GEOLOGICAL EXPLORATION OF THE COUNTRY BETWEEN TYENNA & GELL RIVER

REPORTS BY GOVERNMENT GEOLOGISTS.

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Launceston, July 6, 1908.

SIR,

I BEG to present my report upon the geological exploration of the country through which the Great Western railway survey-line passes, from Tyenna to the 60-mile peg at the Gell River.

I.—OBJECTS OF THE EXPEDITION.

The aim in view may briefly be described as the carrying out of certain purposes designated in "The Exploration Act" passed by Parliament last session, namely:—(1) Exploring the country in the vicinity of the route surveyed for the Great Western Railway; (2) reporting upon the geological and physical features of the country traversed during the exploration.

The other purposes scheduled in the Act, namely, construction of tracks, reports on agricultural land and timber, were in other hands.

Mr. L. K. Ward, B.E., Assistant Government Geologist, had charge of a geological exploring party at the northern end of the surveyed line, from Gormanston to the King William Range, and has presented a separate report.

II.—PARTY COMPOSING THE EXPEDITION.

I had with me Mr. A. S. Atkins, who acted as topographer; Mr. J. Gilbert Timbs, an experienced bushman; and Messrs. Douglas Marriott and Lewis Chaplin, hand-packers. All the members of the party discharged their duties to my satisfaction. Mr. Atkins constructed the topographical map as we proceeded, for this purpose making tedious ascents to the summits of the trig. and numerous other mountains along our line of route.

III.—PERIOD COVERED BY THE JOURNEY.

I left Hobart on the 24th January, and returned on the 2nd April. January and February months were fine, and we covered a good deal of ground without interruption, but work was greatly impeded in March by wet and stormy weather. Towards the end the weather became too tempestuous to justify the expense of further work in the field.

IV.—ROUTE FOLLOWED.

The Great Western Railway pack-track was entered upon where it starts from the Tyenna-road at Rolls' farm, 18 miles from Glenora. The track crosses the Russell's Falls River, and runs westwards on the southern slope of Mt. Field for 11 miles to the Humboldt Divide. There it descends into the Florentine Valley, and continues in a general westerly direction for 6 miles, crossing successively the Little Florentine and the Florentine Rivers, and passing round the south end of the Tiger Range, when it turns northward along the eastern border of the Gordon Plain, and eventually crosses the button-grass plain to the cage on the Gordon River near the Great Bend, 10 miles from the Humboldt saddle. Up to this spot pack-horses can be taken. Beyond this, for the present, a horse can travel safely only in fine weather. In the rainy season there is, for horses, danger of being bogged in the button-grass flats, and there would be difficulty in crossing some of the small creeks in flood. At the Gordon crossing, besides the cage there is a good ford available when the river is not in flood. At low-water the depth does not exceed a foot to 18 inches.

From the crossing at the Gordon a flying journey with one tent was made through the Gorge at the north end of the Thumbs for 5 miles west to Clear Hill. There is no track, but the country is open and can be traversed on foot.

From the Great Bend the line of route which has been staked out by Mr. J. L. A. Moore this year along the Valley of Rasselas, parallel with the Great Western Railway survey, was followed to the 10-mile north of the Bend, or near the 51¼-mile on the Great Western line.

While at the Gordon, the Thumbs, Mt. Wright, and the Gordon hills were ascended, and Dawson's-road across the Tiger Range explored. This old road crosses from Huntley into the Florentine Valley, and takes a winding course to Dunrobin bridge, a distance of 40 or 50 miles. It is well graded, and it would not cost very much to clear it out and make it passable for vehicles.

While in camp 10 miles north of the Bend we ascended the Denison Range, on which three tarns or glacial lakes were discoverel. The Gordon River on the eastern side of the valley was also examined. From this camp we broke into the western country behind the Denison Range, along the new route line staked out by R. Marriott from here to Webster's track on the Gordon River above Pyramid Island.

The ranges on the north side of the gap through the Denison Mountains were ascended, and a camp formed at 5 miles along the route. From here the most northerly of the mountains, known as the Three Stars, was ascended. The next camping place was 3 or 4 miles further west, on the shore of a lake under a precipitous hill of contorted quartzitic schist, which we called Mt. Curly. We found that the lake is the source of the Gell River.

We passed over the hills to the north-west, and at 4 miles pitched the tent at the eastern or southern foot of a steep serrated range, to which we gave the name of the Spires. While here we ascended to the summit of one of the high peaks. Marriott's track passes over a saddle in the range behind where we camped, and then plunges down 2000 feet into the valley of the Denison River, on the west side of which is the Prince of Wales Range. Mr. Atkins took a tent-fly and blanket, and made a forced march into the valley and up the Prince of Wales Range, and then down the river for some distance. This was the furthest point reached in this direction. We decided to return to the Rasselas Valley by following the creek along the foot of the Spires to the north-east, and then down the valley of the Gell to the hut recently erected by J. L. A. Moore, about 3 miles west of the 60-mile peg on the Great Western survey line.

On arrival there on the 18th March I found that the track-cutting parties were being recalled for the end of the month. As bad weather had set in and I was anxious to examine the mineral shows at the Needles on the Tyenna fall of the Humboldt Divide, I decided to turn the steps of the expedition homewards, the more so as at the 60-mile we had come into Permo-Carboniferous (coal measure) country, and there did not seem to be a likelihood of any change to the immediate north. For a continuation of the journey northwards, moreover, fresh arrangements would have had to be made for provisions' supply, as we were just about out of food stocks.

We accordingly retraced our steps to the Florentine Valley, where we branched off with one tent to the divide between Tim Shea and the Needles, descending to the old Humboldt Mine sections on the eastern side of the range, where we formed our last camp.

While here I received an official recall, the original one having been sent to the Iron Store earlier in the month, and consequently not received. On the 31st March we returned to Tyenna, along the Humboldt track, which in its turn followed the previous track made by F. Cockerill from the Tyenna-road to just across the Needles Divide. This track is overgrown, and in some parts passable on foot only with difficulty.

V.—TOPOGRAPHY AND DISTRICTS.

For the purposes of this report the country examined on the expedition may be divided into districts, as follows:—

(1) East of Humboldt Divide.
(2) Florentine Valley.
(3) Gordon Plain.
(4) Clear Hill.
(5) Denison Range.
(6) West of Denison Range.
(7) Gell River.

(1) *East of Humboldt Divide.*

The Great Western survey route starts at Glenora, and follows the valley of the Russell's Falls River westwards for upwards of 20 miles through heavily timbered country, crossing the saddle which divides the Tyenna Fall from the Florentine Valley at 28 miles from Glenora, and at a height of 2063 feet above sea-level. At about 14 miles from Glenora station the line passes through the Tyenna settlement, which is a straggling township of some 50 families, connected with Glenora by a good road. The settlement extends along the narrow valley of the Russell's Falls River for a length of about 9 miles, and the road at present goes as far as Rumney's, the furthest selection out. It enjoys a mail twice a week, but has no school. The land is timbered closely with blue and swamp gum and stringy-bark. It is suited for grazing and hop-growing, and no doubt orchards would do very well on the soil. The best land for stock and potatoes is said to be higher up the slopes of the hills which border the valley. In winter snow lies on the hill crests, but rapidly melts when it falls in the valley. The elevation of the township is about 800 feet above sea-level. The strata exposed all along the roadside are mudstones and mudstone conglomerates belonging to the Permo-Carboniferous system. Further west

beyond Rumney's at Pine Hill on the Port Davey track, as well as on the Humboldt or Cockerill's track, are exposures of felspathic quartz grit forming one of the basal members of the same system. Kaolinised felspar is very prominent in this rock, and locally it is looked upon as granitic. In a sense the stone is granitoid, the felspar in it being fairly plentiful. It has in fact been derived from granite, which must have been at that time exposed in the neighbourhood. The name by which such sandstones are known is arkose. Its presence points to the existence of granite not far off.

Mr. L. Marriott informed me that both tin and colours of gold have been obtained from the River Styx, south of Tyenna, and that granite occurs also in that valley. From the account I was not able to satisfy myself that the alleged occurrence was one of true bedrock granite, and not any enclosed rocks released from the Permo-Carboniferous conglomerate, but in view of the widely-spread arkose I think it quite likely that granite comes to view somewhere in the neighbourhood. In this connection I may mention that shortly before I started on the journey a Mr. F. Keating brought to the Mines Office, Hobart, a heavy lump of tin ore (assaying 72 per cent. Sn.), stated to have been found well up country south-west of Tyenna. This was probably from country drained by the Upper Styx, and if so it would confirm the statement respecting the occurrence of granite in the basin of the Styx.

At 18 miles from Glenora is Rolls' selection, and here the Great Western Railway pack-track starts from the Tyenna-road and passes north-westerly for 2¼ miles along the east side of the Junee River, through myrtle and large swamp-gum forest, with a dense undergrowth of tree and other ferns. The track is well graded, corded in places, and in dry weather excellent in all respects. Permo-Carboniferous white sandstone shows on the track at half a mile, and a little further along are vertical (calcareous?) strata apparently belonging to the older rocks. After this sandstone and grit re-appear. At about 1¾ mile the Junee limestone (Gordon River series = Ordovician) is exposed, striking N. 61° W.*

After crossing the Junee River at an elevation of 1000 feet above sea-level, the old hut built by the Great Western Railway Company is reached, situated on a flat-topped hill which extends a good way south of the hut, and consists of clay containing numerous stones of diabase, soft Permo-Carboniferous sandstone, with occasional pieces of slate, quartzite, and conglomerate. The hill-top is fully 30 feet above the Junee River, and many of the stones are well water-worn, while most of them are sub-angular and of shapes derived from weathering. Still, the whole hill formation suggests a fluviatile torrential origin. It may have been the ancient bed of the Russell's Falls River, the Junee being a tributary which came into existence at a later period when the valley had assumed its present configuration.

The range to the north is composed of dense grey limestone, striking north-westerly and dipping north-easterly. This is fossiliferous, containing imperfect impressions of orthis and another brachiopod. These fossils occur on certain horizons, but are not easy to find, and when found cannot be detached from the matrix. The ones which are most readily observed are those which are exposed in relief on the weathered surfaces. The limestone evidently belongs to the Gordon River series, which has for a long time been considered as Lower Silurian (Ordovician).

Junee Cave.—A quarter of a mile up the Junee River through a lovely fern glade in the myrtle forest is the Junee Cave, reached by a hand-track. A cavity 20 feet in height forms the entrance, and the river, a rapidly-flowing stream of ice-cold water, issues from it. Inside a few stalactites still depend, but the larger ones have been removed by visitors, and others have been defaced. At about 50 feet from the entrance the subterranean river blocks further progress on foot, and can only be ascended a few chains further by means of a raft or boat. The cave, though large at the entrance, where a rough hand-rail has been placed for tourists, is in its present condition rather poor in respect of display of stalactites, and, owing to the river, the task of opening it further by blasting the roof in the end would be somewhat difficult. But this is really the only way in which the cave can be improved. The approach is highly picturesque, the banks of the clear, tumultuous stream being clothed with a luxuriant growth of tree-fern, above which the tall sombre myrtles of the forest tower to a great height.

