

MT. VICTORIA GOLDFIELD

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THE MOUNT VICTORIA GOLDFIELD

1. INTRODUCTION

1. GENERAL

The investigation of which this bulletin is a systematic record constitutes part of a complete study of the goldfields of north-eastern Tasmania designed by the writer twelve months ago. The details of the scheme as then outlined were later altered by the Honourable E. F. Blythe Minister for Mines. It was originally intended to make a complete study of those goldfields in this part of Tasmania which have been the subject of much exploratory and developmental work to appreciable depths, and then apply the information and conclusions thus obtained to the relatively undeveloped fields. Under this scheme preliminary reports on each field would have been published as the field work progressed, to be followed on the completion of the investigation by a systematic account of the goldfields as a whole and the factors controlling the formation of the lodes and the deposition of gold. The decision of the Honourable the Minister for Mines, however, that each field must be examined and reported upon as a separate unit makes such a general treatment impossible at present. Accordingly the conclusions arrived at and indicated in this bulletin are such as a deducible in the main from evidence supplied by this field alone, and therefore lack that completeness which will only be possible when the study of the goldfields as a complete geological unit is finalised.

The evidence available within the field is such as to justify certain conclusions as to genesis which while not permitting of a definite pronouncement as to the relation of depth, to gold values, yet justify certain recommendations in regard to investment of capital.

2. THE AREA EXAMINED

The Mount Victoria goldfield is situated in the North-Eastern portion of Tasmania, the exact position being shown in the locality map as frontpiece of this bulletin. It is connected to the road system of the district by a good macadamised road penetrating to the very heart of the auriferous belt.

The field is 8 miles from the station of Legerwood which as a point on the North-eastern railway is connected with the railway system of the State. As shown in the general geological map, Legerwood is connected with Alberton, the centre of the goldfield, by a first class macadamised road.

The geological survey with which this bulletin deals was not restricted to the actual auriferous belt, but an area was submitted to close examination which includes both the country in the immediate vicinity of the known outcrops of the gold-quartz lodes and a portion of the granite areas lying to

both the east and west. The northern limit of the area was fixed at the junction of the Dorset and Ringarooma rivers, which is well to the northwards of the most northerly known lode. The southern boundary is an arbitrary line located to the southwards of the old Una mine. The suriferous belt extends beyond this southern limit towards Mathinna but as this southern portion can be best approached and studied from the latter point, it has been reserved for investigation as part of the Mathinna goldfields.

The area geologically mapped during this investigation measures 10 miles square and this area of 100 square miles is shown in Plate 11 accompanying this bulletin.

The principal township of the area with general facilities is Ringarooma, while the small settlement of Alberton on the gold-field itself occupies approximately the centre of the area. Launceston, the northern port of Tasmania, is 66 miles from Legerwood. The greater portion of the area is devoted to farming, Ringarooma being in fact one of the richest farming districts of Tasmania.

### 3. ACKNOWLEDGEMENTS

In carrying out the geological survey of this area the writer was helped in many ways by the residents of the district. Such help was greatly appreciated and it is desired to place on record a full acknowledgement and appreciation thereof.

Particularly does the writer desire to acknowledge the very great assistance rendered by Mr. P. Becker of Alberton who acted as field assistant during the carrying out of field work. Mr. Becker's intimate knowledge of the whole district and especially his thorough acquaintance with the work done on the many lodes of the area proved invaluable. Mr. H. Singline of New River also gave valuable and appreciated help in field work.

For general help, the provision of many facilities and for their hospitality the writer desires to specially thank the Hon. Alan Wardlaw M.L.C. of Mineral Banks, Mr. A. R. Fowler of Alberton, Mr. W. White and Serg't. J. Donovan of Ringarooma.

## II PREVIOUS LITERATURE

The first report on this field was prepared in 1883 by Mr. G. Thureau then Government Geologist. A further report by the same writer was issued in 1884 consequent upon a visit made after considerable developments had taken place. This report gives the general position and character of the lodes, but the accompanying maps show in most cases a much greater length of lode than actually exists. This error was most probably caused by the connecting up of outcrops which in the thick virgin forest appears to be portion of the one lode, but which subsequent exploratory work has shown to be disconnected. It is desirable to draw attention to this fact as the length of lodes as depicted in Thureau's map has in several instances, been perpetrated in later maps by Twelvetrees.

