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THE X RIVER TIN
FIELD

BY

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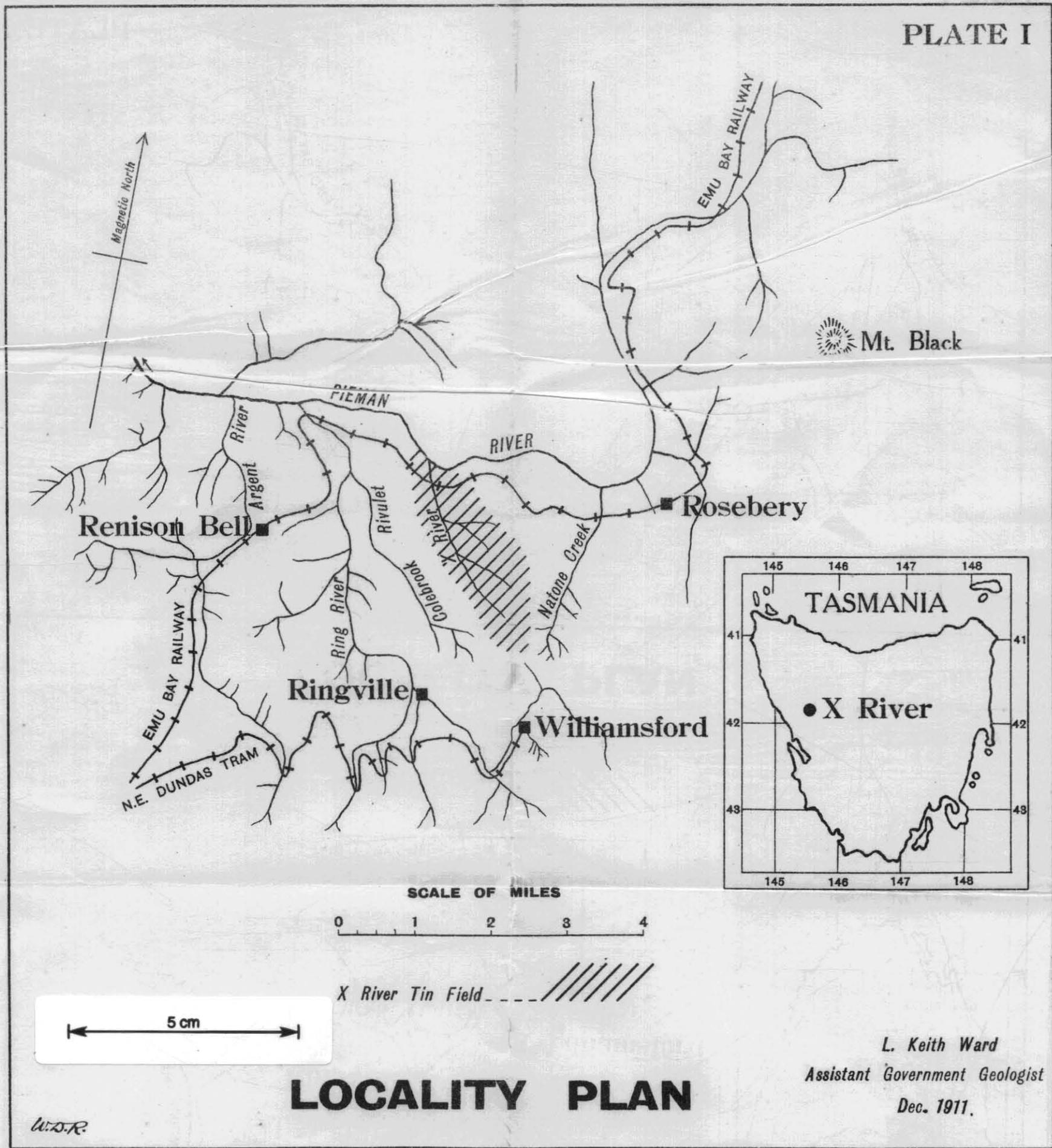
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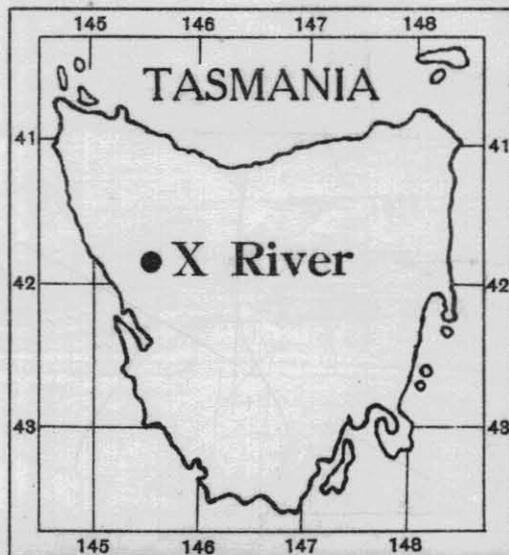
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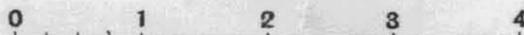
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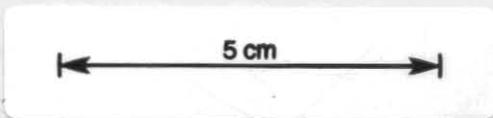
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SCALE OF MILES



X River Tin Field



LOCALITY PLAN

L. Keith Ward
 Assistant Government Geologist
 Dec. 1911.

W.K.R.

The X River Tinfield.

I.—INTRODUCTION.

GENERAL.

THE following report comprises the results of the observations made by the writer during a brief examination of the field, extending from December 6 to December 14, 1911.

The examination was somewhat hurried in consequence of the approaching departure of the writer from the State. The conclusions arrived at have not on that account the value which would attach to those attainable after a more detailed investigation of a wider area, but may, nevertheless, serve to explain some features of the occurrences, and to draw attention to the structural details of the lodes which should be borne in mind during the early stages of prospecting. While the absence of any extensive workings has very seriously handicapped the writer in his field work, the publication of the available information will, it is hoped, conduce to the more economical expenditure of working capital.

The X River field is situated immediately to the eastward of the tinfield of North Dundas, upon which a Bulletin (No. 6) has been prepared by the writer, and issued as a publication of the Geological Survey of Tasmania. The geological information gathered during the survey of the district of North Dundas has been of material assistance during the brief examination of this adjacent district. This Bulletin should be read together with Bulletin No. 6, to which it may in some measure be considered to be an appendix.

GEOGRAPHICAL POSITION.

The boundaries of the field cannot yet be said to be defined. The writer's investigations were restricted to that portion of the district upon which work was actually in progress, and within which discoveries of tin ore have already been made.

The area within which the stanniferous lodes occur is, speaking generally, the basin of the X River.