The Junee River is at the 20-mile on the Great Western Railway survey line.

* Here and elsewhere in this report the magnetic bearings are adjusted to the true meridian by assuming the declination of the needle to be 9° east of north.

Chrisp's Camp.—Seven miles further along the track are two huts known as Chrisp's, at a height of 1700 feet above sea-level, and 2 miles east of the saddle of the Humboldt Divide. The track from the Junee to Chrisp's passes over forest land covered with large myrtles and gigantic swamp-gum and gum-top with fern undergrowth. Loose stones of sandstone and diabase occur in the soil, but no bedrock is seen for the first part of the distance. The indications point to Permo-Carboniferous strata flanking the hillside with diabase on the crest. Here and there white dense quartzite outcrops, striking N. 16° E., and dipping north-westerly at a steep angle.

Chrisp's huts are in a little clearing, 150 feet above which the Great Western Railway survey line passes. Ascending the little creek behind the huts an instructive section is obtained. The hill-slope is covered with deep soil concealing sandstone, limestone, and conglomerate charged with fossils characteristic of the lower Permo-Carboniferous (fenestella, spirifera, strophalosia, encrinites, aviculopecten, eurydesma, &c.). At 2700 feet above sea-level fenestella shales are exposed, lying rather flat, but dipping south-easterly. The smooth surface of these shales has given rise to extensive landslips. The Permo-Carboniferous strata form a large block of country, extending from the East Coast to here, interrupted and surmounted by intrusive sheets of diabase. Columnar diabase here composes the peaks of Wherrett's Look-out, the nameless summit between that peak and Mt. Humboldt, as well as of Mt. Humboldt itself (Mt. Field West). The Permo-Carboniferous beds rest with a strong unconformity on the older limestone and quartzite, which are visible between Chrisp's and the divide. They belong to our lower marine division of the Permo-Carboniferous system, and are consequently below the horizon of the coal measures. We followed them to a height of 2900 feet without change, but it is quite possible that strata higher in the system may be discovered enclosing productive coal seams. The section just described may be observed by following a path just past the huts for a little way up the hill, and then climbing up the steep rock-strewn channel of the little stream which flows past the camp. It is noteworthy that the stream diminishes in volume as it descends, owing doubtless to loss of water through soakage in passing over the limestone beds.

The track continues from Chrisp's westwards to the divide for 2 miles. On the saddle the elevation is 2100 feet. Surface stones of diabase and Permo-Carboniferous sandstone are strewn in the soil. The first solid rock met with is the Junee limestone. Some difficulty was experienced in obtaining the correct strike of this, but several observations tended to show that it is west of north, and the dip north-easterly.

Near the saddle are loose stones of yellow oxidised sandstone and clay containing impressions of orthis and trilobites. Although loose, they are in such profusion as to suggest the proximity of the bedrock. They are evidently identical with the fossiliferous Cambrian sandstone discovered by Mr. Thos. Stephens, M.A., in 1902, on the flanks of Mt. Stephens (locally known as Tim Shea). Among his fossils was a dikelocephalus, which Mr. R. Etheridge has named *D. florentinensis*, and other forms were niobe, orthis, and bellerophon. Mr. Etheridge reported that they appeared to be of Upper Cambrian age.

On the north side of the track is the peak called Wherrett's Look-out, with its diabase-crowned summit, and behind it to the north are two cones which we have called the Knobs. These, together with a lumpy mountainous mass, which we labelled with the name of Pimply, rise northwards into the majestic pile of Mt. Field West (Mt. Humboldt). The precipitous western face of this mountain, composed of columnar diabase, descends into the valley of the Florentine perpendicularly for over 1000 feet. Messrs. Atkins and Timbs ascended this mountain from the Florentine Valley. At about 400 feet above the Humboldt Divide they discovered an enormous cave in the Ordovician limestone. This cave is the size of a large building, and a river as large as the Junee pours into it. In ascending, fossiliferous Permo-Carboniferous strata, shale, sandstone, and limestone conglomerate, were met with. These are below the coal horizon, and no coal seams were seen during the trip. Higher up an excellent freestone was observed. The trigonometrical station is on the highest point, 4721 feet above sea-level, but being built up behind the natural rock summit, and the station pole having blown down, the formed beacon pile cannot be seen from the south and west.

The cave referred to just now is a stupendous natural feature which, though without the attractions of stalactites, will inevitably draw the attention of tourists once a track is established. The present starting-place for a track to it would be from the Great Western Railway pack-track on the west side of the divide, at a point 20 chains past the 12-mile peg, first descending into the Florentine Valley, and then ascending to the base of Mt. Field.

Tim Shea (Mt. Stephens).—This mountain is on the south side of the track as the latter passes over the divide. It is a hog-backed hill rising to 2900 feet above sea-level, with its axis a few degrees east of north and west of south. At the summit its massive bedding is strikingly displayed in crags of fine-grained conglomerate alternating with coarse sandstone and grit and a few beds of coarser conglomerate. The pebbles are quartz and the interstitial constituents are grains of sand. In the fine-grained varieties and the sandstones kaolin (representing felspar) is plentifully distributed, and this affords a ready means of identifying the source of much of the detritus in the Florentine Valley, even when at some distance from the mountain. These are arkose grits, evidently derived from the breaking down of granite. Their strike is about N. 80° E., and the dip N. 10° W. This direction, if prolonged, would bring the strata across the Florentine Valley to the Sawback Range at the south end of the Thumbs. The strata transgress the Cambrian and Lower Silurian beds, and must belong to a different and younger system than either of these. They are plainly younger than the granite, and it seems safe to place them in the Permo-Carboniferous system.

Tim Shea has a precipitous eastern face, and I was unable to find out whether the conglomerate rests anywhere immediately on the older limestone, but there is hardly any doubt that purple slates and quartzites, presumably of Cambrian age, pass below it with a north-west strike and north-east dip. This can be observed well from the southern side.

The Tim Shea conglomerate and grits are specked with grains of specular iron ore, but, as might be expected from their geological age, do not contain any mineral veins.

The Needles.—This mountain is a collection of bold quartzite peaks south of Tim Shea, and separated from it by a saddle called the Needles Divide. The Needles geographically are the northern end of Mt. Mueller, or High Rocky Range, a saddle however again lying between the two.

At the eastern base of the Needles is the old Humboldt Mine. An old track runs from the Tyenna-road for 9 miles to just across the Tim Shea-Needles Divide. This is Cockerill's track, and was utilised by being converted into a horse-track as far as the mine, being now called the Humboldt track. Cawthorn's track to the West Coast at Copper Creek north of Rocky Point starts from the west side of the divide. The old tracks on the Tyenna side of the divide are now choked with fallen timber, owing to a fire which passed along the slope of the Needles a few years since, and this makes it very difficult to get up to the saddle. Between the mining sections and the saddle are some dense beds of horizontal scrub.

The country rock at the mine sections is reddish and purplish slate, with bands of purplish quartzite. The strike is north-westerly. Different observations made showed N. 50° W., N. 40° W., N. 70° W., with a north-easterly dip. This belt of slate is exposed here for 1¼ to 2 miles in width, and evidently not only passes below the Permo-Carboniferous conglomerate of Tim Shea, but must also underlie the limestone between Chrisp's and the divide. Stratigraphically therefore it is Cambrian.

Humboldt Mine.—The title is rather a misnomer, as the mineral discoveries are at the foot of the Needles, and several miles from Mt. Humboldt. The lode outcrop was discovered in 1891, and the property eventually became a gold reward lease. Subsequently it passed into other hands, and a few hundred pounds were spent in putting in a low adit-level and other work. Finally the Great Western Railway Company took it over.

Mr. Clark also discovered a gossan outcrop parallel with the copper lode, north and east of it. A shaft was sunk on it, and a few trenches cut. Work was suspended when the V.D.L. Bank ceased operations.

Parallel with the copper lode, and south over the top of the spur, a galena-copper lode (called the Galena lode) has been found, and a trench cut on it.

An adit-level has been driven on the copper lode for a chain in length, following a well-developed footwall. No hanging-wall is seen in the drive, but there is some quartz on that side. The country rock is a chocolate-coloured silicified slate, striking N. 70° W., and dipping north-easterly. In the face the lode, which is heading north-easterly, dips south-easterly, is 2½ to 3 feet wide, composed of barrén quartz and spathic bands 6 inches to 9 inches in width, separated by lode slate. Five or 6 feet behind the face is a cross-course which traverses the drive parallel with the country slate.

About 100 feet up the hill from the low adit the lode has been driven upon for 8 feet. Here it is 9 to 10 inches wide, has a good footwall, and ragged hanging-wall from which spurs of quartz go off into the country. The gangue is quartz and carbonate of iron. At the entrance of the drive a broad spur of quartzose material showing copper pyrites is exposed on the hanging-wall side. Most of the copper ore obtained has probably come from this spur.

Still 50 feet higher up is an open crosscut to the lode, which is here 4 feet wide and strongly developed. The gangue is quartz and barytes with calcite, and carries thin veins of copper pyrites with a little galena and zinc-blende. A beginning has been made to drive on the lode, and a small winze put down in the floor of the drive, but for some reason this has been filled in. The cheapest way of proving the lode would be to continue the low level. This would test it all the way.

The lode apparently belongs to Beck's spathic copper veins, which are characterised by a gangue consisting of various carbonates with quartz and barytes. In this class of veins transitions are often noticed to spathic iron ore lodes without copper, which are sometimes worked for iron ore.

The outcrop of ferro-manganese gossan, which is a parallel lode, has shed large boulders of iron ore, which lie scattered over the hillside. In Clarke's time, I understand that this ore was supposed to carry silver. I have not detected in it any metallic vehicle for silver or gold, but have no doubt about it forming the upper part of a lode. It has attracted attention from time to time, but although the boulders of limonite are spread over a wide surface, it must not be supposed that the lode below is necessarily of anything like the width. The region round this divide receives a large rainfall, and the moisture carried off on or near the surface will naturally distribute through the adjacent rock much of the iron derived from the decomposition of the pyrites. I had no means of ascertaining what was found at the bottom of the shaft, and saw nothing but gossan turned out at the mouth. The occurrence goes by the name of the "Iron Blow." It is impossible to say what lies below, but it is a legitimate supposition that after passing through the usual stages of superficial alteration or oxidation the lode may be found to contain sulphidic copper ore, forming a member of the group of veins common to the district.

The lodes in the district contain both galena and chalcopyrite as essential minerals, and it is premature to call them either copper or galena lodes before more work has been done, but the probabilities are in favour of copper being the dominant metal.

Several miles down the track on the way to Tyenna a large gossanous outcrop of iron oxide crosses the path. Nothing seems to have been done to this. When work is resumed at the Humboldt Mine it would be advisable to test this lode.

The Cambrian slates which enclose the Humboldt lodes can, I am told, be picked up 8 miles further south on the Gordon track (Trappes' track). The slate, however, is not the factor which governs the existence of ore. The occurrence of granite somewhere in the neighbourhood is strongly indicated, and should be sought, as the granitic magma is the source of the ore deposits. Besides the tin and gold prospects in the Styx basin already mentioned, colours of gold are said to be obtainable on the other side of High Rocky (Mt. Mueller), and the country between that mountain and the Serpentine River is looked upon by Tyenna people as being desirable to prospect. A future expedition should traverse that belt.

