GEOLOGICAL NOTES ON THE ST. HELENS DISTRICT

Introduction.

These notes represent the result of a brief examination of the St. Helens district made at the request of the manager (Mr. W.R.G. Colman) of the Siamese Tin Syndicate. Critical sections of the water race which is now being cut, were examined and yielded much information. The tin deposits were examined briefly and generally. The opportunity was taken to examine other parts of the district.

Previous Literature.

Montgomery, A., Report on Thureau's Deep Lead near George's Bay, 1893.

Waller, G.A., Report on the Mining Districts of the Scamander River and St. Helens, 1901.

Twelvetrees, W.H., Report on Deposits of Clay at George's Bay and elsewhere, 1904.

Geological Map.

The time spent in the district was not sufficient to enable an accurate geological map to be prepared, The map attached is based partly on observations made and partly upon Montgomery's map. The geology to the south of St. Helens was sketched in so as to connect with Twelvetrees map of the Scamander district.

Geology.

Several rock formations are present in the district and these will be described below in the order of their age, starting from the oldest.

Cambro-Ordovician. The rocks of this system occur in two seperate portions of the district, viz. around Pyengana and to the south of St. Helens.

(a) Around Pyengana. Slates and quartzites are visible in the road cuttings around Pyengana and in the bed of the George River. From Pyengana, it is stated, these rocks extend to the west or north-west in a belt about 1½ miles wide.

To the south they cross the Siamese Tin Water race as a belt 2½ miles wide in an east-west direction. Greatest attention was paid to the exposures in the race on the eastern side of the belt.

Unaltered slates occur to a small extent only, the rocks consisting generally of metamorphosed types. Quartzites are not present to any great extent and those present are highly indurated or silicified.

The metamorphosed types are those typically developed by contact metamorphosed of argillaceous (Clayey) rocks. Fine to medium grained mica schists occur but not to any great extent. The rocks close to the granite contact on the eastern side are very much weathered, but appear to consist of fine grained mica schists.

The most common rock resembles spotted slates, chiastolite slates and possibly andalusite slates. The matrix of the rock is however a very fine-grained micaceous schist and spotted or chiastolite schists would be better terms to describe the rocks.

This belt of rocks is bounded on both the eastern and western sides by granite. The eastern contact shows the intrusive nature of the granite and small veins of aplite and granite intrude the schists over a distance of at least one chain from the contact. The altered nature of the Cambro-Ordovician rocks also points to the intrusive nature of the granite. The general occurrence of the belt of schists etc. suggests that they represent a roof pendant occupying a trough in the surface of the granite.

The schists have a general N.N.W. strike with high dips. The dips are generally to the west, but vertical and easterly dips also occur and though the structure was not worked out in detail, it appears that a series of closely folded anticlines and synclines occur.

(b) South of St. Helens. This area was not examined but was shown on Montgomery's map. The Cambro-Ordovician slates and quartzites are shown as coming within a mile of the Golden Fleece Rivulet and as bounded on the north by granite. This area would represent the northern extension of the Cambro-Ordovician rocks of the Scamander Tier as mapped by Twelvetrees. Evidence of their presence is given by the pieces of altered quartzite which become abundant as the Flagstaff Hill is approached by walking south form the Bridge at Jason's Gate.

There was a suggestion in the appearance of the soil to the west of Stony Ford, that slates may occur there. If this is the case, these slates probably represent a W.N.W. continuation of the above generally along the course of, and hidden by the deposits of Thureau's Deep Lead.

The above rocks yielded no fossils but are referred to the Cambro-Ordovician (Mathinna series) system by analogy with similar rocks in the north-eastern districts of the State.

Devonian Granite: Granitic rocks occupy a considerable proportion of the surface of the district and underlie much of the remainder. These rocks form the southern portion of the outcropping part of the batholith of the north-eastern district.

A considerable number of types occurs throughout the district. The commonest type is the usual medium to coarse-grained one containing quartz, plagioclase with lesser orthoclase, and biotite. This type often contains numerous large porphyritic crystals of felspar and is the typical rock of the north-eastern district.

At two localities, viz. around St. Columbia Falls and the intake of the Siamese Race, and south of St. Helens, hornblende is present in addition to biotite. It has generally been considered that the hornblende granites occur near the margin of the granitic intrusions. This is only partly true for the St. Helens district as near some margins hornblende is not developed. It is probable, however, that the hornblende types occur only at the margin of the main intrusion and not against roof pendants etc.

The granitic rocks are characterised by numerous viens and dykes of aplite, the latter often being of considerable width.

Veins of pegmatite and quartz are also present but in much smaller amounts.

It has already beenshown above that the granite is intrusive into the Cambro-Ordovician sedimentary rocks. No other evidence of age is available, but in conformity with other granites in Tasmania it is regarded as having been intruded in the Devonian period.

Tertiary (Thureau's Deep Lead). The presence of a deep lead (or old filled-in valley) was discovered by Thureau during the workings of the tin mines in the eighties. The lead has been reported upon by Montgomery and Waller and referred to by Twelvetrees. This lead represents the filling in of a former river valley and estuary (that of the ancestor of the George River) during a period of subsidence of the land relative to the sea.