This stream is one of the more important tributaries of the Pieman River, and follows, on the whole, a meridional course, draining the country lying to the west of the divide which follows the Colebrook Ridge. The name was given to the river during the survey of the Emu Bay Railway Line by the engineers, who unexpectedly met the gorge of the hitherto unknown river near its junction with the Pieman River.

The Emu Bay Railway Line skirts the northern portion of the field, and a tramway is now being constructed along the X River valley to connect the mining properties with the railway. This tramline will be of immediate service to the central properties already being worked, and will materially assist in their rapid development. It will also aid in the opening up of the outlying parts of the district, now almost wholly unprospected.

The X River district is separated from the mineralised area of North Dundas by a narrow belt of country which is up to the present time not known to carry stanniferous lodes. The town of Rosebery, situated on the Emu Bay Railway Line, lies to the north-east of the centre of the district, at a distance of $2\frac{1}{2}$ miles.

TOPOGRAPHY.

The Colebrook Ridge follows a meridional course along the eastern portion of the district, and some of the stanniferous lodes are situated upon the crown of the ridge or upon the western slopes and spurs, which extend down to the X River valley. The ridge rises to a height of over 1250 feet (aneroid reading) above the level of the X River in the centre of the field.

To the west of the X River is situated a much less prominent ridge, which rises to a height of 300 feet in places, and which constitutes the divide between the basins of the X River and the Colebrook Rivulet (a tributary of the Ring River).

On the southern bank of the Pieman River there remain easily-distinguishable remnants of a great former flood-plain, which has been referred to in previous publications of the Geological Survey of Tasmania as the Pieman pen-plain. (1)

(1) *Vide* Geol. Surv. Tas. Bulletin No. 6, 1909, pp. 6-9, and Geol. Surv. Tas., Bulletin No. 8, 1909, pp. 10-12.

This peneplain has been dissected by the old Pieman River, which has entrenched itself, and now follows a terraced gorge, and by the more youthful tributaries which follow steeply-graded gorges marked by many rapids and some falls.

The rainfall finds its way to the Pieman River in a very short time, on account of the steepness of the grade of the streams.

The features of relief within the district are sufficiently pronounced to afford aid to the prospector when once the lodes have been located, and will be of still greater advantage when more extensive mining operations are being planned. Adit workings for the prospecting of the lodes in depth are in the majority of cases possible, and if the lode contents are proved to justify exploitation, open-cut methods of mining may be advantageously employed in more than one place. No prominent outcrops can be expected to be found on the surface of the Pieman peneplain; but any lodes that lie beneath that surface can be prospected from the gorges which have cut through the alluvial deposits which cover its surface.

The lodes which are of a quartzose character appear to have exerted some slight controlling influence upon the direction of the ridges, but there is otherwise no consonance between topographical development and lithological distribution.

II.—GENERAL GEOLOGY.

The area comprised by the tinfield lies within the wide terrace occupied by the Cambro-Ordovician slates, breccias, and tuffs. Through the latter basic igneous rocks of later date have forced their way. At a still later period there has been a somewhat extensive fracturing of the crust, followed by the cementation of the fissures thus formed by mineral material introduced from below.

Then, after a great interval, during which at least two long periods of denudation were operative upon the area, the northern portion of the district was partly covered and protected by the deposition of gravel on the broad floodplain of the Pieman River. Such are, in brief, the events which have left their record in the geology of the district. A short account of the rocks present in the area is here given:—

A.—IGNEOUS ROCKS.

(1)—*Cambro-Ordovician Tuffs.*

There are at a number of points throughout the district, particularly on the Colebrook Ridge, bands of greenish-

grey rock, which has the macroscopical appearance of a tuff. In the absence of microscopical examination the determination of these bands as tuff beds can only be regarded as provisional. It was not found possible for want of exposures to map these tuffs apart from the slates with which they are associated. In many other portions of the island the association of the sedimentary rocks with fragmental igneous materials has been noted, and it has been found in many cases impossible to separate upon the geological maps the igneous from the sedimentary rocks, where much more abundant natural exposures exist, and where artificial openings are numerous.

In the X River district the tuffs, if they may be granted to exist, are certainly not the predominant components of the series.

(2)—*Serpentine and Norite.*

A broad dyke, of basic to ultra-basic composition and variable lithological type, follows the general course of the Colebrook Ridge, but upon its western flank. From it a narrow dyke branches off in a direction bearing N. 70° W., and extends as far as the X River, but cannot be traced further.

The southern part of this dyke examined by the writer consists of serpentine, which is dark-green in colour, and carries no distinguishable constituents other than serpentine itself and iron ores. On weathering it becomes very pale in colour, and upon the pale-grey surface small octahedra of chromite stand out in relief. Seams and veinlets of columnar magnetite are common throughout the rock, but no massive developments of magnetite were noticed.

To the northward, in the vicinity of the stanniferous lodes, the rock-type is rather different. Whereas the serpentine mentioned above appears to have been derived from an anhydrous rock of peridotitic type, the more northerly portion of the main dyke, as well as the whole of the north-westerly branch, consist of a rock which has in its original condition possessed a considerable felspathic content. The ferromagnesian constituent appears to the naked eye to be bronzite, and the felspar seems to have undergone alteration into saussurite. Hence it appears advisable to call the rock a saussurite norite, pending more minute investigation with microscopical aid. The surface of this type of rock is greenish in colour, and the medium to coarse-grained habit can usually be detected on weathered surfaces.

These rocks bear no direct relationship to the ore deposits, save with respect to their contribution of magnetite and chromite to the secondary deposits of fluvial origin.

The serpentine was not traced southwards to its termination. At its northern end it disappears beneath the younger alluvial deposit of the Pieman peneplain. It is probably directly connected with a broad belt of serpentine, which stretches from the eastern slopes of the Parson's Hood to a point a little to the northward of the area mapped.

B.—SEDIMENTARY ROCKS.

(1)—*The Cambro-Ordovician Slates.*

The greater part of the area which was examined is occupied by the old altered sediments, which are commonly referred to in the literature of the Geological Survey as the Dundas slates. The series is one which possesses wide areal distribution, and a considerable, though undetermined, thickness. Within the limits of the X River district little can be seen of the characters of the unaltered slates. The yellowish kaolin so abundant beneath the superficial vegetable cover is the result of the operation of weathering processes upon the normal clay slate which is visible in the beds of the streams and in the mine workings.

As has been indicated above, the sediments of normal character are associated with beds in which there appears to be a considerable proportion of fragmental igneous material. This is a normal characteristic of the series wherever it has been recognised.