The Cambrian slates eastwards in the direction of Tyenna are covered by Permo-Carboniferous felspathic grits (arkose), which extend as far as Pine Hill, and which are undoubted derivatives from the waste of granite *in situ*.

(2) *Florentine Valley.*

The Great Western pack-track descends from the Humboldt Divide into this valley, through which the Florentine River flows northward for about 25 miles before it empties into the River Derwent 5 miles below the Nive. The valley is bounded on the east by Mt. Field West, Wherrett's Look-out, and Tim Shea, while the comparatively low Tiger Range forms the western boundary on this parallel. The valley is between 2 and 3 miles wide, and its elevation above sea-level varies in the upper part of it from 1300 to 1500 feet. Our camp on the pack-track was 1500 feet, and where the track crossed the river the elevation was 1400 feet. I should mention that all along the main line of route we enjoyed the advantage of being able to control our aneroid readings by the railway levels whenever the pegs could be identified, thus reducing the inevitable errors of aneroid determinations to within tolerably narrow limits. We were enabled in this way to avail ourselves of fixed instrumental levels at the Junce, on the Humboldt Divide, at the Florentine River, at the Gordon Bend, and at the 50-mile. Consequently, it may be stated with some confidence that within a mile of the track the elevation of the land down the Florentine Valley is not below 1300 feet.

Immediately after crossing the divide the forest trees are smaller. We no longer see the huge giants which grow on the eastern fall. The track soon traverses

alternate patches of button-grass on the hillslope, and myrtle, stringy-bark, and peppermint where creeks flow down from the south. The growth of the timber would appear to be conditioned by the moisture afforded by the creeks rather than by any inherent difference in the soil, for where moisture is present the trees flourish equally on the sandstone gravel and the limestone. The divide mountains, Tim Shea and the Needles, rise on the south of the track, and have shed enormous quantities of conglomerate and sandstone detritus into the button-grass slopes which fall away to the Florentine. There is a good deal of this barren detrital gravel underlying the grass, but in the forests a bed of vegetable soil occurs. Also where deposits of hydrated iron oxide (limonite) occur in swampy ground a certain amount of soil enrichment has taken place. The valley stretches away to the north—an expanse of forest growth as far as the eye can reach. The soil evidently grows richer in that direction, for the valley must receive the waste of the igneous rocks of the Mt. Field Range.

The track descending from the divide crosses Cambrian quartzites and yellow fossiliferous sandstones. In the forest to the south numerous blocks of the latter are seen. It was here that Mr. Thomas Stephens made his discovery of Cambrian strata on the flanks of Tim Shea. The strike is difficult to note, as one is seldom certain that the exposures are *in situ*. As far as could be judged, it is about N. 66° E.

Within a distance of a couple of miles from the saddle the track crosses two or three small creeks; at 2¼ miles another perennial creek is crossed at the beginning of a patch of forest of myrtle, stringy-bark, and sassafras. Stones of white saccharoidal sandstone occur loose in the soil. About 400 yards further the track emerges on heathy button-grass, with low peppermint scrub for 700 yards, passing over drift composed of coarse felspathic sandstone and quartzite (Permo-Carboniferous and Cambrian detritus). Within 500 feet of the next belt of forest a band of gossanous earth crosses the track, descending from an elevation on the south side of the path. On a knoll about 200 feet above the path is a collection of small boulders of limonite, associated with loose stones of white sandstone. The ore is swamp iron ore.

A little past this the shade of myrtle forest is again entered, and the Little Florentine, a tributary of the Florentine, is crossed. This flows here in a north-westerly direction, and is a rapid stream between steep banks 25 feet apart. Emerging from the forest further west stones of limestone are seen, and continue at intervals across the open patch. At the entrance to the third forest belt solid limestone crops out, with a strike of N. 14° E., and a dip to the north-west at an angle of 30° or 40°. On the track through this timber angular pieces of felspathic sandstone are scattered sparsely. A small button-grass plain succeeds, and the only rock visible is coarse white sandstone in loose pieces. Limestone crops out further along. Myrtle forest is again entered, and pieces of loose limestone continue to be seen. At 5 miles from the Humboldt the Florentine River is crossed by a bridge at 1400 feet above sea-level. It is here a sluggish stream 55 feet wide, and not more than a couple of feet deep at summer-level, but rising rapidly after rain. It has high banks, no ford, and is crowded with logs. Its slowly-running water is brown from button-grass country. Tall trees of myrtle and gum-top, with leatherwood, line the banks. The river must be in a limestone channel, as this rock crops out on the track a few hundred feet west of the bridge. At about a mile beyond the Florentine a patch of open button-grass land begins, and the track winds westerly and north-westerly round the south end of the Tiger Range over white friable sandstone of undetermined age, oxidised in places and bearing indications of being fossil-bearing. An observation showed the strike as N. 31° W., and the dip north-easterly. Once over the low divide between the Florentine Valley and the Valley of Rasselas, the track goes north through light tea-tree and peppermint scrub, and issues on the Gordon Plain. The steep wall of the Thumbs and Mt. Wright form the western boundary of the plain.

Geologically, the Florentine Valley, as far as regards the part traversed by this track, has been excavated in Cambrian slates and quartzites and Ordovician limestone, the covering of Permo-Carboniferous strata having been removed. The surviving continuation of the latter is seen on Mt. Humboldt and Tim Shea.

Frodsham's Cave is marked on the Buckingham North chart east of the Florentine River. It is a small natural excavation in limestone near Frodsham's track, about 10 feet wide at the entrance and 4 feet high, sloping down for 20 feet at a low angle into the water. The roof shows the rather thinly-bedded limestone striking about N. 10° E., and dipping north-westerly. Outcrops in the immediate vicinity showed a strike of N. 29° E.

A mineralogical feature is the occurrence of deposits of limonite in the button-grass swampy land. Prospectors seem to have assumed that they are lode outcrops. The large deposit marked on the Buckingham chart as "Iron Blow" on Frodsham's track 2 miles east of the Florentine River is an impure yellow hydrated oxide of iron mixed with quartz and quartzite wash, with a north-east-south-west course, and a width of several chains. I saw that it had been trenched upon in ferruginous swamp clay and drift to a depth of from 5 to 10 feet. At the bottom of the deepest excavation the material is very clayey, and contains stones of quartz and kaolin. Boulders of the ore are strewn over the soil, but there is no sign of any lode mineral.

I should mention that Mr. R. Marriott showed me a sample of gossan from somewhere south of the track which had every appearance of being from a lode outcrop. Considering the Florentine Valley as a whole, indications of mineral are more likely to be met with in a southerly direction, that is, towards Mt. Mueller, than northwards. In the latter direction, though the general elevation is rather great, the land will no doubt eventually be occupied by settlements. The Tyenna settlement will extend gradually to the divide, and a continuous area of country from Glenora to the Gordon Plains be brought in time under occupation. West of this limit the high desolate ranges can only be looked upon as the possible home of mineral.

(3) *Gordon Plain.*

This fine plain occupies the south end of the Valley of Rasselas, a parallel valley to that of the Florentine, further west and separated from it by a range not charted on any of the maps, but known generally as the Tiger Range. The comparatively low elevation of this range compared with the height of the great mountains within sight has probably led to its omission from our charts, but it is actually of great topographical importance, for it constitutes a main watershed for the whole of this part of the island. All the rivers on the west side of it flow to the West Coast, and all the rivers east of it flow easterly. Thus the Gordon and its tributaries, the Denison, the Franklin, the Serpentine, and many minor streams drain the country to the west, while east of the Tiger chain the Florentine flows into the Derwent, which, with its contributing streams, collects the waters of the other side of the island. The Florentine and Gordon Rivers are here not more than 3 miles apart, and the Gordon on this parallel is between 150 and 200 feet above the former. Mr. Stephens has pointed out how easy it would be to divert the waters of the Upper Gordon to the Derwent system, by connecting the former with the Florentine. By a topographical freak the Florentine runs north, while the Gordon runs south until it makes the remarkable bend at the Thumbs, when it flows west.

At Huntley the low range in front of the Tiger is known as the Gordon Hills, which form a low chain of rounded eminences skirting the plain. These extend northwards to Wyld's Craig, gradually increasing in height. Standing on their crest east of Huntley, where Dawson's-road passes through the range, and looking eastward, one sees at one's feet a small button-grass valley, beyond which is a low wooded ridge, succeeded by the north end of the Tiger, here overlapping the Gordon Hills line. Turning to the west, the great button-grass expanse of the plain is open to one's gaze, stretching across to the majestic wall of the Thumbs, a huge mountain of quartzite and conglomerate, which rises boldly from the plain to a height of 2300 feet above the Gordon River, or 3860 feet above sea-level. A part of this mountain is prolonged southward into the long low range called the Saw Back, evidently from its jagged, serrated crest. At its north end the axial line of the mountain is severed by the channel along which the Gordon pursues its suddenly changed course. This narrow stupendous canyon, known as the Gorge, admits the waters of the Gordon to the lower country to the west.

The plain itself is diversified only by the fringes of timber bordering the channels of the Gordon and Huntley. The track crosses the Gordon River near the Bend at 21¼ miles from the Tyenna-road, and at 43 miles 15 chains along the surveyed railway route from Glenora station. There is an excellent ford with only 1 to 2 feet of water in summer, and a wire rope and cage for crossing at all times. The river rises after rains from 8 to 10 feet. A hut is available on each side of the river, and by arrangement, a horse-packer can be engaged in Tyenna to load out as far as this. The summer level of the Gordon at the crossing is 1557 feet above the sea.

The plain would seem suitable for grass and summer pasturing. In winter no doubt the climate is bleak and cold. In the middle of February we saw a thin covering of snow on the upper part of the Thumbs.

In Tertiary times the plain must have been the site of a large lake. About a mile south of the cage and on

the east side of the track are a couple of pits sunk by one Sutcliffe, three years ago, apparently to pick up a bog iron ore deposit which occurs on the flat. The material thrown out from these shows the sediment for 10 feet below the button-grass to consist of horizontal layers of laminated clay mixed with stones of chalcedonised limestone containing casts of coral, bivalves, and univalves. Similar fossiliferous stones were obtained from the bed of shingle in the middle of the river at the ford. The soft clays are probably Tertiary, but the most reasonable assumption is that the fossils and the stones in which they occur are derived from the Gordon River limestone, which forms the bedrock of most of the plain. Mr. R. Etheridge says that the coral in several particulars resembles the genus Tetradium (Dana) of the Trenton and Hudson River groups of the North American Continent, and that a bivalve is one of the nuculidæ.

Soft laminated clays of probably the same age occur on the north side of the river a mile west of the cage and 100 feet above river-level; also a mile north of the cage are very pronounced terraces, containing small quartz wash, skirting the base of Mt. Wright, and raised from 15 to 50 feet above the level of the plain. These terraces are fringed with clumps of scrub. There are two horizons at which they occur, the higher, and naturally the older, being 30 feet above the lower. These represent the former shores or bed of the lake, or ponded water of the river, in different phases of its existence.

