.

The topography of the area is one of high relief, rising from 800 feet in the Whyte and Heazlewood Rivers to 2600 feet to the S at Mt Meredith and 2800 feet to the N at Mt Cleveland. The Whyte River, with its main tributaries, the Heazlewood and Castray Rivers, provides the main SW drainage in the area. The Meredith Range forms the divide between this river system and the S-SE drainage of the Yellowband and Wilson Rivers.

GEOLOGY

The oldest rocks exposed in the area are Cambrian mudstone, greywacke, chert and altered basic lava, which are intruded by a complex of ultrabasic, basic and intermediate igneous rocks of probable Cambrian age. The rocks are unconformably (?) overlain by quartz sandstone, quartzite and limestone of probable Silurian age. These sequences have been intruded by a large mass of granite (Meredith Granite) with associated quartz-feldspar porphyry dykes of Devonian age. A belt of small silver-lead and copper deposits occur on the NW flank of the granite mass in host rocks of both Cambrian and Silurian age. Tertiary gravels and basalt overlie the Palaeozoic rocks and form an extensive plateau in the Waratah area at a height of some 1900-2000 feet.

CAMBRIAN

SEDIMENTARY ROCKS

A thick sequence of red-brown finely laminated to massive mudstone with subordinate yellow-brown to grey mudstone, graded greywacke, chert, chert breccia and altered basic lava crops out over an extensive area between Waratah and the Heazlewood River. The sequence strikes generally NE to NNW and dips fairly consistently westerly. These sedimentary rocks and associated lavas have been described in some detail by Groves and Solomon, 1964. The lava is predominantly spilitic comprising phenocrysts of albite, augite and chlorite in a felted groundmass of albite laths, chlorite, epidote, calcite, magnetite and ilmenite. A probable pillow lava which crops out on the Corinna Road, a few hundred yards W of the Magnet Track, is strongly amygdaloidal with large radiating sheaves of chlorite and some quartz. Structures resembling pillows occur and tend to confirm a submarine effusive origin for the spilitic.

Correlations based on lithologic similarity have been made with the Dundas Group by most early workers and with rocks lower in the Cambrian by Banks, 1962. The sequence shows strong similarities to rocks of the Crimson Creek Formation from the Pieman River-Renison Bell area (Blissett, 1962), but at this stage correlation can be tentative only.

IGNEOUS ROCKS

A wide variety of Cambrian igneous rocks occurs in the area, basic and intermediate rocks are predominant to the E in the Whyte River and Godkin areas and ultrabasic rocks to the W in the Heazlewood and Mt Stewart areas. A subdivision is made into five regions for ease of description.

Seven Mile Creek-Betts Track area: undifferentiated igneous rocks including ultrabasic, basic and intermediate intrusive and extrusive rocks.

Magnet Dam-Whyte River area: predominantly dyke-like intrusions of albite gabbro or amphibolite.

Godkin area: extensive intrusions of albite gabbro and albite quartz-syenite.

Heazlewood area: complex of pyroxenite and serpentinite.

Mt Stewart area: predominantly serpentinite and pyroxenite.

Seven Mile Creek-Betts Track area

This complex of igneous rocks was described by Jack and Groves, 1964. The predominant types are serpentinitized pyroxenites, with minor albite gabbro and albite quartz-syenite in the northern part of the area, and altered basalts and breccias adjacent to the northern margin of the granite along Betts Track.

Magnet Dam-Whyte River area

A number of gabbroic bodies apparently intrude the Cambrian sedimentary rocks between the Magnet Dam and the Whyte River. A typical and most extensive example crops out on the main road for about $\frac{1}{2}$ mile east of the Whyte River bridge. It is extremely variable in texture and composition throughout its length. It generally comprises albite, hornblende and chlorite with variable quantities of serpentine, kaolin, sericite and granular diopside. The gabbro has an even granitic texture in places, elsewhere the albite and hornblende are aligned and impart a metamorphic fabric. In places, the rock comprises irregular patches of fine interlocking albite crystals, serpentine and fine feldspathic material in an extremely uneven texture. The hornblende in most cases is somewhat ragged and appears to replace both augite and yellowish chlorite in some sections.

The variation within the gabbroic dyke appears to be due to a progressive degree of alteration rather than a primary compositional variation, but may be related to a late phase of crystallization. The rock may be termed an amphibolite in places, but due to its original igneous origin and association with a widely occurring suite of igneous rocks, a better term may be albite gabbro.