The lead was accurately mapped by Montgomery and very little additional information has been gained since. However in recent years two small faces have been opened up to the east of Goshen which have enabled the lead to be traced further to its head in a westerly direction. One of these faces is on the south side of the George River and the other is on the north. The latter is known as Nesbit's workings and shows coarse gravels with a few boulders of granite and quartz, and numerous pebbles of weathered slate and quartzite. A granite hill occurs to the north and granite is also seen in the tail race to the river. The Siamese Tin Syndicate has sunk shafts in a flat west of Nesbit's workings and proved the extension further in that direction. A valley comes into this flat from the north-west and it has been suggested that this represents the head of the old lead rather than the George River did. It is quite possible that this valley represents the head of the old lead, but is is more probable that is represents a tributary thereto. Further the ancestor of the George River could have crossed the present river near Goshen and then kept to the north side and as the bottom of the lead is about the level of the present river, the whole of the portion near Goshen could have been removed by subsequent denudation.

From Nesbit's workings, the lead crosses the river and keeps to the south side of the present George River and has been exposed by numerous tin workings and has been further proved by shafts and bores sunk into it. The upper layers consist of gravels which to depths ranging up to 13 feet contain sufficient tin ore to be exploited. The lower layers consist of clays, gravels, grits etc. Of particular interest are the gravels containing pebbles of completely weathered Cambro-Ordovician slates etc.

About midway between Goshen and St. Helens the lead turns from its easterly trend and after apparently receiving a tributary from the north, continues in a southerly direction into the valley of the present Golden Fleece Rivulet. It receives a tributary from the south in the vicinity of the Argonaut mine and then changes its course to easterly and runs parallel to, and on the south side of, the Golden Fleece Rivulet.

Towards the head of Medeas Cove, Montgomery showed the lead trending to the north across the Cove and merging into the grits around St. Helens. The lead crosses the Cove in

this direction in a fairly narrow valley, but the grits at St. Helens are probably of later age and effectively cover the old lead.

However it is probable that the lead again turned to the east through the township of St. Helens, crossed George Bay and passed somewhere beneath the cliffs of gravel etc. between Muddy Creek and Moriaty Lagoon (it will be realised that in this vicinity the valley may have merged into an estuary.)

The thickness of the deposits in the deep lead naturally has a considerable range, being least at the head and greatest towards the mouth. The deepest part preserved is that in the north-south portion where the lead runs from the George River valley into that of the Golden Fleece Rivulet. The thickness here is at least 200 feet.

Near Goshen the bottom of the lead is approximately at river level which is probably somewhat over 200 feet above sea-level. The bottom of the lead is below sea-level where it crosses Medeas Cove.

The lead has been pictured above as being the filling of a former river valley. The filling probably occurred under fresh water conditions but somewhere the valley would join an estuary and estuarine or marine conditions would prevail. The deposits generally suggest a fresh water origin, but the weathered natureof the slate pebbles indicates some unusual conditions of weathering possibly caused by estuarine or marine conditions. The general absence of fossil shells is generally against marine sedimentation although not many shells live in estuaries undergoing rapid sedimentation especially of clay. As regards fossil shells however, Montgomery reported that a mine manager had stated that he found some shells near the Ruby Dam.

There is little evidence as to the age of the deep lead, but in conformity with similar deposits in the State formed during a subsidence of the land, it would be regarded as Middle Tertiary. The other deposits are usually overlain by basalt flows which have been regarded as closing the Tertiary fresh-water sedimentation. Generally the basalt flows are considered to be the equivalent of the Pliocene or Newer Basalts of Victoria. As regards Thureau's deep lead however, Montgomery reported that pebbles of basalt had been obtained from a shaft in the deep lead. A similar statement was made by Mr. Campbell as to the presence of basalt pebbles. The basalt was probably derived from the high plains on part of the Blue Tier. If the basalt is the same age as that in the Ringarooma Valley, then Thureau's deep lead would be younger than the Ringarooma leads. It is more probable however that the leads are of the same age and that the basalt pebbles are from an Older or pre-Miocene basalt.

Upper Tertiary or Pleistocene. The grits around St. Helens apparently formed a plain about 20 to 25 feet above present sea level. They occur mainly in St. Helens to the north of Medeas Cove, but small remants are also present on the south side of the Cove. They were therefore once more extensive and have been denuded by the Golden Fleece Rivulet and by George River.

These beds are composed of quartz grit derived by the disintregration of the granite of the district. They extend down to sea-level but in a number of places clay outcrops at sea-level beneath the grits. While the clay may represent the lower part of these beds, it is more probable that they form part of the deep lead.

No definite evidence of the age of these grits is available. They are younger than the deep lead deposits and older than the recent alluvium. They were probably formed during the transgression of the sea that occurred in either Upper Pliocene (Werrikooian) or Pleistocene time.