The terraces are the most favourable sites which I could suggest in this section of the route for testing for alluvial gold. But though much of the gravel has most likely been brought from the north, the bulk of it must have come from the barren slope of Mt. Wright. Waterholes exist in the button-grass here and there, and small creeks meander through the soil, but no pressure seems to be available.

North of the crossing the track passes through about ¼-mile of peppermint forest, and then out into the button-grass. The timber is growing on flat alluvial country strewn with river shingle which borders the course of the present river.

The Gordon River from the entrance to the Gorge eastwards shows numerous bars of limestone crossing its bed, forming a limestone belt at least 1½ mile wide. The rock is dark-grey, regularly bedded, and a little argillaceous. On the hills nearer the Gorge some impressions of orthis were found in it. Its strike, taken at various points, is N. 25° W., and its dip north-easterly. It is evidently the bedrock of the Gordon Plain and the Rasselas Valley. Further east at the edge of the plain it underlies the sandstone strata of the Gordon Hills, which strike about N. 19° W., and dip north-easterly. There is an unconformability also in the dip of the two series, that of the limestone being about 70° and of the sandstone 35°. The latter is friable, slightly felspathic, carries a little mica, and is yellowish, brown to white in colour. There is no definite evidence of age available, but its softness and the presence of the felspathic material suggest a Permo-Carboniferous age.

The crystalline pebbly sandstone and quartzite forming the front wall of the Thumbs and Mt. Wright pass under the western boundary of the limestone, with a dip angle of 50° and a strike of about N. 30° W., showing accordingly unconformity again. The limestone is Ordovician (Lower Silurian); the crystalline sandstone and quartzite (with intercalated conglomerate) must be Cambrian. As the exposures of the limestone in the Florentine Valley and at the Gordon have opposite dips towards one another, a synclinal fold probably exists.

(4) *Clear Hill.*

A journey was made to Clear Hill, 5 to 6 miles west of the Great Bend, with the idea of examining the country behind the front range. The slope of the Thumbs was followed along the south bank of the Gordon Gorge. The deep canyon of the Gordon is at its entrance between the terminal part of the southern spur of Mt. Wright (itself a south-easterly offshoot from the Denison Range) on the north and the north end of the Thumbs on the south, and has been cut sheer down through the sandstone and quartzite strata. Perpendicular castellated cliffs with a straight drop of 500 to 700 feet wall-in the narrow impetuous river. On each side of the chasm this gigantic wall continues for about 4 miles. The texture of the rock varies from that of a dense quartzite, the components of which are indistinguishable with a lens, to that of coarse sandstone, containing small scattered pebbles of quartz. Heavy conglomerate rising to the summit of the Thumbs appears to be intercalated. The sandstone sometimes shows areas in which it has been completely converted to compact quartzite, surrounded by more loosely aggregated sandstone. The pebbles sometimes fall out during weathering, and the exposed surface is then singularly pitted, the cavities closely simulating the hollow casts of fossil shells. Some of the beds contain grains of specular iron ore dispersed plentifully through the stone—so plentifully, in fact, as to give it a dark colour—and in this variety of rock aggregations of iron pyrites occur. The hard pink quartzite at the Gorge entrance is in very steeply-inclined beds, but the dip angle diminishes going west. The whole series seems remarkably free from quartz veins or any indications of economic ores. Bands of heavy conglomerate resembling that of the West Coast Range form the upper part of the Thumbs and Clear Hill. This rock is massively bedded. Its constituents are pebbles of quartz and quartzite with some of quartzitic schist, and are occasionally of very large size. The cementing material is a quartzose sandstone, sometimes forming a quartzite base. The sediment frequently altered its character, for there are interbedded layers of coarse sandstone or grit. The summit of the Thumbs shows the conglomerate in a sharp anticline—somewhat too sharp to be a genuine anticlinal fold. Beyond the Clear Hill Plain the conglomerate reappears as the summit of Clear Hill, with its normal north-easterly dip. From here it can be seen continuing northerly in a continuous line to the Denison Range. The rock separates by jointing into enormous masses, which slide down the slopes of the mountains until the angle of repose is reached; and some care is needed in distinguishing between such blocks and outcrops of the conglomerate *in situ*.

The conglomerate, pebbly sandstone, crystalline sandstone, and quartzite seem to belong to one geological system—the Cambrian. They rest upon the great geological formation of the quartzitic schists which form the mountain ranges to the west. We could not ascertain exactly how far the series extends in that direction on this parallel, but from the broken country seen from the summit of Clear Hill, and from information gathered further north, a change probably takes place immediately west of Clear Hill. Assuming that no folding interferes with the calculation, I estimate that the vertical thickness of these Cambrian beds is, approximately, 5000 feet.

Clear Hill Plain is a broad valley parallel to the Valley of Rasselas, and at about the same altitude. It is open country covered with stunted tea-tree and high button-grass, with narrow belts of myrtle, peppermint, leatherwood, and horizontal fringing the creeks. To the west of it rises the rugged mountain of Clear Hill. Why it should have been called a hill is incomprehensible, for it is a mountain of quite considerable height, being 3800 feet above the sea, and 2300 feet above the plain. The creeks intersecting this plain unite to form one steep-banked stream, carrying a good volume of water into the Gordon River as it flows through the Gorge.

Our reconnaissance did not result in the discovery of any mineral-bearing country between the Gordon Plain and Clear Hill. If there is any in this direction it must lie still further west. The country immediately behind Clear Hill and the Denison Range is full of mountain chains, running north and south in long lines, and waiting for exploration to give them names.*

One cannot help admiring the bold scenery of the romantic gorge of the Gordon, with its precipitous cliffs. If it were made easily accessible and paths cut in the rocky banks, it would become one of the sights of the island.

A township site, Huntley, is reserved on the Gordon Hills, east of the plain. The surface soil of the latter is button-grass humus covering clays which rest on limestone. Though the land must be called poor, it is not poorer than that on which many towns in Tasmania are built, and if grassed would no doubt be suitable for summer pasture. In fact, I believe cattle used to be kept on the plain at one time. This Valley of Rasselas forms the "farthest west," beyond which one cannot imagine settlement ever extending. West of it the mountains rise immediately 2000 feet above the river, and their cold and barren ranges interpose a wall which stops the further advance of the settler.

(5) *Denison Range.*

The great Denison Range flanks the Valley of Rasselas to the west as one proceeds north of the Gordon Bend. First comes its southern offshoot (Mt. Wright), which forms a wall on the west for about 5 miles, and then the main ridge of the Denison in continuation of the Thumbs and the mountain north of Clear Hill comes to the front and rises above the plain in lofty peaks.

The surveyed railway-line and the track recently staked lead across the button-grass alluvial plain between the mountain and the river. The latter is fringed with trees, and occasional clumps of timber occur near creeks

* In connection with the subject of naming mountains, &c., it is evident that the practice of giving them the names of individuals has been followed quite far enough. Natural features or some factor of the survey should be used as bases of nomenclature.

and water-holes. The growth of timber increases going north.

Here and there in the creeks outcrops of rock are visible, showing the limestone bedrock still to continue.

A little past the 27-mile peg on Moore's track is a steep-banked creek with several bars of limestone crossing its bed in a north-westerly direction. And at about 8 miles from the Bend is a timbered ridge crossing the track, and exposing limestone, yellow and of cavernous texture, and bearing impressions of fossil shells (orthis). The latter are badly preserved, and Mr. Etheridge is unable to say more than that they resemble *O. lenticularis*.

Our camp was fixed near the 51¼-mile of the Great Western survey, at the turn-off to a new track which R. Marriott was burning and staking across the mountains to the Denison and Gordon Rivers. The wooded plain here shows ridges of white, often friable, and loosely aggregated sandstone, striking north to north-west, and dipping easterly at 50° to 60°. It occupies country between outcrops of the limestone, and possibly belongs to that system. On the other hand, a Permo-Carboniferous age is not excluded. The valley is a couple of miles wide, and the river is on its east side, and beyond is the wooded range of the Gordon Hills. Deposits of limonite in the button-grass soil continue to occur. There is one about 3 miles south of the camp, and another quite close to the latter.

The front wall of the Denison Range is composed of crystalline and pebbly sandstone, like that on Mt. Wright. It weathers into a visible conglomerate, owing to the small pebbles of quartz showing on the weathered surfaces. Its strike is N. 30° W., and the dip 45° to 50° south-easterly. These strata can be followed to 1200 feet above the plain, and are then succeeded by strong bands of medium-grained and coarse conglomerate, which appear to plunge below the pebbly sandstone strata. The pebbles, too, in the latter increase in size as the conglomerate bands are approached. The conglomerate continues to the summit of the range, the front part of which is 1600 to 1900 feet above the plain, but rising at the back into peaks 4200 feet above sea-level. Some freestone is interbedded with this. Behind the conglomerate again are quartzites dipping conformably below it. Under the peaks of the Denison are three small lakes or tarns lying between steep walls of conglomerate. These are in cirques or small valleys, with precipitous scarps at their head. In these cirques glacier erosion has excavated deep basins. The tarns can be of no great age, for there has not been time enough for stream action to fill and obliterate them.

Local glaciers have at no very distant time clothed these ranges. Large blocks of conglomerate occupy isolated positions on the shoulder of the mountain, and one immense perched block poised on a quartzite spur 1000 feet above the plain is a feature of the landscape visible for miles. At the bottom of this spur and at the mouth of the adjacent valley are hundreds of ice-borne boulders of conglomerate spead out on the plain in a fan-shape, looking as if dropped there but yesterday. Some of these huge rectangular boulders measure as much as 16 feet by 8 feet. From their disposition with reference to existing topography it may be inferred that the last glacier epoch in this part of Tasmania continued down to the recent period.

The line of the conglomerate outcrop can be seen extending on the crests of the mountains to the south as far as Clear Hill and the Thumbs.

Above the lakes are patches of King William pine. Their position under the shadow of the lofty peaks of the summit of the range is picturesque in the extreme, and they will well repay visits by mountain-climbers.

No mineral lodes were seen in these conglomerates and sandstones, nor any signs of the proximity of eruptive rock.

(6) *West of Denison Range.*

R. Marriott's track line across the ranges to the Denison River Valley branches off from the 31½-mile on Moore's track in the Valley of Rasselas. At the turn-off a notice of distances has been marked on a mail-box. The track follows a north-west direction for 2 miles, and then turns west, passing through a gap in the Denison Range, and affording a good section of the country. The same succession is seen as was noticed further south. In Squirrel Creek, a stream of clear water flowing from the Denison Gap, limestone is exposed in long bars, striking N. 16° W., and dipping as usual in a north-easterly direction. Further west the pebbly sandstones and quartzites of the Denison and Mt. Wright make their appearance, striking N. 18° W., and dipping north-easterly. The coarse conglomerate backbone of the range is seen rising into the bold mountain summits north and south of the gap. On the west side of the Denison Peaks regularly-bedded pink and grey quartzite or sandstone is seen in the distance dipping easterly below the conglomerate band.