In 1901 the late W. H. Twelvetrees reported on the field. His examination was devoted almost wholly to the actual lodes and the mine workings and his report deals in somewhat meticulous detail with this phase of the subject. Twelvetrees again visited the field in 1903 and his resulting report, in addition to bringing the data on mine workings up to date at that time, discusses the general geology of the auriferous belt itself. Such a discussion had definite limitations, however, because of the limited area examined and the lack of detailed survey. This second report of Twelvetrees includes a map showing the lodes and it is in this map that many errors in Thureau's original map are perpetrated.

### III. PHYSIOGRAPHY.

#### 1. TOPOGRAPHY

The main topographic features of the area are indicated in Plate 11. which shows the contour lines at 200 feet intervals. The topography of the auriferous belt is shown in greater detail in Plate 111 in which the contour interval is 100 feet. These contour lines can only be regarded as approximately accurate.

The above maps show clearly that the dominant topographic feature of the area is Mt. Victoria the summit of which is 3900 feet above sea-level. At the foot of this prominent mountain peak and at an elevation of from 2500 to 2600 feet above sea-level, there occurs an appreciable extent of plateau country. Individual units of this plateau are known as Mathinna Plains, Cotton's Plains and Una Plain. Standing on the summit of Mt. Victoria it is quite apparent that this plateau is merely a remnant of a dissected peneplain as additional units at the same level can be observed in all directions. The noticeable remnants at the foot of Mt. Victoria enumerated above constitute a pronounced watershed between the northern southern and eastern drainage systems of this part of Tasmania and represent that portion of the virginal peneplain not yet out into by the recession of the heads of the respective valleys.

Below the level of this plateau and the spurs which spring therefrom, the topography is very broken, the full effect of the cycle of erosion still in its youthful stage being seen at these levels. Viewed from the level of the valley bottoms or from the relatively gently undulating country in the vicinity of Ringarooma (900 feet above sea level)., the relief can be described as high the sides of the valleys being steep and in many places precipitous. The main portion of the auriferous belt is situated on the western side of one of such prominent spurs running north-westwards from Mt. Victoria.

A prominent feature observable from the vicinity of Ringarooma is known as Oliver's Hill. This is one of the leading spurs from the Mathinna Claim but is rendered particularly noticeable by the occurrence on it of a basaltic plug, which, resisting denudation more than the surrounding sandstones, now stands out as a

rugged knob with a steep slope northwards.

There are three main drainage systems in the area namely those of the Ringarooma, South Esk and St. George's Rivers. Of the former system three main tributaries have entrenched themselves in the old peneplain and now occupy deep valleys namely the Dorset, New and Cascade Rivers. Only the head waters of the other two drainage systems are observable within the area being confined to the southern and south eastern portion of the general geological map.

The reader is referred to Plates 11. and 111 for any further details as to the topography which he may require either in regard to the subsequent descriptive matter in this bulletin or in connection with prospective mining operations.

## 2. RELATION OF TOPOGRAPHY TO MINING

### A PROSPECTING AND EXPLORATION

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As stated above the gold-quartz lodes occur on the western slope of a prominent spur springing from the northern part of Mt. Victoria. This spur divides the Dorset valley from that of the New River and it is within the former valley that practically all of the lodes are confined, with the exception of the most northerly lodes which occur on the New River side of the spur.

The outcrop thus occur on the relatively steep western slope and in general can be well prospected by adit levels down to the level of the Dorset River or approximately 1000 feet above sea level. The lode outcrops occur at this level up to 2400 feet above sea-level.

The steepness of the slopes is sufficient to prevent excessive accumulation of detrital material, so that lode outcrops are not hidden to any appreciable extent but are so exposed as to be readily observed when the thick cover of vegetation is removed.