In one place, in the northern part of Section 4953-m, there is a bed containing numerous elongated pebbles and boulders. This bed appears to be a consolidated shingle bed in which the separate boulders and shingles have been compressed and greatly elongated by the crustal movements which gave rise to the slaty cleavage. The shingles are themselves composed of slate, and after suffering elongation adopt rather remarkable forms. Some of them are drawn out into forms shaped like spindles, but greatly elongated. Others are stretched into long blades with rounded or pointed ends. Even the more massive fragments are pinched at the ends and terminate with sharp points.

The only exposure of this rock is in a creek bed which has been worked for tin ore. The strike is at this place N. 35° E., and the inclination of the beds vertical.

In other places the only exposures giving any information regarding dip and strike are not of any value for the reason that the presence of the vein fissures at those places is itself a sign of dislocation, which is likely to be of a local character.

(2)—*The Alluvial Deposits of the Old Pieman Flood-plain.*

In Bulletin No. 6 of the Geological Survey of Tasmania (pages 35-36) a description of these unconsolidated river gravels has already been given. It is unnecessary to repeat that description in this place, since the gravels of the X River district are identical in character and form part of the same geological unit. The age of the deposit is estimated by the writer to be approximately Pleistocene.

The gravel appears to overlie, in the northern portion of the X River field, at least some portion of the lode systems exposed in the gorge of the river, and its presence in the vicinity of the railway-line has effectively concealed any underlying extension of these lodes in that direction.

III.—ECONOMIC GEOLOGY.

A.—THE PRIMARY STANNIFEROUS ORE-DEPOSITS.

(1)—*Mineralogy.*

The tin content of the lodes here under consideration exists always, as far as is yet known, in the form of cassiterite. No sign of the presence of stannite has been encountered, even where the lode is strongly pyritic in character.

The minerals associated with the cassiterite in the primary ore cannot at the present time be fully enumerated for want of the necessary exposures at depths below which secondary alterations have taken place. There are, however, sufficient exposures of ore to indicate, with a reasonable degree of probable accuracy, the nature of the primary ore.

There seem to be present two main groupings:—

- (a) The first of these, which is represented by the ore-body now being prospected within the limits of Section 5014-M by the X Proprietary Syndicate, is especially distinguished by the presence of abundant tourmaline and a predominantly siliceous gangue. Iron pyrites and arsenical pyrites are present also, but in lesser amounts. The cassiterite is coarse in grain, and in a few places forms shoots of almost clean ore, with which only quartz is associated. Traces of gold are found in the lode.

- (b) More densely pyritic material, the exact nature of which in depth cannot with such accuracy be ascertained. Almost all of the workings on lodes of this type are extremely shallow, and little more than gossan is exposed. However, from indications observed upon the Athenic Prospecting Association's Section 5156-m, the Olympic Prospecting Association's Section 4943-m, and Section 4878-m at the mouth of the X River, the writer would class these lodes as pyritic-cassiterite lodes. It is true that there are certain siliceous shoots of tin ore within the boundaries of lodes of this type—the rich shoot of ore located on the Olympic Association's section, and now being worked, is an example—but the bulk of the lode-matter seems likely to be densely pyritic in depth. There are already good proofs that iron pyrites, arsenical pyrites, and copper pyrites are all associated with the cassiterite in these deposits.

The cassiterite in the siliceous portions of the lode is fairly coarse-grained, but that disseminated through the oxidised sulphides is excessively fine.

The difference between these two groupings is not one upon which too much stress should be laid, and it is by no means certain that the tourmaline-bearing type does not merge into the other.

(2)—*Structural Features.*

The resemblances between the tin-ore deposits of the X River and those of North Dundas are not restricted to composition only, for in structural details there is much similarity also.

In the X River field the simple tabular type of lode, commonly known as a simple "fissure-lode," is hardly known. Its place is almost invariably taken by a more complex type, which may be referred to as a "lode-system."

The difference between simple fissures and these highly complex fissure-systems is caused by the nature of the stresses producing the fissuring and the behaviour of the rocks under the stresses.

Both at North Dundas and the X River fracturing of the crust has been compound—not simple; and the ore-

bodies which have resulted from the filling of the fractures and the impregnation of the country-rock within the limits of the broken zone are correspondingly complex as regards their structure.

Much more development work is required throughout the whole district before an accurate description of the structural peculiarities of the ore-bodies can be given; and the relationship between adjacent ore-bodies is at the present time quite unknown. The following account of the structure of the lodes is therefore to be regarded as subject to any modifications that may be necessary in the light of more extensive exposures.

There seem to be two rather different varieties of structure among the lodes of the field.

In the first place there exists a variety of lode-system very closely resembling that which exists at North Dundas along the line of the "Renison Bell-Montana-Boulder lode-system," described by the writer in Bulletin No. 6 of the Geological Survey of Tasmania (pp. 64-66). The principal lode worked in the X Proprietary Syndicate's Section 5014-M, and probably also the western lode crossing the X River in Section 4911-M, near the south-eastern corner of Section 4878-M, belong to this type.

The tunnel workings on the former lode and the outcrop of the latter in the gorge of the X River give some idea of the details of the structure.

The several components which together constitute the lode-system dip in all directions, and the blocks of intervening country-rock have no constant features of dip or strike. This country-rock is shattered and traversed by numerous small veinlets of lode-matter; and there has been some impregnation also along the bedding-planes and joint-planes of the slate.

The formations as a whole constitute lode-systems which may be said to be greatly-elongated stockworks; for they have at any point the complex fracture-scheme of a stock-work, and yet extend lineally for a distance which is large in proportion to their width.

The strike of the formations as a whole is very nearly meridional—a little to the west of north, as far as can now be ascertained. In this respect they resemble the main mass of serpentine and norite, which has an approximately meridional strike.

In the absence of continuous exposures this general direction of strike must for the time be accepted. It is possible that the lode-systems observable in the X Proprietary Syndicate's sections, in Section 4911-M and in Section

4878-m, all are to be grouped together as components of a great master-system which has a strike of about N. 30° W. That is to say, the meridional lodes may be arranged *en échelon* in a broad belt of mineralisation which extends along the general direction of the course of the X River, and lies chiefly to the west of the river. This matter will readily be understood by reference to the map on which the lodes are shown in their relative positions.

The width of the lode-systems of this type is considerable, but it cannot yet be stated in definite figures. Each of the formations mentioned as examples of the type is certainly over a chain wide, perhaps over 2 chains.

Of the other lodes in the district, the structural features appear to be less unusual. There has been very little done to expose the lode-matter, but sufficient to show that the lodes are rather impregnations of sheeted zones than simple fissure fillings.

As examples of this structural type, the main lode on the Athenic Prospecting Association's Section 5156-m, and the lode-matter, which strikes in a direction parallel to the railway-line in Section 4878-m.

The details of the lode-structure in Section 5156-m are by no means clear. The course of the lode as a whole has been proved to traverse the section diagonally. But the several parts of the formation appear to have a more northerly strike. Perhaps it may be found, when more work has been done, that the components of the formation strike only a few degrees west of north, as do the lodes in the adjacent Section 4943-m; while the whole system trends much more nearly north-west.