At the 3-mile along this track, near Marriott's camp, 2050 feet above sea-level, the first exposure of schist occurs in the creek. The bar of rock which is visible embraces quartzitic, graphitic, and sericitic varieties, and moreover contains some pyrites. It has an east and west strike, and dips north. The occurrence is isolated and separated from the main body of the schists coming in further west. Whether the rock exposed is *in situ* or not is not quite certain. It is possible that it is an exposure of the underlying platform upon which the sandstones and conglomerates were laid down.

About a mile west of this the schist country is entered. The general strike of the strata now alters. Previously it was west of north; now it is east of north—and this was a stable character as far west as we went. There is thus a strong unconformity between the Pre-Cambrian and the Cambrian strata.

At the junction of the systems on the north side of the gap is a long and high crest composed of a breccia of large angular stones of quartz and quartz schist, which is situated between the upper members of the schists and the basal sandstones of the conglomerate series. It almost looks as if it had been brecciated *in situ*, as in some blocks foliation lines are visible; yet other pieces enclose fragments of schist lying in all directions. In any case, it would not be younger than the base of the Cambrian system.

The track passes west over rounded glaciated or snow-worn hills north of the most northerly of the three peaks which are nameless on the published maps, but are known as the Three Stars. The North Star rises to a height of 3300 feet above sea-level, and consists of quartzitic schist right up to the summit, dipping south-easterly. From the Star a good view is obtained of the back of the Denison Range, with its immense screes of sandstone and quartzite falling into the profound wooded gorge which separates that range from the North Star.

The schist is often strongly contorted; sometimes the rock has been altered into a pale-green sericite schist; frequently the change has been slight, and its appearance is little more than that of a laminated sandstone or quartzite, accompanied by a development of sericite giving a yellowish tint to the otherwise white rock. Argillaceous varieties occur, and some pyrite is apt to occur in these in the form of disseminations. Some pyrite is visible in argillaceous schist in a creek flowing north, situated at the foot of the western slope of the Northern Star. This schist has an easterly dip; the same dip exists in an outcrop of similar rock about 100 feet above the creek going west. Here the rock has interlaminations of quartz, often minutely puckered. The track crosses this hill into Badger Flat, the button-grass covered floor of an old lake with two streams running north. At its south end is a watershed, and on both sides are the vestiges of old terraces. This flat runs north and south. On the west side are exposures of greenish slaty-looking schist, striking north-easterly, and dipping north-westerly. Fine cleavage lines appear running at a steeper angle than the foliation planes.

At 9 miles from the Valley of Rasselas, and at 2400 feet above the sea, is an uncharted lake nearly a mile long and 300 yards wide, with its long diameter north-east to south-west. On its south-eastern side is a towering hill with precipitous white quartzitic schist walls rising nearly perpendicularly for 1000 feet above the water. The schist shows out on the cliff-wall in wonderfully contorted forms, and we named the hill Mt. Curly, and the sheet of water Lake Curly.* The hills on the west side of the lake are 750 to 800 feet above the water, and a closed valley a mile or two long exists at the head of the lake, into which a creek flows. King William pine grows at this end. A white or feathery pine also grows. Stunted tea-tree, mountain-gum, honeysuckle, mountain grass-tree, celery-top, and waratah grow on the hillsides, as well as tall button-grass. The water-level rises quickly after rain, as there is a rapid drainage from the hillsides. The flood level is 3 or 4 feet above summer level. On the west side, at any rate, the water is comparatively shallow, and from appearances it is not very deep anywhere. Its area has certainly shrunk, as there are signs that the lake was formerly more extensive. The former northern extension is now a large marsh; the southern end is fringed with rushes, and is also bordered by marshy ground. Argillaceous and sericitic schists strike along the lake side and the lake bed in a direction N. 15° to 23° E., with a north-westerly dip. On the hill on the west side of the lake is a succession of somewhat harder varieties, and the crest is a ridge of sericitised quartzite schist with the same general strike and dip. A little iron pyrites was noticed as specks in some of the quartz schist pebbles on the lake beach.

* I learned afterwards that Mr. R. Marriott had given it the name of Lake Amelia, but with reference to using the names of individuals see earlier in this report.

A mile to the west in the next valley is another small lake with four islets, lying in a cirque, with steep cliffs at its head. At the water's edge on the north-eastern side the siliceous micaceous schist contains sporadic crystals of iron pyrites. The hill on the western side of the tarn (which is about ¼-mile in length) is composed of sericitised quartzite schist with much quartz. On the shoulder of this hill is a peculiar open fissure, 4 feet in width, crossing the strata in an east and west direction. It has no sign of ever having been filled. It could be seen to extend to 50 feet in depth, but whether that is the bottom or not could not be ascertained. Near the peaks of the hills the schist contains pure white quartz in great quantity, and this has no doubt stiffened the crests, while intermediate saddles have been worn down in softer argillaceous and sericitic varieties.

The Gell River has its source in Lake Curly, and pursues a winding course for 11 or 12 miles, until it empties into the Gordon near the 60-mile on the Great Western survey.

A couple of miles further west is the Spires Valley, a parallel one to that of Lake Curly, trending north-east and south-west. A stream rises in it which is a northern fork of the Gell River. The valley lies between summits nearly a mile apart, and has a wet grass-covered floor, which receives from the flanks the sheddings of the mountains. Large quantities of stone are dislodged from the peaks under ordinary atmospheric influences. In addition, large boulders are plentiful in the valley and on the flanks mingled with moraine material. Roches montonnées are numerous. The whole valley structure suggests moving ice as the chief factor in producing many of the more striking phenomena now visible. On the east side of the valley the schist dips north-west, and on the west side a south-easterly dip begins. The valley is therefore a synclinal. The range on the west side rises to 3700 feet above sea-level, or 1300 feet above the valley, and is a steep wall of quartzite schist rock divided into domes or peaks by the erosion of intervening saddles of softer argillaceous or sericitic schists. We gave the range the name of The Spires. It is not charted on any of the maps. Its lower flanks are clothed with peppermint, myrtle, and tea-tree scrub. The crest of the range is a hard crystalline purplish quartzite schist, strongly contorted in places. White quartz veins and schistose laminæ of quartz pass through the rock. The quartz carries a fair amount of specular iron ore. At the base of this range is a belt of micaceous clay schists interleaved with quartz in thin foliæ and lenticles. The quartz and adjacent schist carry pyrite and arsenopyrite; stains of scoroditic green are visible in the quartz. This is 100 yards south-west of the Flat Rock camp at the foot of the track which ascends to the saddle. Some dishes of stuff taken from likely-looking material behind bars of schist failed to show colours, although the dark argillaceous rock was extremely favourable looking.

Marriott's track ascends steeply through a myrtle forest to the saddle or gap through the range 700 feet above the valley, and then descends 2000 feet into the valley of the Denison River, crossing this at a height of 1100 feet above sea-level. Tall button-grass and thick scrub flourish in this valley. Mr. Atkins pushed on down the river, and ascended the Prince of Wales Range, which is a fine chain of quartzite schist to the west, running north-easterly and south-westerly. The foliation planes of the schist are in the same direction, and their dip is north-westerly. The highest point of the range is about 2500 feet above the river, or 3600 feet above sea-level.

Mr. Atkins' advance journey to the Prince of Wales Range was the furthest west reached on this expedition. In the bed of the Denison River he discovered an exposure of the limestone, and Mr. R. Marriott informs me that it also occurs lower down the river. The occurrence of Ordovician limestone in this broad and profound valley between mountain chains of Pre-Cambrian schist suggests an enormous age for the original valley floor.

A good deal of quartz is present in the schistose strata, but not in the form of reefs.

(7) *Gell River.*

From the camp under the Spires a traverse was made eastwards across country to near the mouth of the Gell, opposite the 59½-mile on the Great Western survey. Here, at 18 miles north of the Gordon Bend, Mr. J. L. A. Moore had built a hut for the convenience of prospectors and exploring parties. This is at about 1800 feet above sea-level.

The country between the Spires and here is much broken. High hills afford steep gaps, through which the Gell River and its north fork follow a tortuous course. Button-grass and heathy marsh alternate with scrub. The land is high and wet, and wears the desolate aspect of country stamped with the impress of glacier action. The monotonous quartzite schist continues, with its north-easterly strike, until just before reaching the Gell Hut. Near its eastern border east of the Gell River Mr. J. L. A. Moore discovered some visible gold in it, and the discovery in itself is of some importance, as where some of the precious metal occurs more is likely to be found. The singular feature of this find is that no reef or lode formation appears to be present. Minute particles and streaks of gold are noticeable in the samples, which represent a typical sericitised quartzite schist, such as forms the mountain ranges of the area to the west. Some work should be done at this spot, with a view of discovering any neighbouring reef or some more decisive indication of lode action than at present meets the eye. The fact that gold does occur is sufficient warrant for a search. A piece of the stone given to me by Mr. Moore was submitted to the Government Analyst, Mr. W. F. Ward, who reports as follows:—

"Traces only of gold were yielded by the bulk of the stone, although minute particles of gold were visible on one face."

The Gell Hut is built in a good position, on rising button-grass land south of the Gell River at the edge of peppermint scrub. The Gell is here a river three-quarters of a chain wide, swiftly flowing, rising and falling quickly, with water coloured brown from button-grass, and its banks fringed with peppermint and honeysuckle scrub. On the hill west of the camp are numerous boulders of olivine basalt mingled with stones of Permo-Carboniferous sandstone. Thick scrub on this hill prevented a close examination of the bedrock. It would appear, however, to belong to the Permo-Carboniferous, surmounted by basalt. Across the Gell on the east side a north-west-south-east hill ridge rises 300 feet above the river, showing Permo-Carboniferous freestone and crystalline sandstone strata, dipping north at a low angle. On this hill stones of diabase and Permo-Carboniferous conglomerate occur loose. In boulders of the latter are waterworn stones of quartz, quartzite, and quartz-porphyry, cemented with quartz-sand. This explains the occasional discovery in the Gordon and Denison Rivers of pebbles of granite and quartz-porphyry. They have been released from the conglomerates by denudation.

To the north-east and east of this hill all seems coal country—gently rolling hills, mostly wooded, and separated by treeless patches. The Valley of Rasselas southward from here is covered with coal measure sediments, gradually becoming denuded, and showing exposures of quartzite and limestone. The foot hills to the west along the track have been rounded, probably by ice sculpture; the creeks from the west bring down conglomerate wash from the Cambrian strata of the high range. The track south passes over button-grass and through clumps of peppermint scrub, and leads to the camping place at the turn-off of Marriott's track through the Denison Gap.

Great Western Railway.

It does not come within the scope of my instructions to argue either for or against the construction of this line, but the exploration has an admitted bearing on the subject, and a brief statement of the results will probably be looked for. The bare facts disclosed by the work of the expedition are as follows:—

(*a*) Heavy myrtle and gum-topped forest covers the country between Tyenna and the Humboldt Divide, rising to 2000 and 3000 feet above sea-level. In this section the caves at the Junee and on Mt. Field West and the forest scenery will attract tourists, if easy access is provided.