It so happens that the lodes to which most attention has been paid outcrops at elevations of from 1200 to 1400 feet above sea-level. Consequently water level has been reached in following the lodes down before such a depth has been attained as would provide scope for mining operations on a considerable scale. In future mining operations on such lodes, as for example the Premier, Rosalind-Gumsucker, Alberton, Mercury, etc. the topography is of no help as shaft sinking will have to be resorted to.

The degree to which adit mining can be carried out on the various lodes is indicated in detail in Chapter VII but in general it may be stated that the conditions while not ideal are certainly very good.

## B. TRANSPORTATION

The occurrence of the lodes on the slopes of such a steep spur will allow of gravity transportation of all material mined down to 1000 feet above sea-level. The details of the topography make the conditions more suitable for transportation by aerial ropeway rather than by ground trams although in many places these are possible.

Below 1000 feet above sea-level power haulage to that level will have to be resorted to.

## 3. RAINFALL AND WATER-SUPPLY

The area being one of comparatively high relief, the rainfall as is usual in Tasmania under such conditions, varies considerably in different parts of the field. Thus the rainfall at Ringarooma is less than at Alberton which itself is less than on the Mathinna and Cotton Plains region.

The rainfall is well distributed throughout the year, months of January and February while being driest yet have an appreciable precipitation. The annual rainfall and its distribution is given in the following table which gives the data for Ringarooma. The figures for Alberton, the plateau, and the higher parts of Mt. Victoria will be progressively higher than those in the table.

### RAINFALL AT RINGAROOMA

Average over 25 years  
in inches.

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January	2.62	July	5.81
February	1.79	August	5.24
March	3.20	September	4.92
April	3.65	October	4.58
May	4.40	November	2.70
June	7.10	December	2.87
Annual	48.88		

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In regard to water supply, the area may be described as well watered. The good rainfall combined with a heavy forest growth in the catchment areas ensures a constant water-supply in the main streams. Neither the Ringarooma nor its tributary the Mt. Dorset ever ceases flowing and the New River only in occasional years during February or March.

As far as gold-mining operations are concerned it is the Dorset River to which attention must be paid in connection with water-supply. The amount of water available in this stream is insufficient to provide more than a mere handfull of power and the topography of this valley does not present *does* favourable conditions for extensive water conservation.

For general milling and similar operations, however, there is quite an adequate water-supply

in the Dorset River itself although not necessarily in all the tributaries thereof. For this reason it will be advisable to locate whatever treatment plants may be erected in the future in the flat country immediately adjacent to the Dorset River.

For household purposes there is sufficient excellent water to supply requirements of whatever mining population may ultimately develop.

The lower reaches of the Dorset and New Rivers contain broad alluvial flats with a coarse shingle sub-soil. These flats become very dry in Summer. There is sufficient water in the Dorset River which can be diverted by a small weir to irrigate these flats. Production from this productive area could in this way be very economically and effectively increased.

#### IV. GENERAL GEOLOGY

##### 1. THE ROCK TYPES REPRESENTED IN THE AREA AND THEIR MODE OF OCCURRENCE.

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##### A. IGNEOUS ROCKS

##### (1) Granite and Quartz-Porphry

The general geological map (Plate 11) shows two areas of granite - one on the extreme western and the other on the extreme eastern edge of the map. Both of these areas in fact are but small portions of extensive outcrops of a large batholith which characterises the north-eastern part of Tasmania. In such a large batholith a large range of granitic and associated rocks may be expected to occur and this is the actual fact in north-eastern Tasmania. In those included in this area, however, the occurrences are limited to a coarse-grained normal granite with in one or two places the pneumatolytic alteration rocks which result from the action of the pneumatolytic phase of ore deposition thereon the most plentiful of which in this area is greissen.

The normal granite carries biotite and it is only where pneumatolytic action has taken place that muscovite occurs. Orthoclase is predominant although plagioclase is present the variety approaching oligoclase. The structure is typically granitic.

The eastern granite area extends beyond the limit of the map towards Derby and Weldborough and thence is continuous to the Blue Tier and Gladstone. The south eastern portion of the boundary of this batholithic outcrop is shown in the general geological map (Plate II) and it is evident from a study of this boundary in relation to the contours that the roof of the batholith is very steep sided in this vicinity. No such information as to the subterranean batholithic roof is supplied by the western outcrop.