Godkin area

A large mass of basic and intermediate igneous rock crops out in a belt between the Whyte River at the Godkin Mine and the logging tracks N of the main road. The mass, which intrudes Cambrian sedimentary rocks to the E and is in contact with ultrabasic rock to the W reaches a maximum width of nearly 2 miles along the main road. The western margin of the mass is faulted against Silurian (?) sedimentary rocks S of the road, and it is only about $\frac{1}{4}$ mile wide at the Godkin Mine.

An extremely weathered rock with granitic texture is exposed along the greater part of the main road section of this area. Boulders of a granite rock are found just S of the road and along the Godkin Track and prove to be an albite quartz-syenite. The actual extent of this rock type is difficult to assess due to poor exposure, but the area represented as intermediate igneous suite in Figure 9 represents the approximate limit of the syenite. Albite quartz-syenite is found elsewhere in small dykes apparently intruded into basic and ultrabasic rocks. It is possible that a network of such dykes exists in the Godkin area rather than an extensive intrusion, as creeks draining the area also contain boulders of basic intrusive and extrusive rocks.

The syenite has a granular texture and comprises predominantly sericitized albite, hornblende and quartz with minor penninite, orthoclase, magnetite and sphene. The percentage of quartz and hornblende-chlorite is variable, generally with an inverse relationship, with the quartz reaching a maximum of 25%. A feature of the rock is the strongly developed graphic intergrowth of quartz and feldspar. Analyses of the rock (Nye, 1923; p. 39) indicate a rock intermediate in composition between an albite granite and a soda syenite.

The albite quartz-syenite is bounded to the N and S by massive basic rocks, predominantly albite dolerite and gabbro. These rocks do not exhibit the same degree of alteration as the albite gabbro of the Whyte River area. They comprise interlocking albite laths 0.25-2 mm in length with intergranular pyroxene and larger patches of penninite and serpentine. The albite is ophitic towards the chloritized material and is subophitic towards larger crystals of pyroxene in places. Pyrite is extremely common throughout the rocks as disseminations and small veinlets.

In general the syenite appears to represent a slightly later phase of intrusion than the dolerite and gabbro, as dykes of syenite intrude the basic rocks and probable xenoliths of basic rock occur within weathered syenite near their contact.

Heazlewood area

An extensive complex of ultrabasic rocks occurs between Thirteen Mile Creek and the Nineteen Mile Hut on the main road. In the Heazlewood area, the rocks are predominantly partially serpentinized pyroxenite with minor serpentinite.

The pyroxenite varies from a fine-grained, even-textured rock to an extremely coarse-grained rock of uneven texture, with many porphyritic types. The predominant type exposed along the road section is an extremely weathered brown clay in which the orthorhombic pyroxene phenocrysts are prominent. In Roaring Meg Creek pyroxenite with strongly aligned crystals is found in association with coarser, uneven-grained pyroxenite. These rocks are composed essentially of varying proportions of hypersthene and augite with minor enstatite and bronzite. Feldspar is present in minor amounts in some rocks which border on a basic composition. An important feature of the ultrabasic mass in the Heazlewood area is the remarkable variation in composition and texture of the rocks over extremely small areas. This suggests a complex history of igneous activity during injection of the ultrabasic magmas.

A relatively thin NW-trending belt of serpentinite cuts the pyroxenite about $\frac{1}{2}$ mile E of the Heazlewood River bridge. It is rather

schistose with intense development of slickensides in places. A small albite quartz-syenite dyke intrudes pyroxenite in the Mt Wright area and abuts sharply against the serpentinite. This suggests a late development (or intrusion ?) of serpentinite or a faulted contact between the pyroxenite and serpentinite. A faulted contact is also suggested by parallelism of the boundary with the Godkin fault zone and the development of small ore bodies along the boundary.

Two small patches of red-brown mudstone occur within the pyroxenite near the Old Jasper Mine. They have a baked appearance and are tightly folded in places. Their appearance and limited occurrence suggest that they are probably remnants of roof sediments picked up by the intruding magma. A further occurrence at the Old Jasper Mine is a rock comprising large ovoid amygdaloids of quartz mosaic with minor carbonate in a groundmass of fine interlocking needles of actinolite and interstitial quartz. The occurrence of this rock in association with pyroxenite and the association of basic lavas and breccias with pyroxenite amphibolite along Betts Track, suggest at least limited extrusion and shallow intrusion in the magmatic evolution of the ultrabasic and basic complex.