The discolouration with limonite of the country-rock which is found between the bands of gossan in the sheeted fracture-zone causes no little obscurity of structure, while operations are restricted to the oxidised zone. It seems to the writer probable that the slate itself has been strongly impregnated with metallic minerals, which have metasomatically replaced portions of the sedimentary material, and that the discolouration of the slate is due to the oxidation of the minerals thus thoroughly disseminated through the slate of the fracture-zone.

(3) *The relation of the Stanniferous Lodes of the X River to the Lodes of Neighbouring Fields.*

The X River tinfield lies upon one of the principal zones of mineralisation of the West Coast region of Tasmania.

The writer has elsewhere (in the Proceedings of the Australasian Association for the Advancement of Science,

Sydney, January, 1911; and briefly in Bulletin No. 10 of the Geological Survey of Tasmania) shown that there is a well-defined mineralised belt which extends from the Heemskirk Range through Comstock, Zeehan, the Five-mile, North Dundas, Rosebery, and Mt. Farrell, to Granite Tor and Mt. Claude, along which related igneous rocks and similar ore-bodies outcrop at various points. The lodes distributed along this zone vary in composition from point to point, in accordance with certain physico-chemical principles discussed at some length in Bulletin No. 8 of the Geological Survey of Tasmania. Briefly stated, the variations in the character of the lodes are related to their proximity to the igneous masses which were derived from the same magma. In other words, the lodes which occur either in or at the borders of the granite or granite-porphyrty are characterised by the presence of the metals tin, bismuth, and wolfram; while the lodes more distant from these igneous rocks are characterised by the presence of silver-lead ores.

The granitic intrusions appear to have approached more nearly to the surface of the period of invasion (Devonian) at some places than they did at others; so that along the belt intruded by the granitic magma the profile of the granite appears to have been an undulating one. In a general way the silver-lead lodes are now found above the troughs of this undulating surface, having been removed from the crests by denudation. In the same way the ores of tin, wolfram, and bismuth are found above the crests of the undulating surface of the granite.

While no granitic rock has yet been recognised in the X River district itself, it is probably not far below. The nearest known outcrop—the granite-porphyrty of Pine Hill, North Dundas—is less than $2\frac{1}{2}$ miles distant from the centre of the field.

The pyritic tin ore of North Dundas is closely related to that of the X River district, and the tourmaline-bearing ore of Pine Hill, North Dundas, is closely related in composition to that of the X Proprietary Mine.

To the eastward tin ore associated with gold has been found on Section 2252-m, immediately to the eastward of the Rosebery station. Wolfram, bismuth, fluorspar, and tourmaline have been found at the Mt. Black Proprietary Mine in the same vicinity.

The Colebrook Copper Mine lies just to the eastward of the centre of the field, and the ore found there possesses some characters which indicate its relationship to

the stanniferous lodes here mentioned, as regards both the metallic minerals present, and the non-metallic gangue.

The old Lynton Mine, Section 4734-m, in which the galena is associated with barite, is situated almost on the stanniferous belt of the X River field, and a similar close association has been noted between tin ore and barytic lead ore in the Comstock district. ⁽¹⁾

B.—THE ALLUVIAL DEPOSITS OF SECONDARY ORIGIN.

There are no very striking features present in the alluvial and detrital ores of the X River district. The importance of these does not appear, as far as may be judged from a rapid examination of the field, to be great.

The streams which join the X River from the westward carry a little clean tin ore, but there is no great amount of wash, which seldom attains a depth of more than a few inches.

Along the banks of the X River itself there are some alluvial deposits of small extent. These carry a certain amount of chromite in octahedral grains, and of magnetite in short rods, both having been derived from the serpentine-norite dyke.

The creeks to the eastward of the X River naturally contain these same heavy impurities mingled with the alluvial tin ore.

From the older gravels of the old Pieman peneplain a certain amount of gold finds its way into the creeks which dissect its surface, and fine "colours" from this source have been recognised in several places by the prospectors of the field.

IV.—THE MINING PROPERTIES.

(1)—*The X Proprietary Syndicate's Sections.*

The mineral leases owned by the syndicate are six in number—5003-m, 5004-m, 5013-m, 5014-m, 4973-m, and 4974-m, comprising in all 381 acres.

These sections were not taken up at such an early date as those lying to the north-west. But immediately after the discovery of tin ore in Sections 4878-m and 4911-m, a prospector (Mr. T. Williams) made his way up the valley of the X River and found alluvial tin ore on a flat now crossed by the boundary-line between Sections 5013-m and

⁽¹⁾ Compare also the proximity of barytic galena lodes to bismuth-bearing ore-bodies at the southern end of the Mt. Farrell field. Geol. Surv. Tas., Bulletin No. 3, pp. 49 and 51.

5014-m. Following the fragments of broken lode-matter up the hill to the westward he located the principal lode-system, now being worked in Section 5014-m. From that time onwards the main object of the syndicate has been to expose this lode-system by trenches and tunnels at various points along its course.

This lode follows an approximately meridional course southwards from the intersection of the northern boundary of Section 5004-m to the central portion of Section 5014-m, beyond which no attempt has yet been made to prove its existence.

An early trench across the lode-system in the centre of this section disclosed ore of promising appearance, and another trench a few feet to the north gave even more promising results over a width of 20 feet. The former trench was continued for some distance in a westerly direction, and does not even then expose the whole width of the lode-system, which apparently is over 100 feet wide. Realising that shallow trenching affords very little information beyond the mere proof of the existence of the lode, the syndicate decided to drive a tunnel in a westerly direction across the lode 60 feet below the outcrop on the crown of the hill. At the time of the writer's departure from the district this tunnel had been driven 200 feet, the last 80 feet of which traverse the lode-system.

The bands of quartzose ore carrying tourmaline and cassiterite can be seen on the back, floor, and sides of the tunnel, dipping in all directions. The ore is to some extent gossanous in places, and in others a little iron pyrites and arsenical pyrites appear. Some of the veins of ore are extremely rich in tin ore, and their width is in places as much as 2 feet. The material of these veins in many places shows the banded structure of typical crustified ore.

Between the veins of quartzose ore there are displaced blocks of clay slate also dipping in all directions. Minute veinlets of siliceous ore traverse this slate in many directions, and even where they are not visible the slate has been found by assay to carry up to 0.7 per cent. of tin. The country-rock giving this comparatively high return of tin ore is dark in colour, and has clearly undergone some alteration by the mineralising solutions (perhaps silicification and tourmalinisation have occurred, but no certainty can be attached to this suggestion in the absence of microscopical examination). The pale-coloured clay slate, which forms the bulk of the material between the veins,

has been also assayed and found to carry 0.2 per cent. of tin.