From the existence of the deep plunge of the roof in the eastern area, however, it becomes clear that its sub-surface connection with the western

occurrence must be in the form of a comparatively deep trough-like depression in the batholithic roof. That a connection does not exist is suggested if not definitely proved by the occurrence of the quartz-porphry dyke in the main tunnel of the Ringarooma Mine.

This quartz-porphry dyke is 22 feet wide and is only seen in the tunnel no surface outcrop being visible. The rock is a normal quartz-porphry and shows no sign of crushing or mineralogic reconstitution.

Both the granite and quartz-porphry are intrusive into the Cambro-Ordovician slates and sandstones and the absence of metamorphic characters due to crushing, point to these rocks being portion of the huge igneous invasions which represented the end-point of the Epi-Silurian age.

## 2. DIABASE.

There are three separate occurrences of this rock in the area one large mass constituting the mountain mass of Mt. Victoria rising about the old peneplain, and two small outcrops at Cemetery Corner and near the western granite boundary respectively. The rock is the normal diabase already fully described in various publications of the Geological Survey.

In regard to the mode of occurrence of this rock in the three occurrences in this area, the evidence is clear that the two small occurrences are dyke-like masses. The interpretation of the form of the large mass, however, is not so easy as the contacts are mostly covered by detrital material and large talus deposits.

Looking at Mt. Victoria from the westwards the castellated walls of diabase are seen rising abruptly from a less steep talus covered slope. This gives the impression of a sill lying on the Permo-Carboniferous sediments. On the eastern side of the mountain however the diabase occurs in situ down to a much lower level. This may of course be due to faulting but this scarcely seems possible in view of the basal beds of the Permo-Carboniferous continuing from west to east along the northern slopes of the mountain at the same level. It seems more probable therefore that on the eastern side of Mt. Victoria the diabase is transgressive in relation to the Permo-Carboniferous sediments. The sill-like appearance on the western side of the mountain would then suggest that an extension westwards from the transgressive portion gave a sill structure along the bedding planes of the sedimentaries. The structure would thus seem to be of the nature of an asymmetric laccolith - a structure which recent investigations have shown to characterise the diabase of Tasmania in other districts. Loftus Hills, Royal Society of Tasmania 1922. "Progress of Geological Research in Tasmania since 1902".

### 3. BASALT.

Quite an appreciable portion of the area mapped is covered by basalt. The general geological map shows that this basalt does not occur in the suriferous belt but starting at Oliver's Hill extends northwards to the northern boundary of the area as a continually winding sheet.

The thickness of this sheet varies, being in places merely a thin shell while at other points it is upwards of 100 feet thick. The average thickness however is in the vicinity of 50 feet. On Oliver's Hill the thickness cannot be seen and is at least 1000 feet and the appearance in this locality is that of a volcanic neck. This seems to be confirmed by the manner in which the present distribution spreads outwards and downwards from this thick basaltic mass. In addition, the occurrence on Oliver's Hill of coarsely crystalline basalt showing blades of augite up to half inch in length, indicates the evidence of such a mass of igneous material as would permit of slow cooling.

The basalt is the normal olivine basalt of Tasmania and by its decomposition it has given rise to a very rich chocolate soil. Its age is late Tertiary.

### B. SEDIMENTARY ROCKS

#### (1) MATHINNA SLATES AND SANDSTONES

(a) STRATIGRAPHY. This important sedimentary system occupies approximately two thirds of the area. It is by far the most extensive both in thickness and areal extent of the sedimentary formations of the district. In fact the occurrences in the Mt. Victoria goldfields are only a small part of a development of this rock system which characterises the north-eastern portion of Tasmania extending from the Tamar River eastwards and from Fingal northwards in both cases as far as the sea coast.

The geological survey of these north-eastern goldfields has not yet been advanced sufficiently to warrant anything approaching a general description of the system. Such a description of the whole system which aggregates many thousands of feet in thickness can only be compiled after all of the fields have been examined. It must suffice therefore, for this bulletin and the others dealing with individual goldfields, to confine attention to the portion of the system developed in the area and its structure. On the completion of the descriptions of these individual fields it will be possible to present a general summary of the stratigraphy and structure of this Cambro-Ordovician system.