Mt Stewart area

The predominant rock type in the Mt Stewart area is a massive green to black serpentinite comprising antigorite as aggregates of fibro-lamellar structure surrounding anhedral crystals in places. A band of schistose pyroxenite some $\frac{1}{2}$ mile long and $\frac{1}{4}$ mile wide occurs at Mt Stewart and is the host rock for the ore body in that area. In part the rock is strongly banded and graded (?) subparallel to the schistosity, which trends approximately N-S with a steep easterly dip. In Loughnan Creek large veins of talc commonly cut the serpentinite. Osmiridium must also be a fairly common constituent as rich deposits of alluvial osmiridium are virtually confined to this river valley in the Mt Stewart area. In places the serpentinite has a baked and platy structure due to the proximity of the granite.

SILURIAN

A sequence of sandstone, quartzite, calcareous mudstone and limestone occurs in the area between the Mt Stewart and Godkin tracks. White, medium-grained, saccharoidal, thickly bedded sandstone is predominant with minor white to buff medium-grained quartzite, stylolitic limestone and rare conglomerate. From descriptions of the Godkin Mine (Nye, 1923) and drilling by the E.Z. Co. it appears that the sandstone, quartzite, mudstone and limestone form a continuous sequence, the limestone locally being the youngest bed, provided the sequence is not inverted. The sandstone is lithologically similar to the Crotty Quartzite of the Zeehan area (Blissett, 1962) which is considered to be lower Silurian. Fossils from the limestone and calcareous mudstone were described by Etheridge (1896) and include the coral *Favosites*, the annelid *Cornulites*, the brachiopod *Rhynchonella* and the pteropod *Tentaculites*, which indicate an age between Ordovician and Devonian. Poorly preserved gastropods and brachiopods are extremely common in some sandstone horizons but to date have not been identified. From lithological and palaeontological considerations, the sequence is probably Silurian in age.

The contact between the Silurian and Cambrian sequences is not exposed in the area. In the Godkin area the Silurian sequence, which

dips fairly steeply E, appears to be faulted against Cambrian igneous rocks. The occurrence of small isolated patches of limestone along the E margin of the Silurian sequence appears to be due to the intersection of minor NNW-trending faults with the major NW-trending fault zone, the limestone occurring between the two fault blocks. Elsewhere the Silurian rocks appear to be unconformably overlying both Cambrian sedimentary and igneous rocks, the Silurian sandstone having a low dip to the E where exposed.

DEVONIAN

MEREDITH GRANITE

The Meredith Granite occupies a large tract of country to the S of the area examined and forms a large stock which is elongate NE-SW and intrudes predominantly Cambrian rock. It has been described previously by Jack and Groves, 1964.

The northern extension of the Meredith Granite encloses the serpentinite at Mt Stewart. The granite-serpentinite contact is extremely irregular in detail with numerous small projections of the granite into the serpentinite. Small veins of quartz-tourmaline are common in places and boulders of quartz-tourmaline occur throughout the Mt Stewart area. A small E-W trending quartz-feldspar porphyry dyke cuts the serpentinite just S of the Mt Stewart mine workings and extends over Loughnan Creek. It comprises large phenocrysts of quartz, orthoclase and oligoclase with a few laths of biotite in a fine groundmass of quartz and feldspar. Perthitic intergrowth of the feldspars is common. Reid (1921) recorded a similar subparallel dyke about $\frac{1}{2}$ mile to the S.

The granite-serpentinite boundary is a strong topographic control in the area, the serpentinite forming a large amphitheatre-like depression surrounded by hills of granite. The headwaters of the Castray River are entirely controlled by the boundary, the river forming a loop around the granite margin.

TERTIARY

SEDIMENTARY BEDS

Sub-basalt gravel, siltstone, claystone and lignite occur commonly in the area around Waratah but are not present in the Heazlewood area.

BASALT

A basalt sheet, some 50 to 150 feet thick, occurs extensively in the Waratah area and is in contact with the Meredith Granite about 4 miles from Waratah on the main road. Isolated patches of basalt occur in the Bald Hill area north of the Heazlewood River and several small dykes occur within the granite (Jack and Groves, 1964).