(*b*) The Florentine Valley is also thickly timbered, but not with such giant trees as those on the eastern side of the divide. This valley will no doubt be eventually taken up by settlers, probably further north than where we passed through it. At the south end its elevation is about 1400 feet above sea-level. Its soil at this end is in alternating patches of poor to fair quality.

(*c*) The Valley of Rasselas (1500 to 1700 feet above sea-level) is sparsely timbered, and consists largely of button-grass plains. The bedrock is principally limestone. If grassed it would be good summer pasture land. Going north the timber is more plentiful. This route will always be the most advantageous for reaching the highly-picturesque gorge of the Gordon River at the Great Bend, the fine Alpine country of the Denison Range, with its lakes, and the romantic mountain and lake scenery to the west. No settlement can be hoped for in the high, cold, and wet country west of the Valley of Rasselas.

(*d*) Except at the Needles, no mineral country was met with near the southern half of the railway route. At the Needles on the east side of the divide copper ore lodes were met with. Mr J. L. A. Moore made a discovery of gold in the schist near the Gell River. Further search is necessary to establish whether this is

important or not. Apart from these, only sporadic occurrences of iron pyrites were noticed. The general indications were unfavourable. Still, although a great area of country was covered, it would be absurd to say that close prospecting would be resultless. Moreover, the country traversed is a mere fraction of the immense area which remains unexplored. The tracks which have been staked out will guide prospectors into this remote and difficult region.

Recommendations.

In making recommendations for future explorations, it must be understood that they have special reference to the work, begun on this expedition, of examining unexplored country, and are outside the immediate general programme which has been drawn up by the Geological Survey for submission to the Mines Department. That programme, apart from the surveys now in hand of the North-East Dundas tinfield, and from those of Mt. Balfour and King Island, which are urgent, contemplates the examination and charting of the West Coast Range from Farrell to Pillinger as an essential work to which the geologist in charge of the West Coast charting must devote as much time and attention as possible. Of course, it must also be conceded that it is highly desirable to acquire some definite knowledge of the nature and possibilities of the great mountainous wilderness lying west of a line drawn through the Frenchman, Prince of Wales Range, Thumbs, Mt. Mueller, Mt. Weld, and Mt. Picton. This *terra incognita* embraces an area of over 4000 square miles, nearly one-sixth of the whole of Tasmania. A few tracks, some of them 40 years old and older, have from time to time been made through it in different directions, but few of these have been of a permanent nature, and in many cases all that can now be seen of them are traces of the line which has been followed. If tracks are made, some, if not all, of them should be permanently open. The initial expense of making them involves further expense in attending to them each year. It may well be that some tracks are not found to be worth keeping open. Main lines of communication, however, will always be found necessary, and it is worth considering whether on such tracks, especially where there is likelihood of results from prospecting, stores should not be kept at Government expense in the summer months for supplying provisions to prospectors. The provision difficulty in these wilds is a serious one, and it effectually bars the solitary prospector. How can the prospector be expected to exist and work in this uninhabited area when he has no food supplies to fall back upon? A hut and a Government official in charge of stores in a central position would make all the difference. Under such an arrangement the difficulty of keeping tracks open would disappear. I have gained the conviction that unless some such arrangement is adopted this western and south-western country will remain unprospected for generations to come.

A great part of the country consists of high moorland covered with low shrubs, such as stunted tea-tree, mountain-gum, heathy scrub, and button-grass. It can be burned off in broad belts, and if this is done much track-making is unnecessary at first. The prospector can see by the line of burned country which way to follow; he can, moreover, get over the country easily, and prospect without difficulty where he desires. Money spent in burning the country in this way is well spent, and benefits the explorer even more than does the cutting of tracks (except of course through timber). For great distances not much more is often required to be done beyond staking a line of route (it would be of immense advantage if the tops of these stakes were painted white) over the moors, and putting log bridges over the rivulets.

The present journey has established the fact that the country between the Florentine and the Prince of Wales Range is not what can be described as a mineral belt. Eruptive rocks, derivatives from the magmatic reservoir which is the source of valuable metals, are absent throughout the area (excepting irrelevant occurrences of diabase and basalt), and beyond a few unimportant indications nothing favourable was noticed. It is possible, however, that some mineral may subsequently be discovered away from the line of route followed by the expedition. Mountains in all directions were ascended, and search made for lodes and sheddings from lodes. I think that there is no likelihood of improvement until the country further west is penetrated. From information, I conclude that the meridian of the Jane and Franklin Rivers must be reached before the geology changes and a mineral zone supervenes. In the basin of the Jane and Franklin there would appear to be a zone which invites exploration. Mr. Ward, who carried on the northern exploration, makes recommendations in respect of this.

With respect to the southern half of the area examined, it is to be feared that mineral deposition has not been active. In the examinations undertaken by the Tasmanian Geological Survey it is becoming more and more apparent that the deposition of ore in this island has been genetically related to the consolidation of the granite. The Zeehan area and Mt. Heemskirk, the Heazlewood district and the Meredith Range, the Farrell, Lyell, and Darwin fields, and the acid eruptives of the West Coast Range, the Middlesex field and the adjacent granite, the Dial deposits and the Dial Range, the East Coast fields and the granite masses of that side of the island—in all these the rock and the ores are mutually related, and the fields can be depended upon as centres for exploitation. But further south there is only a limited exposure of granite at Cox's Bight, at the south end of the Bathurst Range, where also some tin ore appears. If any granite exposures or indications exist in the new western country, there will be grounds for anticipating the discovery of mineral. Especial attention is necessary during these explorations in the way of searching for a concealed granite axis trending southwards from Granite Tor towards Cox's Bight, for in a sense all hopes depend upon this. The West Coast Range axial line of igneous rock lies too far to the west of the unexplored country to influence ore-concentration in the belt examined on this expedition, and any mineral deposits which may exist will be connected with other and parallel igneous lines. Hence, if any decided granitic outcrops exist in this *terra incognita*, we may be very hopeful of valuable discoveries; if these rocks prove to be absent, then it is highly probable that mineral occurrences will be only sporadic, and prospecting expenditure unremunerative. It is as well to be under no delusion in this matter, but to recognise conclusions which are being forced increasingly upon the officers of the Survey, and appear to have a basis both in fact and theory. It is needless to add that these conclusions strongly support the advisability of covering the unknown country with a network of exploratory traverses, in order to learn something definite of its nature and possibilities.

Dealing with the more southern portion of the route, there are two directions in which geological examination would throw light on much with respect to which ignorance prevails at present. The first is the country between Mt. Mueller, south-west of Tyenna, and Rocky Point on the West Coast, half-way between Birch's Inlet and Port Davey. A journey across the island here would traverse the formation lines coming from the north, and would show whether the mineral zones continue so far to the south. Some granite has been reported from the Wanderer River, and quartz-tourmaline stones from Moore's Look-out. Copper also has been recorded from Copper Creek, south of Mainwaring Inlet. This point is the termination of Cullen and Cawthorn's 1894 track from Tyenna, and if it be decided to make this traverse, the track should be cleared out where necessary, and the country burned in advance of geological exploration. A hut should be built half way (at the Serpentine), where a depôt of provisions could be established. This would be absolutely necessary, as the distance across to the coast by track is over 70 miles. It would be in continuation of the present exploration, being a parallel traverse further south, and if a further vote is granted, should, I think, be undertaken.

The second direction in which more knowledge is desirable is south of Tyenna, in the basin of the Styx, and near Mt. Weld. Tin and gold have been found in the sand of that river, but their place of origin is unknown. This of itself would indicate the desirability of a geological examination. Naturally, this area is nearer to settlements than the country referred to previously, and its examination may perhaps be considered as belonging to the general work of the Survey rather than as a fit subject for a special Parliamentary vote.

The present expedition, if it has not made any discoveries of value, has furnished precise and reliable information respecting country about which little was known, and concerning some of which absolutely nothing was known, and it will doubtless be of service in preventing expenditure in directions which are hopeless. At the same time a knowledge of the geological structure of the country traversed has been gained, which has already proved useful in the interpretation and correlation of features further north. The information which has been acquired will, moreover, be of value in connection with the material in course of collection for the construction of a geological map of Tasmania, a desideratum the importance of which is undeniable. The following table shows the geological sequence of the strata met with on this expedition:—

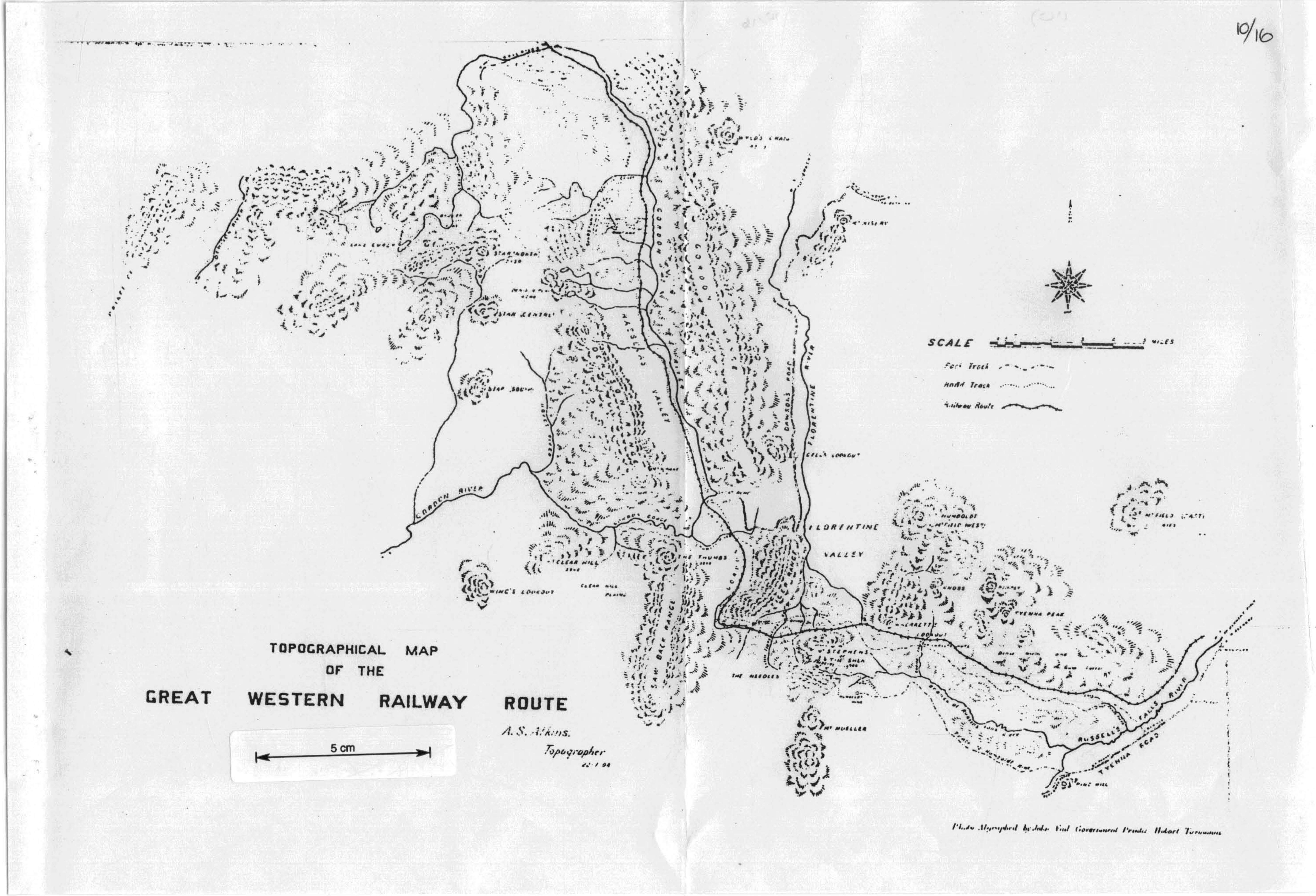
Geological Systems.	Occurrences.
RECENT.	Beds and banks of existing streams. Deposits of bog iron ore in the Florentine Valley and the Valley of Rasselas. Boulders in the Valley of Rasselas transported by glaciers descending from the Denison Range.
PLEISTOCENE.	Vestigial terraces of alluvium in the Valley of Rasselas and on Badger Plain. Alluvial floor of the Gordon Plain. These, of course, may be of somewhat earlier or somewhat later date.
TERTIARY.	Olivine basalt on hill behind Gell Hut.
MESOZOIC.	Diabase crowns of Mt. Humboldt, Wherrett's Look-out, Wyld's Craig, and diabase in loose stones on hill east of Gell Hut. This igneous intrusion apparently occurred at the close of the Mesozoic or the beginning of the Cainozoic.
PERMO-CARBONIFEROUS.	Conglomerate and mudstone at Tyenna. Conglomerate and fossiliferous shales on Wherrett's Look-out and Mt. Humboldt. Arkose grits of Russell's Falls Valley and Pine Hill near Tyenna. Arkose grits and conglomerate on Tim Shea. Sandstone and conglomerate near Gell River Hut.
DEVONIAN.	The formation of the copper-bearing lodes at the Needles probably started in this period.
ORDOVICIAN.	Fossiliferous limestone at Junee, Wherrett's Look-out, Mt. Humboldt, Florentine Valley, Great Bend, Valley of Rasselas. Limestone in Denison River.
CAMBRIAN.	Purple slates at Humboldt Mine. Yellow dikelocephalus sandstone in clays on Humboldt Divide and Florentine Valley. Conglomerate and pebbly sandstone and quartzite on Thumbs, Clear Hill, Mt. Wright, and Denison Range.
PRE-CAMBRIAN.	Quartzite schist and sericitic quartzite accompanied by argillaceous and sericite schist. A great system of foliated rocks rising unconformably from beneath the Cambrian of the Denison Range, and forming the mountain chains to the west. These belong to the upper division of the Pre-Cambrian, dominantly of sedimentary character, and called by American authors Algonkian or Proterozoic.