The rocks of this system as developed in the Mt. Victoria field are slates, sandstones, felspathic sandstones and quartzites. As

regards relative abundance the slates largely predominate followed by quartzites and sand stones in that order.

The slates throughout the system show wide variations. In colour they range from black to light grey or yellow. They likewise present great variations in degree of fissility. The thickness of the beds also vary within wide limits from beds only an inch or two in thickness intercalated between sandstones or quartzites to beds of fissile slate a hundred or more feet thick. The black slate of the Ringarooma and Mercury is typical of the darker varieties and are characterised by marked crenelation while the extensive beds some distance above the Alberton saw-mill are blue-grey slates of normal habit. The lighter coloured varieties occur almost invariably in relatively thin beds although in the northern portion of the surfiferous belt yellow to yellowish brown semi-fissile slates occur associated with similar coloured sandstones of which they may be regarded as fissile varieties.

Normal silicious sandstones only occur occasionally the rocks referred to as sandstones in this bulletin being distinctly argillaceous or felspathic varieties. The latter (felspathic) sandstones are only developed in one locality namely on the Mathinna Road a few chains beyond the point where it enters upon the Mathinna Plain.

The argillaceous sandstones occur throughout the series in various parts of the area.

Quartzite beds are well developed in the upper portion of the series particularly in the area immediately east of the New River Waterfall and also in the precipitous gorge above the Alberton Saw-mill. They are white or grey in colour and of varying degrees of silicification.

The stratigraphical succession in this system as developed in the Mt. Victoria goldfield can be deciphered with the data presented in one particular portion of the field. The part of the area supplying this very useful information is the long spur running northwards from Cotton's Plain down to the New River valley and up which the Pyengana Track has been located. In this locality the strata are comparatively level having a dip towards the south-east of only about  $15^{\circ}$ . Going up the spur from its northern foot towards Cotton's Plain the beds are traversed in ascending order. Thus at the foot of the spur yellow argillaceous sandstones occur corresponding to those in the northern end of the gold belt in the vicinity of the Almora and neighbouring lodes. Overlying these occur the more normal grey slates with interbedded quartzites and sandstones which themselves are overlain by sandstones and quartzites with narrow beds of light grey slates. On top of all these occur the felspathic sandstones.

In the succession, as depicted above, the black slates are not mentioned. The position of these slates in the system is below the yellow argillaceous sandstones and are therefore the lowest members as exposed in this area. This

becomes clear when the anticlinal fold, which occupies the suriferous belt, is considered in relation to the relative positions of the yellow argillaceous sandstones and the black crenulated slates penetrated by the Ringarooma and Mercury Mine workings. Such relative position shows that the former beds occur in the outer limb of the fold while the latter beds are penetrated as the axis of the anticline is approached. This clearly indicates that the black crenulated slates underlie the soft yellow argillaceous sandstones. As to the thickness of the black slates varies, and that which underlies it there is no evidence disclosed in the field to indicate.

(b) Structural Geology The whole of this sedimentary system shows clear evidence of the action of horizontal compressive forces. The metamorphic action has not proceeded to the state of schist development, the development of slaty cleavage representing the maximum effect on the rock masses. The type of metamorphism and the structural geology indicate that the system as here exposed was subjected to organic compression within the zone of fracture and not within the zone of flowage. Under these conditions the crenulation of the black slate series is due to the original black shales acting as incompetent beds relatively to the overlying sandstones.

The type of folding characterising this rock system is that of simple open folds. Close folding has not so far been observed in the area and the most pronounced fold is that which occurs within the suriferous belt and the existence of which has a great significance in regard to the genesis of the gold-quartz lodes. This fold is a normal anticline the inclination of the limbs varying greatly from point to point but averaging about  $60^{\circ}$ . The folds lying both to the east and west of this well developed anticline are more gently undulating with comparatively low dips on the limbs and in many cases they are monoclinical in character. Such folds can be very clearly seen in the cliffs of the valley above the Alberton Sawmill.