QUATERNARY

Thin deposits of river gravel and sand occur in the present streams. In Loughnan Creek and Castray River coarse gravel contains deposits of osmiridium in association with ilmenite, chromite and zircon, but the deposits are very shallow.

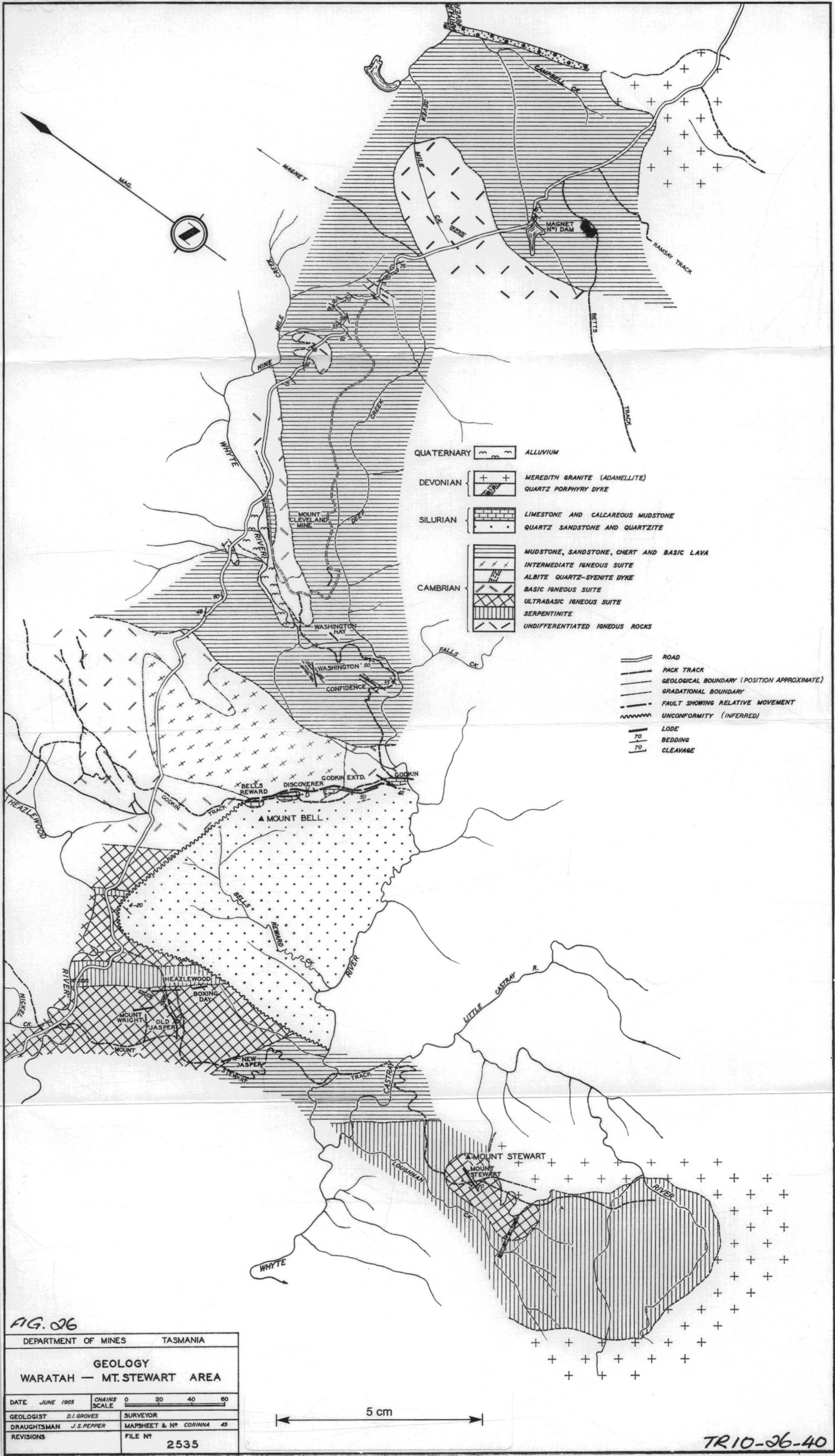


FIG. 26

DEPARTMENT OF MINES		TASMANIA	
GEOLOGY			
WARATAH — MT. STEWART AREA			
DATE	JUNE 1905	CHAINS SCALE	0 20 40 60
GEOLOGIST	D. I. GROVES	SURVEYOR	
DRAUGHTSMAN	J. S. PEPPER	MAPSHEET & N°	CORINNA 43
REVISIONS		FILE N°	2535