This tunnel affords an excellent section of the lode-system, but is, of course, quite insufficient in itself to provide data on which to calculate ore reserves. In order to gain information for this purpose it is advisable to carry three or four rises through from the back of the drive to the surface, and to sink a corresponding number of winzes or to drive a lower-level adit and effect connections with that now existing. When this has been done at a few points along the course of the lode-system a reasonable estimate can be formed of the contents and grade of the whole formation. So good are the prospects obtained in the present workings that these further developmental operations should be commenced at once. The present tunnel should be continued until the fractured zone is completely traversed and the ore blocked out in the manner indicated.

At the time of the writer's visit the amount of quartzose ore won from the drive and stacked at the mouth of the adit was estimated to be about 100 tons. The average grade of this ore is certainly good.

Another short tunnel was started at a point some 4 chains north of that already mentioned. It is rather shallow, and has been begun from a point within the limits of the lode-system, for veins of ore were exposed in cutting the approach. A tunnel started from a point some distance to the eastward and at a lower level, to come in under this place, would give valuable information. The small amount of ore exposed at this spot is on the whole similar to that visible in the main tunnel workings.

The only other work which has been done upon the lode-system to which reference is being made consists of trenches cut across part of the formation in the adjoining Section 5004-m. On the northern bank of a creek, the bed of which has been sluiced for the alluvial tin ore, there is a trench a chain long which cuts the capping of the lode. Tin ore is visible in the lode-stuff, but the grade of the ore is not as good as that exposed to the southward. The full width of the system is not exposed by this trench. Still further north, and close to the X River, another trench also shows tin-bearing stone. The superficial clay at this place contains very fair prospects of tin ore. Between these two trenches the lode is covered by the alluvial deposit of the old Pieman peneplain.

Beyond the northern trench the lode system is visible in the river-bed on the northern boundary of the section, but has not been opened up.

No other work has yet been carried out upon lode-matter which indubitably forms part of this main lode-system. It is especially desirable that prospecting operations should be carried out to the south of the principal tunnel. And it is known that fragments of tin-bearing lode-stuff occur in the small creeks entering the X River from the westward at points further south than any existing workings.

There appears to be very strong evidence of the existence of a parallel lode-system lying to the west of that already described. A shallow trench has been cut in the southern part of Section 5014-m, and in it stanniferous lode-matter has been exposed of a character similar to that seen in the main tunnel.

Again, near the northern boundary of Section 5004-m there is a small outcrop of lode-stuff, barely visible for the dense cover of vegetation and the surrounding gravel. This latter, when considered together with the outcrop in Section 5014-m and the outcrop of the so-called "pyritic lode" in the bed of the X River in the central part of Section 4911-m, points to the necessity for trenching in order to test whether or not there is a continuous lode-system lying a short distance to the westward of that now being worked. It may even be found that there is an extremely wide lode-system comparable to that of the Renison-Bell-Montana-Boulder line at North Dundas, rather than two distinct and parallel systems.

Moreover, to the eastward of the main line of lode-matter, there appears to be another development of quartzose ore barely exposed near the south-eastern corner of Section 5014-m, and again in the bed of a creek which has been worked for alluvial tin ore in Section 4953-m. There was no cassiterite visible in those portions of this occurrence which the writer examined, but the general character of the vein-stuff is identical with that of the stanniferous lodes.

In the south-eastern corner of the western Section 4974-m, a little quartzose vein-stone has been found at the root of a fallen tree. This stone may be portion of a lode lying to the west of any mentioned above. The vegetable cover is dense at this place, and no outcrops can be expected. It is certainly advisable to trench for lode-matter at this place, especially in view of the fact

that alluvial tin ore is known to exist in the creek running through the 10-acre Section 5099-m, which is situated to the westward.

The alluvial deposit in the bed of the creek which crosses the main lode in Section 5004-m has been worked for a short distance, and a few bags of tin ore have been recovered. The water-supply at this place is poor, save while rain is actually falling, and the deposit is only a few inches in depth.

The value of the property appears at the present time to lie chiefly in the principal lode-system upon which operations are now being carried out. The prospects are certainly good, and if future developments planned upon the lines here suggested prove the ore-shoot to be continuous for any distance the property is a valuable one. The topography is favourable to open-cut methods of mining the lode-system within Section 5014-m to an appreciable depth below the surface, and the ore-veins may readily be picked from the intervening blocks of clay slate, if picking is necessary. The further discussion of these matters should be postponed until the ore-body has been properly blocked out and sampled, a procedure which can be heartily recommended in the light of existing developments.

At the same time every endeavour should be made to test the other known occurrences of lode-matter, and to prove their continuity and relationship to the lode-system now being tested.

(2)—*The Sections lying to the North of the X Proprietary Mine.*

The first discovery of tin ore in the district was made on Section 4878-m, within the boundaries of which the X River effects a junction with the Pieman River.

A little prospecting was done upon this section many years ago, but evidently without any thought of the possibility of the presence of tin in the gossanous outcrops. In this respect the history of the North Dundas district shows a striking parallel. However, in July, 1911, Mr. Fox proved the occurrence of tin ore at this place, and his discovery led to the prospecting of the country lying to the south-east.

At the time of the writer's visit the only work in progress was the sluicing of the upper slopes of the western bank of the X River, immediately to the southward of the Emu Bay Railway-line. The water-supply is not

abundant, and work is consequently intermittent. Less than a ton of ore has yet been won, but detrital and alluvial ore is known to extend for some distance along the bank of the X River. The ground thus treated by sluicing is shallow, and contains both fine and fairly coarse tin ore. The latter is rather angular in character, and is usually associated with quartz.

This fragmental ore has been shed from a broad lode-formation, the strike of which appears to be approximately meridional, *i.e.*, parallel to the course of the X River in this part of the section.

Some trenches have been cut across the capping of the lode-formation, which has a width of up to 30 feet. The exact nature of the lode is as yet difficult to determine. There is a broad band of limonite-stained slate containing veins of gossanous material, and also some siliceous veins. A little pyrite and arsenopyrite remain unoxidised in some parts of the lode. Cassiterite is only visible in the siliceous portions of the formation, and its distribution seems to be rather irregular. Bulk samples taken across the width of these trench exposures show that a certain amount of tin exists over the whole width of the formation, and that in one place it is present in proportions which exceed 1 per cent.

Little can be seen of the outcrop of the lode to the north of the railway-line on account of the superficial clay, but a trench on the bank of the Pieman River proves that there is some extension of stanniferous lode-stuff in that direction.