The axes of these folds have a general strike of  $330^{\circ}$  to  $345^{\circ}$  and possess an undulating pitch. As a consequence of this undulation of the pitch, the strike varies within appreciable limits swinging in places to nearly east-west.

The exposures throughout the field are not sufficient to allow of the determinations of the details of these undulations of the pitch, but in no part of the field does there appear to be evidence of a very pronounced pitch, minor undulations being apparently the general characteristic.

The relationship between the main anticlinal fold of the suriferous belt is shown in Plate IV. This is a vertical cross section at right angles to the axial direction. This section also shows the two reserved faults, or thrust planes which separate the folded western portion of this rock

system from the eastern portion which is characterised by a low dip in a general south easterly direction.

The existence of these thrust faults can be well seen from the eastern side of the deep gorge below Cotton's Plains Waterfall. Looking south-westwards from that point it becomes obvious that the gorge marks the outcrop of a zone of ever-thrusting consisting of two parallel thrust planes. The western side of the eastern thrust plane is folded while the eastern side possesses a remarkably low dip and absence of folding. It is clear that such a condition of things has been brought about by pressure directed from the westwards. Such pressure was, early in its period of application, relieved by fracture and movement along the two thrust planes thus protecting the eastern portion from the full effect of the compression. The western portion, however, as the pressure continued and thrusting took place along the planes, suffered some buckling as the result of the frictional resistance to movement along the planes this being most pronounced near the planes themselves, thus producing the well developed anticline of the gold belt. This zone of thrust faulting is one of the most significant structural features of the area and in conjunction with the associated anticline is of great importance in considering the genesis of the gold-quartz lodes. This significance will be dealt with in a later chapter of this bulletin.

Plate IV. shows the geologic structure indicated above and it must be studied to obtain a correct conception of the structural geology of the Mathinna slates and sandstones as developed in this area. In connection with this section the details of strike and dip in Plate II. and III. must be taken cognisance of. It thus becomes apparent that the statement made in previous reports that the Dorset valley occupies an anticline is not correct as it is clear that the greater part of this valley lies within a shallow syncline.

## (2) PERMO-CARBONIFEROUS MUDSTONES & SANDSTONES

The rocks of this system are confined to the southern portion of the area particularly at the base of Mt. Victoria extending thence to Cotton's and Mathinna Plains.

The geological Map (Plate II) shows a ring of these rocks surrounding the diabase of Mt. Victoria and continuous with the occurrences on Cotton's Plain. The relationship of the contours to these outcrops shows that no rocks of this system occur below an elevation of 1550 feet above sea-level. Exactly to what height they continue up the slopes of Mt. Victoria cannot be stated as the diabase talus masks everything else. Neither can it be ascertained for the same reasons whether the Trias-Jura System is developed above them as is so common throughout Tasmania.

The occurrences of Cotton's Plain consists of white pebbly sandstones and really form only a thin covering over the Mathinna Slates and Sandstones. The beds outcropping on the slopes of

Mt. Victoria itself consist of pebbly mudstones but as stated above the details of the stratigraphic succession cannot be observed.

On the Mathinna Plain the occurrences shown in the geological map (Platell) consist of discontinuous relatively thin beds of light-coloured sandstones lying unconformably on the Cambro-Ordovician slates and sandstones.

### (3) TERTIARY RIVER GRAVELS

In only one locality in the area is there an exposure of the infra-basaltic pluvial deposits of Tertiary age. This is in the northern part of the field on the left bank of the Dorset River not far above its junction with the Ringarooma. River gravels are there exposed underlying the basalt and they resemble the other river gravels of this part of Tasmania in every respect. They carry a little tin but not sufficient to be of commercial value.

### (4) GLACIAL DEPOSITS

On the slopes of Mt. Victoria, particularly on the western side there occur accumulations of diabase boulders of all sizes up to 15 feet largest dimensions, situated some distance from the natural limit of the talus slopes. Their manner of occurrence and their situation on the western side of a shallow U-shaped valley running parallel with this side of the mountain, suggest the possibility of a glacial origin. The size of some of the boulders standing up prominently as they do to heights of 12 feet or more is very suggestive of glacial erratics.