5 cm

TR10-26-40

ECONOMIC GEOLOGY

Primary Deposits

An elongate NNW-trending zone of low grade silver-lead-zinc mineralization occurs along the NW flank of the Meredith Granite mass. Tin mineralization occurs sporadically within greisen zones in the granite and in association with quartz-feldspar porphyry dykes at Mt Bischoff to the N. Conformable tin ore bodies, similar to those at Mt Bischoff, occur within Cambrian rocks at the Cleveland Mine but are not directly associated with granitic rocks. Reid (1923) recorded quartz-feldspar porphyry dykes in the vicinity of the mine but they have not been reported subsequently.

TIN

An extensive pyrrhotite-cassiterite ore body is at present being investigated by the Aberfoyle Tin Development Partnership at the Cleveland Mine, and mining of the deposit is expected to commence in 1966. This deposit and the area adjacent to the mine were not examined during this investigation as detailed mapping is being carried out concurrently by the mine geologists. Mason (1965) indicated that the semi-conformable lode replaces a shaly horizon closely associated with chert in the Cambrian sequence. Parallel repetitions of the lode are produced by complex folding of the mineralized bed. The lodes comprise predominantly pyrrhotite and pyrite with cassiterite and chalcopyrite in a gangue of quartz, carbonates, wollastonite, cordierite, tourmaline and fluorite. Farrand (1963) considered that the enclosing chert is of sedimentary origin and not a product of the mineralization.

SILVER-LEAD-ZINC

Silver-lead-zinc mineralization is confined to relatively thin quartz-carbonate veins, many of which are structurally controlled by geologic contacts within the area. The Godkin lodes (Godkin, Discoverer and Bells Reward) occur along the faulted contact between Silurian (?) limestone and Cambrian igneous rocks and the Heazlewood and Boxing Day lodes along a possible fault contact between pyroxenite and serpentinite. The Mt Wright lode occurs entirely within altered pyroxenite, but subparallels the pyroxenite-serpentinite boundary, less than 200 feet to the NE of the mine. The Washington, Washington Hay and Confidence ore bodies occur within thin bands of basic igneous rock intrusive into Cambrian sedimentary rocks. The Mt Stewart lode is also enclosed entirely within igneous rocks, the ore body, however, being parallel to the strong schistosity of the enclosing pyroxenite.

The silver-lead-zinc lodes have a remarkably simple and consistent mineralogical composition throughout the area. The lodes are generally partially banded, with argentiferous galena, sphalerite and minor pyrite and chalcopyrite in a gangue of carbonates and quartz. Strong green staining of the gangue is typical of the deposits and is probably due to traces of chromium which may be derived from the basic and ultrabasic host rocks (Nye, 1923). The similarity of the lodes in composition and structural position suggests a common origin for the deposits. A genetic relationship of the deposits with the granite is suggested by their occurrence in suitable structural traps along the flank of the granite mass.

COPPER

Copper mineralization, with the exception of minor copper associated with the Mt Cleveland tin lodes, is limited to three lodes confined to the ultrabasic mass in the Heazlewood area. These are the Old and New Jasper lodes and a small lode just S of the road $\frac{1}{2}$ mile E of the Heazlewood River bridge. The lodes comprise splashes of chalcopyrite and bornite with minor pyrite and sphalerite in a gangue of quartz and jasper or as thin veinlets and splashes within the pyroxenite itself. Malachite and azurite are common as secondary enrichment within gossanous parts of the lodes. There are marked differences between the copper deposits and the silver-lead-zinc lodes previously described. The confinement of the copper deposits to the ultrabasic complex and the general lack of carbonate-quartz gangue are outstanding features. It is possible that the copper is genetically related to the ultrabasic intrusion rather than to the later granite emplacement. Possible origins for the copper are primary segregation of copper sulphides from the ultrabasic magma, pre-emplacment segregation followed by injection, or transfer by solutions or remobilization of primary copper within the ultrabasics during granite emplacement. The latter possibility is favoured as the copper deposits occur adjacent to probable Devonian silver-lead-zinc mineralization and are in part structurally controlled by contacts within the ultrabasic mass.