Some details remain to be filled in, and doubtful points settled, but the framework of the succession may be accepted as approximately correct. It is submitted that through the geological expeditions a definite advance has been made in our knowledge of the geology of a large portion of the island.

I have the honour to be,
Sir,
Your obedient Servant,
W. H. TWELVETREES,
Government Geologist.

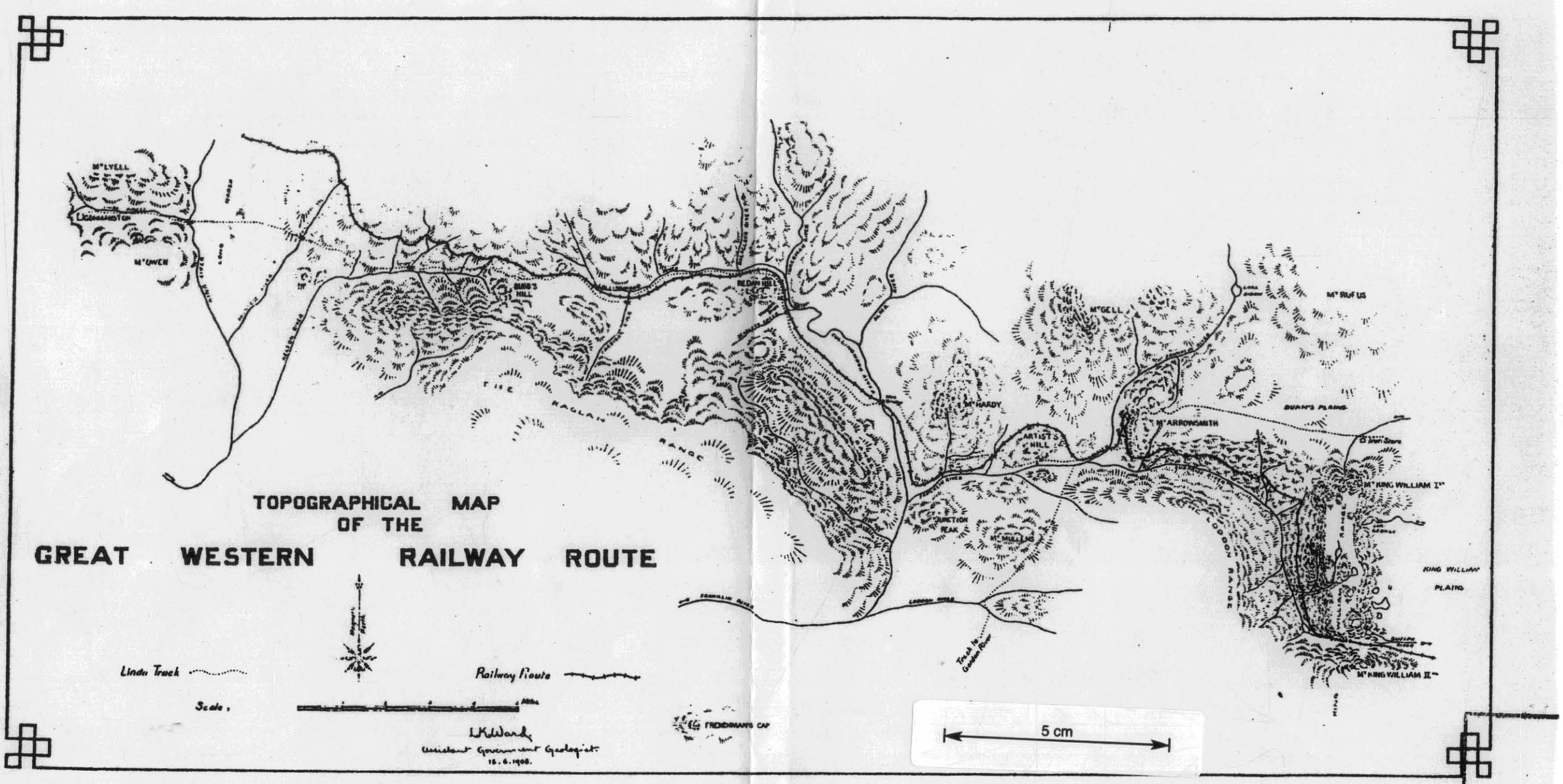
E. A. COUNSEL, Esq., Surveyor-General, Hobart.

10/16



TOPOGRAPHICAL MAP
OF THE
GREAT WESTERN RAILWAY ROUTE
A. S. Atkins.
Topographer
SCALE
MILES
Foot Track
Road Track
Railway Route
GORDON RIVER
VALLEY
FLORENTINE RIVER
FLORENTINE
VALLEY
HUMBOLDT
TYENNA PEAK
THE NEEDLES
SAW BACK RANGE
RUSSELLS FALLS RIVER
TYENNA ROAD
5 cm

11/16



TOPOGRAPHICAL MAP
OF THE
GREAT WESTERN RAILWAY ROUTE

Linda Track .....

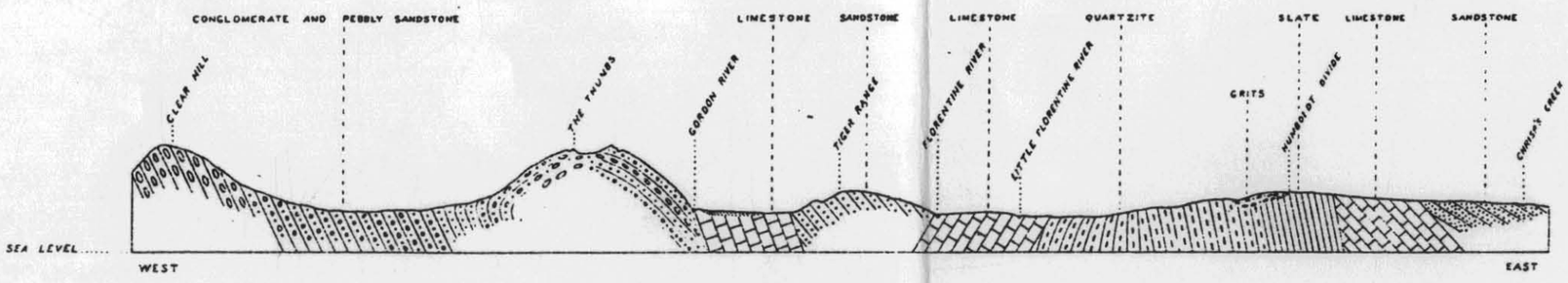
Railway Route ———

Scale,

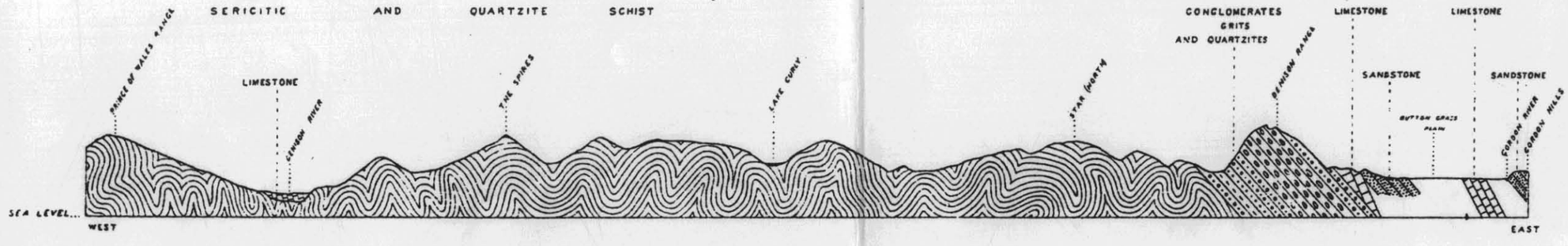
L.K. Ward
Assistant Government Geologist
15.6.1908.