The only attempt yet made to prove this lode in depth has not yet been pushed far enough to give conclusive results. A tunnel was started in a direction bearing W. 20° S. from the X River bank, and has reached lode-matter, though the whole width of the formation does not appear to have been penetrated. Bands of gossan, quartz, and dense pyritic ore were passed through. The latter ore consists principally of arsenical pyrites, with which are associated copper pyrites, iron pyrites, and some quartz. The tin content of these heavily-mineralised bands has not yet been determined. The pyritic ore only forms a fraction of the whole formation, though it will probably be found that there are metallic minerals disseminated throughout the whole width.

There is little else done upon the lodes within the section, though there is clear evidence of a line of mineralisation extending in a north-westerly direction (approximate-

mately parallel to the railway-line, and just above it). Whether two separate lodes or a broad-sheeted zone has been impregnated is not clear. It is known that some of the gossanous matter and the quartz veins which strike in this direction are stanniferous to a degree which warrants the adoption of more active prospecting measures. The topography is favourable to the prospecting of the lodes at depth by tunnels driven in a south-westerly direction from points situated on the southern bank of the Pieman River.

The property is one of no little value if the stanniferous content of the lodes mentioned proves sufficient to justify the mining of the lodes, which certainly possess considerable size. The data now available are sufficient to amply justify the expenditure of enough capital to prove the tin content at a number of places.

Adjoining the latter section on its eastern boundary, and immediately to the south of the Pieman River, there is a 40-acre section, 5084-m, which is almost entirely covered by the alluvial deposit of the Pieman peneplain. However, in the north-eastern portion of the section there is an exposure of stanniferous lode-matter on the bank of a small creek which has cut its way through the gravel. The relationship of this lode-stuff to the other known lodes of the district cannot be satisfactorily determined at the present time. The writer is inclined to think that it lies to the eastward of the line of the main lode-system worked on the X Proprietary Syndicate's sections to the southward.

South and adjoining this mineral lease lies a 51-acre section, 4911-m, upon which three massive lodes are known to exist, but within the boundaries of which no work has yet been done.

In the first place the main lode-system worked by the X Proprietary Syndicate is visible in the bed of the X River on the southern boundary of the section. It has not been followed northwards.

To the west of it lies a very broad zone of fractured slate, in which occur numerous veins of mineralised quartz. The structure of this zone cannot be determined at the present time. From the presence of pyrites in the river-bed exposure the name of "the pyritic lode" has been given to the formation. Small pieces knocked off the outcrop have shown, on assay, an appreciable tin content. The river crosses the formation at an acute angle, and admirable facilities exist for cutting benches in the steep banks to test the value of the lode.

After crossing this formation the river turns abruptly to the west, and its gorge becomes deeper. A small waterfall of about 30 feet exists, and just below this the outcrop of another complex lode-system rises precipitously from the river-level. The structure of this lode seems to resemble that of the principal lode-system on the X Proprietary Mine. The more durable quartzose portions of the formation stand out in relief, the softer country between the veins having been hollowed out by the agents of erosion. Here, too, fragments taken from the vein-matter have been proved to carry tin ore, but no more than that has yet been attempted. Tunnels can easily be driven along the course of the formation at this place to prove its extension northwards and southwards. Cross-cuts from the tunnels will be necessary to prove the width, which is considerable.

No outcrops are to be seen when once the gorge of the X River is left, for the gravels of the Pieman penplain cover the surface.

(3)—*The Olympic Prospecting Association's Section.*

On the western slope of the Colebrook Ridge, and occupying a large portion of one of the main spurs which extend from that ridge into the X River valley, a section, 4943-m, of 80 acres, charted in the name of A. Morton, is now being prospected with very encouraging results.

The early prospecting in the beds of the steeply-graded creeks which traverse the section proved the presence of fragments of very rich lode-stuff, and the source of this ore was found in the lodes which occupy the south-eastern part of the section, on the eastern side of the great serpentine-norite dyke which runs through the middle of the lease. At the time of the writer's visit very little had been done towards the opening up of the known lodes.

Close to the eastern boundary there is a gossan outcrop which is at least half a chain in width. The strike of this occurrence of lode-matter appears to be N. 10° W., but it is desirable that some trenches be cut across it before the strike can be regarded as certain. The gossan is said to carry tin ore, but it is not known in what proportions the tin is present.

Two chains to the westward of this massive outcrop lies the ore-body from which the fragments of rich ore were shed. The rich shoot of ore is exposed by a bench cut on the steep hillside, and a face 20 feet long and 15 feet high was exposed at the time of the writer's examination.

The rich ore occurs in a narrow vein from 3 to 9 inches in width, and consists almost entirely of cassiterite and quartz. This shoot occupies the central part of a vein which is 18 inches wide, and consists of semi-oxidised quartzo-pyritic ore. The strike of the vein is N. 8° W., and the dip is to the east at 80°. From the main vein numerous veinlets of partly oxidised pyritic ore carrying appreciable proportions of cassiterite may be seen penetrating the footwall country.

There has been nothing done to prove the extension of this rich ore northwards or southwards, nor to open up the surface between the rich vein and the gossan outcrop which lies above it to the eastward. This work should be commenced forthwith.

The relation of the good shoot to the gossan cannot yet be determined, for the dip of the latter is unknown. But the dip of the rich ore is eastwards, and it is necessary to search for other possible makes of ore between it and the gossan.

A short distance to the north-west, and from a point 170 feet lower down the hill-slope, an old tunnel has been driven for a distance of 180 feet by former lessees of the section. The bearing of the tunnel is E. 12° N., so that its course is approximately at right angles to the strike of the lode-matter already mentioned.

At a distance of 120 feet from the entrance a short drive southwards follows a gossanous vein now known to carry tin ore. The last 14 feet of the main tunnel are in gossanous material, said to carry good tin values.

The face of the tunnel is in clean slate, but it should be continued further, for there is the possibility of other makes of ore behind this apparent wall. The former abandonment of the tunnel was due to the fact that tin ore was not suspected in the gossans of this district, which was being prospected for copper. The relationship of the ore met in the tunnel to the other outcrops is at the present time undetermined.

The rich shoot of ore is at the present time being broken down from the open face on the hillside, and bagged for transmission to the smelters. In itself the shoot is not large, but its importance is great in that it points to the possibility of the discovery of similar veins of high-grade ore in the more extensive formations known to carry a small percentage of tin ore.

The position of the outcrops is such that a considerable quantity of ore can be cheaply blocked out and mined if the grade proves sufficiently high.

(4)—*The Athenic Prospecting Association's Sections.*

A group of three mineral sections, 5155-m, of 49 acres, 5156-m, of 74 acres, and 5166-m of 80 acres, are held by the Athenic Prospecting Association. These are situated upon the crown and western slopes of the Colebrook Ridge, and lie to the east of the Olympic section, and to the south of the property of the Colebrook Prospecting Association.

The discoveries of tin ore within these leases were among the first made in the district, Messrs. Hill and Fenton having carried out some early prospecting there during the middle portion of the year 1910.