NICKEL

Small nickel deposits occur within serpentinite at the McCormick-Miller (Lord Brassey) Mine to the north of the Heazlewood River Bridge (Hughes, 1957, Williams, 1958). The deposit comprises small veinlets of heazlewoodite, pentlandite, millerite and magnetite with some secondary zaratite and hellyerite. Williams (1958) considered that segregation took place at depth with subsequent injection of the segregated nickel sulphides following emplacement of the magma. Similar deposits occur at Trial Harbour while the Cuni deposits at Zeehan comprise nickel sulphides in association with chalcopyrite.

OSMIRIDIUM

Osmiridium deposits are largely confined to gravels in Loughnan Creek near Mt Stewart. However, near the head of Loughnan Creek, three extremely rich osmiridium-bearing veins intersect the serpentinite and have been successfully worked (Reid, 1921). The rich pockets of osmiridium are confined to well-defined veins of limonite, clay and talc which are 3 to 18 inches in width and trend 20° to 35° M with a steep SE dip. Enrichment in osmiridium has generally occurred at the intersection of small transverse planes, containing minor osmiridium, with the main veins. Continuous variation in width is a prominent feature of the veins.

ORE GENESIS

Two phases of ore formation are thought to have occurred throughout the Waratah District. Partial segregation of sulphide minerals is considered to have occurred prior to emplacement of the ultrabasic complex in the Cambrian, with subsequent injection or transfer by solutions of nickel and possibly copper sulphides. The major mineralization phase occurred in association with granite emplacement during the Devonian. Silver-lead-zinc mineralization probably occurred along fractures and other structural weaknesses in the Cambrian and Silurian roof strata over a large granite batho-

lith which is now partially exposed. Tin mineralization was confined to aplite and greisen zones within the granite and to local cupolas and associated acid dykes in places. Remobilization of primary copper deposits into structural traps within the ultrabasic complex may have occurred concurrently.

Secondary Deposits

OSMIRIDIUM

Osmiridium occurs in river gravels of many of the streams draining the ultrabasic complex in the Heazlewood area. The main workings investigated were those at Mt Stewart, where the rich osmiridium deposits were virtually confined to the narrow valley of Loughnan Creek. The creek bed is cut entirely in serpentinite, and the alluvial osmiridium appears to have been derived from small joint planes within the rock. At the head of the creek several talcose veins were found which contained abundant coarse osmiridium. The common associates of osmiridium in the deposits are magnetite, ilmenite and chromite which are common constituents of the ultrabasic rocks and were probably derived from the serpentinite bedrock exposed by the creek.

TIN

Alluvial tin deposits occur within the Meredith Granite to the south of the area examined. Jack and Groves (1964) found no direct source for the coarse tourmaline-quartz-cassiterite gravels in the vicinity of the deposits at Pine and Yellowband Creeks and the Wombat Flat area. The granite boundary to the north was suggested as a possible source for the deposits, with a late Tertiary or Quaternary N-S drainage to transport the cassiterite to the south. The granite boundary was examined in the Mt Stewart area where the proportion of quartz-tourmaline material was found to be fairly high, although the cassiterite content appeared low. However, further investigation of the granite contact is warranted before any definite conclusions on the source of the cassiterite can be reached.

The consistent association of cassiterite, tourmaline and quartz and lack of sulphides in the quartz gravels, and the coarse grain size of the cassiterite grains relative to the tin crystals in the pyrrhotite-cassiterite lodes, indicate that the Mt Cleveland lode is not the source of the alluvial tin in the southern area.

Mine Workings

A comprehensive summary of the history, geology and mine workings for the silver-lead-zinc and copper lodes in the area was given by Nye (1923). A brief summary of the features of the larger deposits are given below.

SILVER-LEAD-ZINC

The Godkin-Discoverer-Bells Reward Lodes

The Godkin, Discoverer and Bells Reward Mines were all opened to test a persistent line of gossan which occurs on the faulted contact of the Silurian sedimentary sequence and Cambrian igneous rocks.