These deposits resembling glacial moraines and erratics do not extend below 3000 feet above sea level. They seem to represent the western melting edge of an accumulation of ice on the western slopes of the mountain. The glacier must therefore have been of a strictly mountain-glacier type and did not descend beyond a point which is now about 3000 feet above sea level.

There seems to be no doubt, therefore, that ice accumulated on the slopes of this mountain in Pleistocene time to a sufficient extent to produce the glacial erratics and moraines now observable. This conclusion is in concordance with that which will be pointed out later in regard to the greater amount of water in the valleys at that time than at present and also with the conclusion recently formed by both Professor Sir T. W. Edgeworth David and the writer that the Gladstone gravels and sands situated to the north-eastwards of this area at the northern foot of Mt. Cameron are of glacial origin and represent out-wash aprons from similar glaciers on the northern slopes of Mt. Cameron.

### (5) RECENT RIVER-GRAVELS.

The areas marked yellow on the general geological map (Plate II) consist of the alluvial accumulations formed by the existing rivers. Such

alluvial deposits occur particularly in the valleys of the Dorset and New Rivers extending up these valleys to the foot of the steep slopes upwards to the old peneplain.

The alluvial deposits are characterised by the pronounced predominance of coarse shingle ranging up to 15 inches maximum dimension. Associated with this shingle occur grits gravels and sands but there is a distinct ascendancy of the shingle.

The depth of this alluvial naturally varies, but its maximum thickness has not yet been ascertained as all attempts to sink shafts have failed owing to the heaviness of the water-saturated material. Such shafts have been sunk to a depth of 40 feet without striking bedrock.

Both the amount of the shingle and the size of the individual boulders are such as to indicate that a much greater glow of water must have characterised these valleys than that which exists at present. Even the winter floods which are at times of appreciable size are not capable of moving the large bodies of shingle now to be seen in these alluvial deposits. It is of course possible that this shingle was brought down by the waters of the melting glaciers and it is certainly significant in this connection that the two river valleys in which this shingle is so largely developed head from the slopes of Mt. Victoria where the glacial moraines and erratics are developed. The fact, however, that the present rivers are only about 5 feet below the surface of these alluvial accumulations shows some doubt on such a conclusion as in other parts of Tasmania there has been appreciable erosion of the glacial deposits.

It seems most probable therefore that these shingle deposits were formed during a period of heavy rainfall which preceded the present climatic conditions and which succeeded the glacial epoch.

## 2. THE GENERAL SEQUENCE OF EVENTS LEADING TO THE PRESENT GEOLOGICAL STRUCTURE AND TOPOGRAPHY

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The oldest rocks exposed in this area are the Cambro-Ordovician Mathinna Slates and Sandstones. These beds were laid down on the sea floor of Proterozoic rocks now visible in the area some distance from land as the general fineness of the sediments indicates. The period of sedimentation which this rock system represents was a prolonged one as it represents some thousands of feet of sediments the exact thickness not being yet possible of estimation.

Following upon this period of sedimentation there ensued a diastrophic period during which the slaty cleavage was developed. Exactly as to what extent the folding and thrust faulting has been brought about by this period of diastrophism as compared with a later orogenic period cannot at present be stated. Nevertheless the general relationship of the slaty cleavage to the folds

points to their being both the result of the same compressive forces, and indication which is also given by the relationship of the main anticline to the thrust fault. It seems safe therefore to deduce that the main structural features of the Mathinna Slates and Sandstones were developed during this Epi-Cambro-Ordovician diastrophic period.

Following upon this period of diastrophism the area formed part of a land surface and a prolonged period of denudation ensued. The complete absence of the Silurian system in this locality when contrasted with their widespread development in the western half of the island indicates either that this area continued to be a land surface through out the Silurian period or that erosion subsequent thereto but preceding the Permo-Carboniferous was so complete as to remove all signs of this comparatively large system.