Up to the present superficial work only has been done; but the results obtained are sufficiently good to warrant the adoption of more energetic and systematic measures.

In an old trench, cut by a former owner of the lease, and situated in the north-eastern portion of Section 5156-m, tin-bearing lode-stuff of good grade has been found. The lode in this trench is over 5 feet wide, and carries a narrow band rich in tin ore. The exact character of the primary lode-stuff at this place cannot yet be told, for the trench exposure shows only a band of much altered and weathered slate, deeply stained with iron, and containing gossanous bands. The tin ore is not visible to the unassisted eye. A soft, scaly, green mineral (perhaps chlorite) is present in the lode. The outcrop may be traced from this place across the ridge and for some distance down the eastern slope of the Colebrook Hill. Its strike is N. 33° W., and the dip appears to be very nearly vertical. A few holes have been excavated in the capping, but no serious attempt has been made to expose the vein-matter. The topography is favourable to the prospecting of the lode from its southern end, in Section 5166-m, by means of a tunnel.

The principal attention of the prospectors of the section has been directed towards the opening up of a lode which traverses the same Section 5156-m, and outcrops most prominently upon the crown of the principal spur running westwards from the Colebrook Ridge.

The lode follows a course which has on the whole a north-westerly strike if the several outcrops which have been located from point to point lie upon the same lode. On account of the presence of the vegetation and the want of work done upon these outcrops this strike is by no means certain. When any one outcrop is examined by itself it certainly appears that the strike is much more nearly meridional than is that of the general trend of the outcrops when these are regarded collectively.

Throughout its length the lode is found to carry some tin ore. No idea can yet be formed of its average value. Pieces broken from the outcrops, crushed and vanned, show the presence of the tin ore, which is seldom visible to the naked eye. There are numerous bands of limonite, some friable and some massive, within the formation. The latter variety of ore when broken open sometimes shows unoxidised pyrites. The more friable bands give the best results when vanned for their tin contents, probably because crude crushing appliances allow the loss of a fair proportion of the cassiterite in that part of the ore which is not reduced to a sufficiently fine state of division.⁽¹⁾ The tin ore in this lode appears to be in all cases very fine-grained.

It seems to the writer probable that the outcrop is that of a composite lode which, in its unweathered state, consisted of numerous bands of pyritic ore and intervening belts of mineralised slate. Some of the bands of gossan certainly carry good values, though no tin ore can be detected before vanning. The only visible cassiterite occurs in small siliceous veins which are associated with those of a gossanous nature.

There are a number of trenches near the western boundary of the section, and a tunnel has been driven to intersect the lode at a depth of 50 feet below the outcrop. The course of the tunnel is at first southerly, and it turns to the south-west to cross the formation. The lode-matter has been sampled in bulk and assayed. The tin content of the whole is fair, and it is known that some of the bands of gossanous material carry good values.

The course to be recommended for the prospecting of the lode in this locality includes firstly the cutting of a number of trenches across the formation at frequent intervals until the course of the lode is clearly defined, and secondly, the extension of the tunnel workings. The tunnel should be driven along the course of the lode with crosscuts at regular intervals to prove its width.

There are no indications yet as to the probable depth below the surface to which the oxidation of the lode-matter has proceeded. The amount of pyrites now observable is quite insignificant in amount. The features of relief of the country are so accentuated in this vicinity

⁽¹⁾ *Note.*—In these rough vanning tests carried out in the field it is seldom that the whole of the sample taken is crushed sufficiently fine to pass through a sieve of close mesh. The result is that the cassiterite finally observed in the dish represents the content only of the portion of the sample which has been reduced to a fine powder.

that it may reasonably be hoped that there will be found some considerable depth of oxidised ore.

The large extent of the outcrops is sufficient proof of the importance of the property; it remains only to open them up in such a manner that an accurate estimate of their value may be obtained.

(5)—*The Southern Sections situated on the Colebrook Ridge.*

A group of three sections, 5274-M, of 78 acres, 5277-M, of 23 acres, and 5275-M, of 73 acres—charted in the name of G. Stokell—are situated at the southern end of the Colebrook Ridge.

A commencement was just being made to prospect this area at the time of the writer's visit.

In the northern part of Section 5274-M there is a very massive outcrop of gossan, upon which a shaft has been sunk in the past. No information with regard to these old workings are available, and it would be well to test the material obtained from the shaft for its possible tin contents. It is certainly advisable to cut through the superficial portion of the gossan before taking samples for assay. The observations made by the writer in the adjacent tin-field of North Dundas⁽¹⁾ point strongly to the fact that the gossanous capping of a pyritic-cassiterite lode is often relatively poor in tin. There is apparently a superficial redistribution of the iron by continual solution and reprecipitation, and the more insoluble tin ore remains in that part of the capping which represents portion of the original lode.

The strike and dip of the gossan lode in this section cannot yet be ascertained, and no information can be expected before the dense vegetation is removed and some trenches are cut. The position of the outcrop on the crest of the ridge is admirably suited for inexpensive prospecting.

A few chains away, and to the south-west of this formation, lies another of similar character. It is partly exposed in a cutting on the old Mt. Black pack-track. Tin ore is said to be present in this gossan. The recommendation given above with regard to the need for the opening-up of the gossan before taking samples for assay should be borne in mind with respect to this lode-matter also. Every endeavour should be made to ascertain whether there is

(¹) *Vide* Geol. Surv. Tas., Bulletin No. 6, 1909, p. 71. The more recent developments on the North Dundas field show that these precautions are necessary in all cases when gossans are being prospected for tin ore.

any connection between the two gossan outcrops. That which is seen on the pack-track appears to strike in a direction bearing N. 25° W.; but verification of this direction is needed from deeper workings before it can be regarded as certain.

At the south-eastern corner of the section there is a little iron-stained stanniferous lode-matter exposed at a point on the Williamsford track.

And again in Section 5275-m, near the south-eastern corner, there is a fairly massive quartzose lode, the strike of which is N. 12° W.; and in which tin ore has been found. Some chlorite is present in the quartz.

The creeks which drain this portion of the Colebrook Ridge are known to carry fine-grained tin ore.

Hitherto very little work has been done with the object of finding stanniferous lodes in these leases, and prospecting cannot but advance slowly on account of the presence of so much vegetation. Much remains to be done within the boundaries of these three leases.

V.—CONCLUSION.

The X River district is at the present time at only the very earliest stage of development. Hitherto there has been practically no tin ore produced from the field. The few small parcels of alluvial ore which have been sent out have been obtained from the creek beds or the cappings of the lodes by small parties of prospectors working with crude appliances. The ore thus won represents for the most part the coarse-grained cassiterite of the lodes.