At the Godkin Mine the structure is complicated by several small NNW vertical faults which cut the prominent NW fault which forms the Silurian-Cambrian contact, with the formation of several subsidiary lodes. The lodes have been worked to a depth of 110 feet on 3 levels from a main shaft. A small patch of ore was intersected on the most easterly lode (a dislocated part of the main NW fault) and

was stoped over a width of 10 feet. It was reported by Nye (1923) to have assayed some 15% lead, 49 oz silver per ton and 27% zinc. Total production from the Godkin Mine has been some 52.3 tons of lead from an estimated 327 tons of ore. The North Godkin Section was worked to a depth of 210 feet from two adits and a shaft, but only barren gossanous material was intersected. At the Godkin Extended the lode was worked from three levels, a small patch of sulphide bearing lode between Nos. 2 and 3 levels assaying 4.75% lead, 13 dwt silver per ton and 30.16% zinc. The Discoverer Section was worked from four adits to a depth of 460 feet below the summit of Mt Bell. Two lines of gossan were investigated, the most westerly being entirely superficial and the other giving way to a barren ferruginous lode. The Bells Reward Section to the N has been worked from an adit 600-700 feet in length and a shaft to a depth of 154 feet. A few feet of gossanous lode were cut with some sulphide impregnations in limestone wallrock for 15 feet from the lode.

The Electrolytic Zinc Co. subsequently drilled 5 diamond drill holes totalling 3157 feet along the Godkin line of lode. The Bells Reward section was tested by three holes and the Discoverer and northern part of the Godkin Extended by one hole each. The deepest hole was at the Godkin Extended section with an intersection depth of about 300 feet. A few feet of ferruginous material were found in each hole, but no sulphide mineralization was discovered. It appears that the strong gossans at the surface generally give way to a soft, ferruginous and manganiferous lode with little or no galena at depth, with development of fairly rich, although small, pockets of galena and sphalerite in places.

Mt Wright Lode

The Mt Wright Lode occurs within altered pyroxenite about 150 feet SW of a continuous belt of serpentinite and subparallels the pyroxenite-serpentinite contact which may be faulted. The lode, which dips 30° to 70° E, has been worked from two adits and has been stoped over a maximum length of 20 feet between Nos. 1 and 2 levels. Clean galena veins occur up to 10 inches wide, average 2-3 inches, and occur in association with carbonates, pyrite, sphalerite and quartz. A winze below the lower level is reported to contain 13 inches of banded ore which extends underfoot. Total production from the mine has been about 55 tons of ore, averaging about 58% lead and 75 oz silver per ton.

Heazlewood-Boxing Day Lode

The Heazlewood Lode occurs within altered pyroxenite adjacent to a serpentinite mass and sub-parallel the pyroxenite-serpentinite contact. The lode has been worked from two adits and a shaft to a depth of 170 feet, and has been stoped over a length of 230 feet and a maximum depth of 60 feet. To the SE two shafts were sunk on the Boxing Day Lode which is parallel and probably continuous with the Heazlewood Lode. The width of the Heazlewood Lode varies from 4 to 14 feet, but the galena occurred in a vein only 2 to 3 inches in width which widened into 6 inch bunches in places. The lode consists predominantly of carbonates and minor quartz with a strong green colouration of the gangue typical of the silver-lead-zinc deposits in the area. Total production from the Heazlewood Mine has been some 230 tons of ore assaying 56% lead and 88 oz silver per ton.

Mt Stewart Lode

The Mt Stewart Lode occurs within an elongate band of schistose pyroxenite entirely enclosed by serpentinite. The lode is subparallel to the strong, approximately N-S, vertical schistosity of the pyroxenite. The lode has been worked from a main shaft, two small shafts and two adits to a total depth of about 200 feet. Two shoots of ore have been stoped in the mine, the northern shoot over a distance of 100 feet to a depth of 200 feet and the southern shoot 80 feet to a depth of 110 feet. The lodes, averaging 1 to 3 feet in width, comprise banded quartz and galena with minor sphalerite, pyrite and chalcopyrite and assay about 4% lead, 30 oz silver per ton and 8% zinc. Total production from the mine has been at least 2000 tons of ore containing between 6% to 14% lead and 75 to 111 oz silver per ton.