Photo Lithographed by John Vail Government Printer Hobart Tasmania

12/16



CLEAR HILL TO CHRISP'S CREEK



PRINCE OF WALES RANGE TO GORDON RIVER

GENERALIZED SECTIONS

SCALES

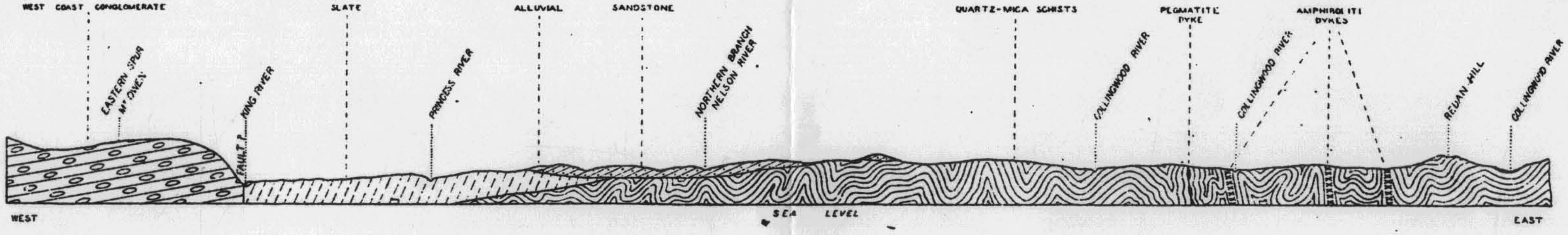
Horizontal 1" = 1 MILES

Vertical 1" = 1000 FEET

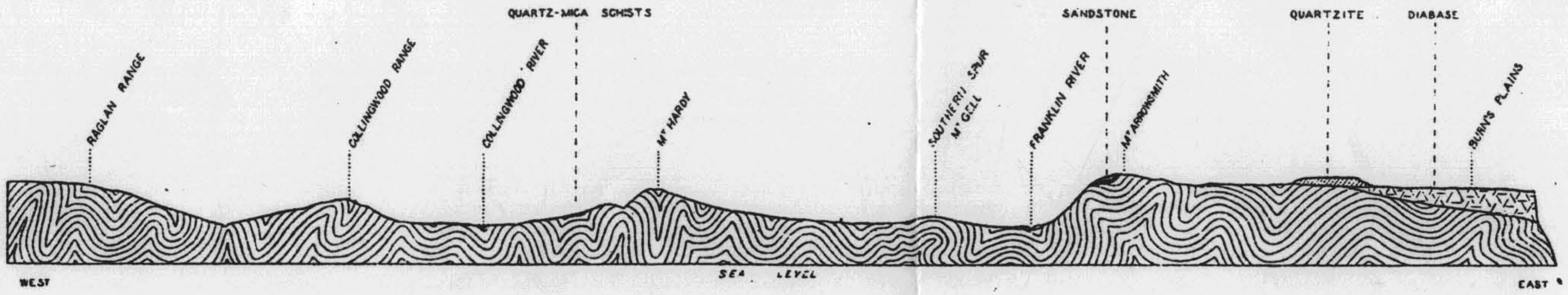
5 cm

to accompany Mineral Industries Government Geologist 22/7/08

Photo Mezzotyped by John Vail Government Printer Hobart Tasmania



MOUNT OWEN TO REDAN HILL



RAGLAN RANGE TO BURN'S PLAINS

5 cm

GENERALIZED SECTIONS

SCALES

HORIZONTAL ... MILES VERTICAL ... FEET

L.K. Ward, Assistant Government Geologist. 15.6.1908.

Photo Algraphed by John Vail Government Printer Hobart Tasmania.

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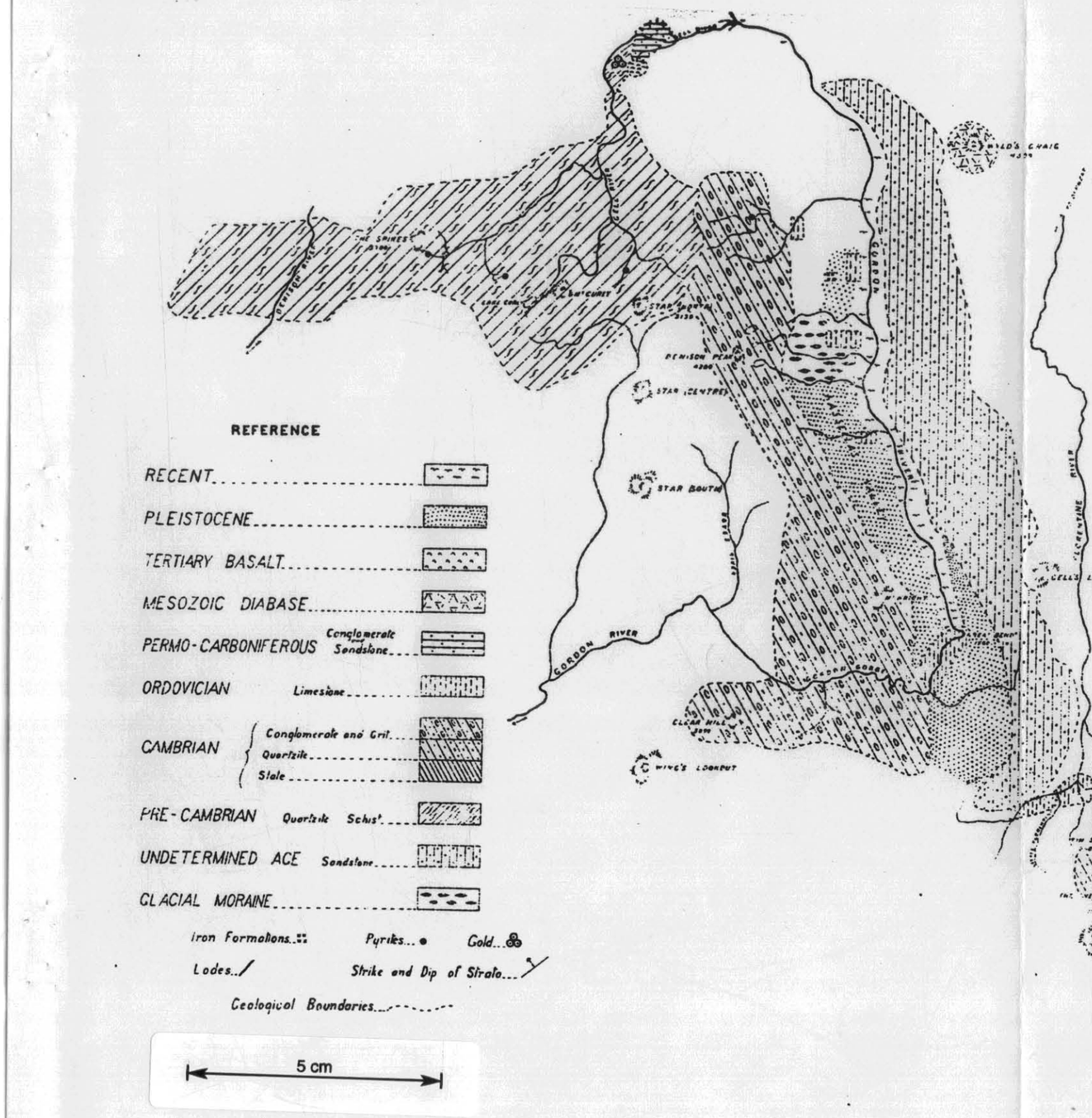
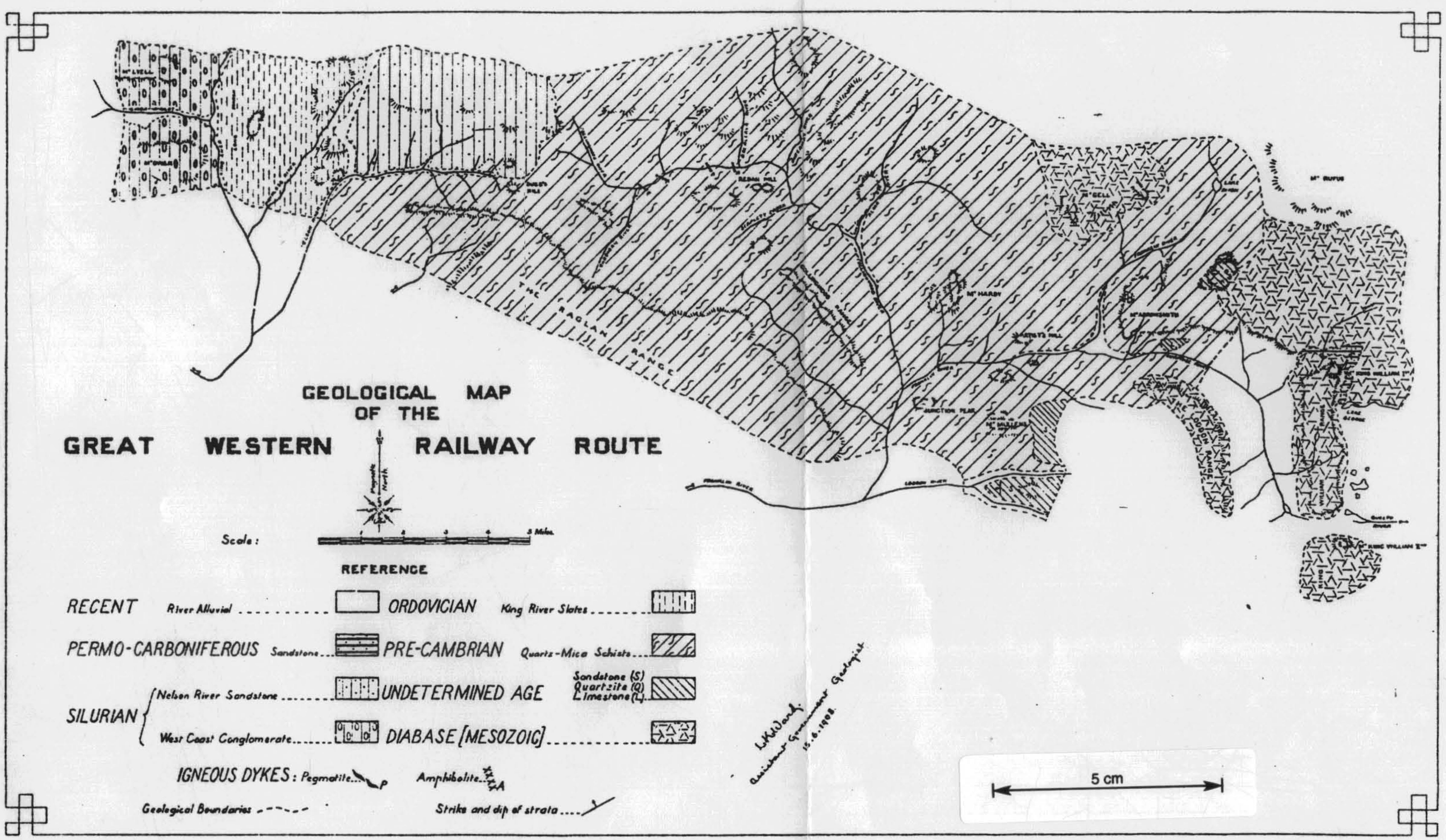


GEOLOGICAL MAP
OF THE
GREAT WESTERN RAILWAY ROUTE

Photo Mographed by John Vail Government Printer Hobart Tasmania



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MAP OF PORTION OF TASMANIA SHOWING POSITION OF EXPLORATION TRACKS CUT AND MARKED DURING THE YEAR 1908.

5 cm

SCALE 5 MILES TO AN INCH.

Map reduced by photocopying.

Tracks shown thus

ON: APR 19??

16/16