Recent. No attempt was made to map the recent deposits. River gravels and alluvium occur along the George River especially near Goshen & Pyengana. They probably also occurred along the Golden Fleece Rivulet, but are now hidden by tailings.

One area in which deposits were mapped as Recent is that around the mouth of Constable Creek. These consist largely of gravels formed by pebbles of Cambro-Ordovician types. Though mapped as Recent these gravels may in part be as old as the St. Helens grits, the difference in type being due to the source being Cambro-Ordovician slates etc. instead of granite.

Economic Geology.

The only metallic mineral deposits in the St. Helens district of any importance are those alluvial deposits containing tin ore.

Primary deposits of tin ore occur in the granite, but very few have been discovered and worked. One primary deposit occurs to the south of the Stony Ford bridge and was opened up many years ago by open cuts and shafts. It consists of a lode 6-7 feet wide in the granite. The lode material is a dark fine-grained type consisting of quartz, chlorite and/ortourmaline, and occassionally felspar, with small amounts of cassiterite and chalcopyrtie.

The alluvial tin deposits are superficial ones overlying the deep lead or along present day streams in the vicinity of the deep lead. These range up to 20 feet in thickness, but usually average between 5 and 12 feet. The bottom is sometimes granite, but is generally clays or gravels of the deep lead (locally referred to as marine bottom). The deposits consist of gravels or pebbly grits, the pebbles being of quartz. They have been worked in numerous places in the past and form the ground to be worked by the Siamese Tin Syndicate in the near future.

The deep lead has been tested in many places by shafts and bore-holes, although many of the older shafts were not bottomed. It appears that though the deep lead material may contain some tin ore, the content is altogether too low to be payable. In view of this, the question arises as to the origin and source of the tin ore in the superficial layers. The latter follow the contour of the ground and so have been formed as a result of the erosianal processes which have formed the present surface features. The pebbles and the tin ore in the deposits

would be derived from local sources and as the deposits are always in the vicinity of the deep lead, it would appear that they have been formed by the disintegration of the upper members of the deep lead.

It is possible that where little or no denudation has occurred, the upper beds of the deep lead may still be present. If these upper beds occur anywhere it will be at the highest point of the divide between the George River and Golden Fleece Rivulet occuppied by the deep lead. The upper beds here agree generally with the tin-bearing wash elsewhere. It would appear therefore that the upper beds were tin-bearing to a much greater extent than the lower ones. If this is so, the upper beds must have been formed under conditions permitting concentration, viz. the land remaining at much the same level for a considerable time and with the river running through and not only depositing gravel etc. and tin ore, but removing the fine gravel, sand etc. so that the tin ore was concentrated in a small bulk of sediments. It is also possible that the greater part of the primary tin deposits were not uncovered until the time of formation of the upper beds of the lead, thus enabling greater quantities of tin ore to be washed into them.

The only alternative explanation of the richer content of the upper layers is that every part of the lead has had the upper beds denuded and the tin ore contained in same has been concentrated in 5-10 feet of gravels and grits derived therefrom.

It is of course possible that other processes have affected the deposits. Thus sandy beds probably of marine origin exist in the workings of the George River Company. Similar beds but of greater thickness occur near the bridge over the George River on the Anson Bay road. Also it is stated by Mr. Colman that alayer of gravels encircle the granite hill between the Anson's Bay and Moorina roads. These factors would suggest that an estuary of the sea existed up the valley of the present George River (and probably also that of the Golden Fleece Rivulet). If such were the case, the superficial tin drifts may have been partly concentrated by the sea along old beach lines. It would be necessary to carry out a detailed geological survey occupying 3 to 4 weeks to definitely determine whether the above events took place, the time of invasion of the sea would be later than the formation of the lead and earlier than the formation of the St. Helens grits.

The cassiserite is fine in grain and contains ruby and resin varieties. Other minerals associated with it are ilmenite, pleonaste, and zircon, sapphire etc.,

Siamese Tin Syndicate.

This syndicate holds practically all the leases between Medeas Cove and Power Rivulet. The whole of this ground has been tested by shafts and boreholes and the depth and value of the ground determined. The quantity of ground is stated to be sufficient for many years work.

In order to work the ground efficiently a water race is being cut from the South George, the intake being about one mile below the St. Columbia Falls. The length of the race is approximately 26 miles and the cutting has been almost completed. It will provide sufficient head to enable all the ground to be worked.

Summary & Conclusions.

The geology of the St. Helens district has been described above. The probable origin of the secondary tin deposits has also been discussed. These consist of superficial gravels ranging up to 12 feet in depth. They are tin-bearing chiefly when overlying or in close proximity to Thureau's deep lead. As far as can be seen there is little possibility of any other extensive deposits away from the deep lead.

The Siamese Tin Syndicate, Ltd., is the principal company working in the district. They hold a large area of ground between Medeas Cove and Goshen, which has been tested by shaft sinking and boring. A water race is now being cut and sluicing should commence in 3 or 4 months.

A detailed survey of the tin deposits was not undertaken, and would require a period of 3 to 4 weeks.

(Signed) P.B. Nye.
GOVERNMENT GEOLOGIST.

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