The grade of the X River is so steep that only the large tin ore can be expected to be found in appreciable amount in the beds of the river and its tributaries. It is certain that almost all the fine-grained ore has found its way to the Pieman River.

Hence it follows that the importance of the lode-matter still *in situ* is much greater than could be estimated after an examination of the alluvial deposits only. The fine state of division of the tin ore in many of the lodes has been commented upon in other parts of this report. The losses, which are inevitable in the natural processes of concentration by stream action, can be minimised in any future scheme of milling if this fact is kept constantly in view. In some of the lodes, notably at the sites of present mining operations on the X Proprietary and Olympic Mines, the grain of the cassiterite is coarse, and no difficulties in concentration need be anticipated.

It has been shown above that there are a large number of lodes within the district in which tin ore has already been proved to be present. Many of these lodes appear, from their outcrops, to be of considerable size; and if the tin content proves sufficient for the exploitation of the lodes upon a large scale, the future production from the district will be large. Until there is more work done upon the lodes, and until adequate data are available for the estimation of grade and tonnage, any discussion of the potentialities of the field as a tin-producer must be qualified in such a manner as has here been done. It is certain only that there is a wide distribution of tin ore in lodes which it has been the object of this bulletin to describe. Mining operations carried out upon the lines here suggested will provide the necessary information for a more definite pronouncement to be made in the future.

On the whole, the writer has no hesitation in stating that in his opinion the field is one of considerable promise, and that throughout its extent the lodes are worthy of being energetically prospected with a view to exploitation upon a large scale.

In conclusion, the writer would offer his sincere thanks to all who so generously assisted him in the field, and to those whose hospitality he enjoyed during the recent examination

L. KEITH WARD, B.A., B.E.,
Assistant Government Geologist.

Launceston, 28th December, 1911.

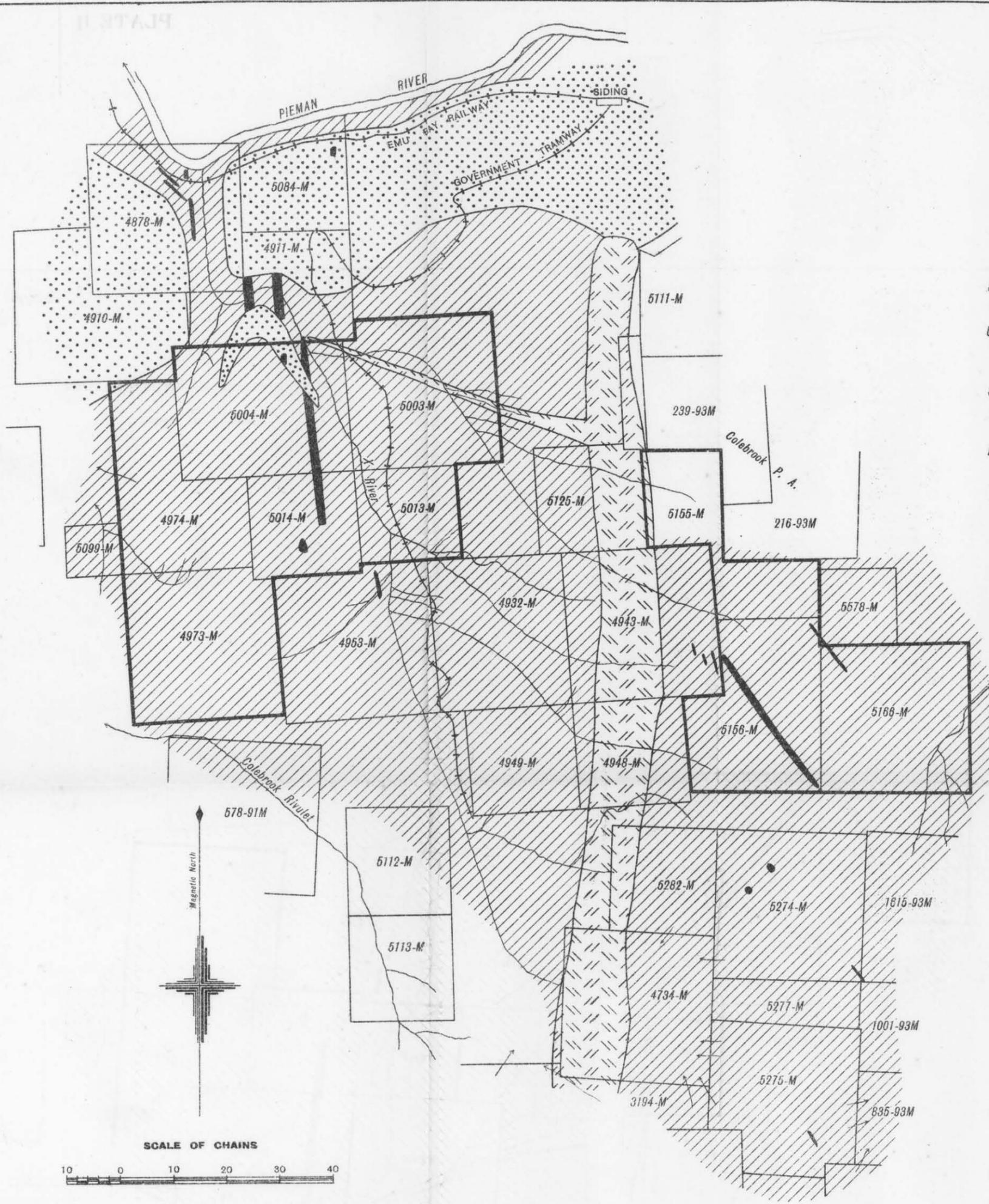
GEOLOGICAL SKETCH MAP OF THE X RIVER TIN FIELD

LEGEND

Slates and Tuffs	CAMBRO-ORDOVICIAN	
Unconsolidated Gravel	PLEISTOCENE	
Serpentine and Norite	DEVONIAN	
Lodes		

KEY TO NUMBERS OF MINERAL SECTIONS.

Number of Section.	Acres.	Lessee.
4973-M	80	X Proprietary Syndicate
4974-M	66	
5003-M	80	
5004-M	80	
5013-M	36	
5014-M	39	
4932-M	71	E. Mulcahy and T. Lyons
4953-M	80	
4878-M	80	
5084-M	40	
5155-M	49	Athenic P. A.
5156-M	74	
5166-M	80	
4943-M	80	Olympic P. A.
5274-M	78	G. Stokell
5275-M	73	
5277-M	23	
4911-M	51	H. Cox
5125-M	40	P. A. O'Byrne
4910-M	70	A. Packett
5113-M	40	T. Buckley and others
4948-M	40	P. E. Karlson
4949-M	40	
4734-M	80	Fahlerz Pros. Syndicate
5578-M	20	K. J. Watkin
5099-M	10	H. Edwards



W.D.R.

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Dec. 1911.