Washington-Washington Hay-Confidence Lodes

Nye (1923) and previous workers recorded that the Washington, Washington Hay and Confidence Lodes are all associated with apparent basic igneous rocks, in places altered to serpentinite, which occur in an area of predominantly Cambrian sedimentary rocks. The Washington Lode transgresses at least two such igneous bodies and the Washington Hay and Confidence Lodes occur within a body which is reported to be continuous between the two mines. A thin section of this apparent igneous rock from the Godkin Track near the Whyte River bridge proves it to be a greywacke with a high percentage of volcanic rock fragments.

At the Washington Mine the lode, which is generally gossanous with minor sulphides, has been worked from two adits with little success. Smith (1897) recorded a small patch of high grade oxidized ore, but the remainder of the lode appears to have been barren. The Confidence and Washington Hay Lodes comprise predominantly green-stained carbonates with galena, sphalerite, pyrite and minor quartz. The lode at the Washington Hay Mine has been worked from a shaft and adit to a depth of 80 feet, predominantly in gossanous material containing cerussite and crocoite. The lode was 2 to 9 feet wide with 1 inch veins and splashes of galena, although a 4 to 5 inch vein of galena is reported from a winze below the adit. Total production from the mine has been 40 to 50 tons of ore assaying 60% to 75% lead and 80 to 105 oz silver per ton. At the Confidence Mine the lode has been worked on three levels with little success. A small patch of ore has been stoped from No. 1 level to the surface, a vein of galena 2 to 8 inches in width being reported from the hanging wall. Below No. 1 level a few small veinlets and splashes of galena are present but no stoping has been carried out. Total production from the mine probably does not exceed 53 tons of ore assaying 41% lead.

COPPER

Old Jasper Lode

The Old Jasper Lode occurs on the contact of altered pyroxenite and a silicified lava in an area of predominantly ultra-basic rocks enclosing small patches of foliated Cambrian sedimentary rocks. At the mine the lode has been worked from 5 adits and an open cut. The lode formation comprises veins and splashes of chalcopyrite and bornite in a predominantly quartz gangue. Malachite and azurite are common in the surface gossan above the lodes.

The continuation of the Old Jasper Lode is probably exposed at the Eastern Blow. A jasper-quartz formation is exposed in a small

trench and contains small veins and disseminations of chalcopyrite and bornite. Some prospecting has been carried out between the Old Jasper Mine and the Eastern Blow with no success.

New Jasper Lode

The New Jasper Lode has been worked from surface trenches and shafts and two levels worked from adits. The surface workings exposed a gossan capping containing oxidized copper ores including malachite, cuprite and tenorite which formed rich patches of ore.

The underground workings intersected a lode comprising small veins and splashes of chalcopyrite and bornite within altered pyroxenite a few feet N of the pyroxenite-sedimentary rock contact. A small percentage of calcite represents the only gangue present. Stopping has been carried out on both levels over short distances, and a winze 20 feet below No. 2 level was reported to have exposed a vein of chalcopyrite some 18 inches in width.

The total production from the Old and New Jasper Mines has been at least 188 tons of ore averaging about 20% copper. The estimated contribution from the New Jasper Mine is 50% to 70% of the total.

CONCLUSIONS

The silver-lead-zinc and copper lodes in the Heazlewood-Godkin area are generally small, discontinuous and low grade. In places small pockets of rich ore have been found and mined at relatively shallow depths.

The Mt Stewart Mine is by far the largest producer in the district with a total production of 2000 tons of ore. The northern ore shoot has been completely stoped from a depth of 200 feet to the surface and the southern shoot from 110 feet to the surface. It is possible that the lodes continue to greater depths although there is a general decrease in silver and lead values with depth. The lack of good access is also a deterrent to future exploration of this lode. The Heazlewood, Mt Wright, Washington, Washington Hay and Confidence silver-lead-zinc mines have never been worked with much success due to the thin discontinuous nature of the lodes. A similar problem has also arisen with the Jasper Copper Mines. The Godkin-Discoverer-Bells Reward line of lode has been thoroughly prospected by underground mining and drilling with little success. However, small pockets of rich ore which occur in the Godkin section itself have not been investigated by drilling. The occurrence of several lodes, produced by cross faulting, provides a reasonable drilling target. The ore may be found to concentrate at the intersection of such lodes at depth, as in other silver-lead-zinc mines in western Tasmania.

The prospects showing some promise in the Heazlewood-Godkin area, apart from the Cleveland lode, are the McCormick-Miller, Godkin and Mt Stewart lodes, but future exploration of the sulphide ore bodies in general is not recommended.

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