The probability, however, that the former alternative is correct namely that this north-eastern portion of Tasmania was a land surface throughout the Silurian Period and suffered continued erosion during that time is weakened by the consideration that the basal member of the Silurian system in Tasmania- The West Coast Range Conglomerate Series - being a typical littoral deposit may never have been deposited in this locality which, being the site of deeper seas received sedimentary accumulations characterised by limestones, which could have been eroded much more easily than the conglomerate series. A final decision as to the palaeogeography of this area must, therefore, be postponed until further evidence is available.

At the close of the Silurian period, whether this area was the scene of sedimentation or not there occurred a very important orogenic period during which the granite was irrupted into the Cambro-Ordovician Sediments as a large composite batholith which extends from this area over a great part of north-eastern Tasmania. The formation of the quartz-gold lodes represented the end-point of this batholithic invasion.

The palaeogeography of the area during the Devonian period, however, can be stated more definitely as the complete absence of sedimentary rocks of that age throughout Tasmania compels the conclusion that the whole of Tasmania was a land surface during the Devonian period. Further than this there is evidence available in other parts of Tasmania which clearly indicates that the result of the circle of erosion operating during the Devonian period was the exposure of the Epi-Silurian granite at the surface over large areas and the ultimate development of a peneplain over the whole of the area now occupied by Tasmania.

The peneplained land surface of which Tasmania formed a part sank at the close of the Devonian period to sea-level and lower. On this partially submerged land-surface the glacial deposits of the Permo-Carboniferous system were then deposited followed by the other sedimentary accumulations of that period. There seems,

however, in the area we are now considering, to have been no accumulation of carbonaceous material, the sediments being apparently wholly marine.

Whether the succeeding Trias-Jura fresh water deposits were laid down in this area cannot be stated but in view of their existence a few miles to the southwards it seems very probable. On the evidence available within the field, however, no definite conclusion is justified unless such a decision is based on the occurrence of the diabase. In other parts of Tasmania masses of diabase similar to that on Mt. Victoria are intrusive into the Trias-Jura horizon after cross cutting the Permo-Carboniferous. The existence of the thick mass of diabase on Mt. Victoria therefore would by analogy indicate the previous existence of Trias-Jura sediments at that level which have been since removed by denudation. This seems the most likely conclusion.

At the conclusion therefore of the Permo-Carboniferous Trias-Jura sedimentary the invasion (intrusive but not extrusive) of the still weak sedimentary accumulations by the diabase took place - this being a compensating action in genetic relationship to the sinking in of Gondwana (?) land to the west of Tasmania.

There then ensued a prolonged period of denudation which removed the portion of the Trias-Jura sediments which overlay the diabase which had been intruded into them. This cycle of denudation was a complete one for the peneplain now represented by Colton's and Mathinna Plains represents its final achievement the mass of Mt. Victoria standing up as a monadnock.

The uplift of the peneplained surface took place and the carving of the present valley system commenced. This has proceeded sufficiently to develop deep broad valleys which by a subsequent oscillation of the strand-line received a deposit of river gravels now represented by the Tertiary deposits.

The out-pouring of the basalt took place as the next incident in the geological history of the area. The basalt was erupted towards the close of the Tertiary period at Oliver's Hill and spread northwards and downwards therefrom filling the river valleys and covering whatever Tertiary fluviatile or locustune deposits had formed in the valleys.

Denudation has continued up to the present time, the cycle of erosion now in progress although having continued for a considerable time being yet far from its completion. No evidence of minor oscillations during this cycle is available in this area, but the glacial epoch has contributed its quota of erosion. This glacial epoch was followed by an epoch of high rainfall which gave the water responsible for the erosion of the deep steep-sided valleys now in existence. The present rate of erosion is the result of the rainfall now characteristic of the area and is correspondingly less rapid in its effect. Thus the present cycle of erosion is still in its youthful stage and is proceeding at a less rapid pace than it did in the immediately preceding phase.

## 1. GENERAL REMARKS

The study of the economic geology of such an area as the Mt. Victoria Goldfield presents many difficulties chief among these is the fact that mining operations have so far been very limited and even where such operations as have been carried out below water-level observations are now impossible because of the flooding which has taken place since active mining was suspended twenty years ago.

Nevertheless it has been possible by combining the detailed field observations of this present investigation with the data contained in reports of previous Government Geologists in regard to the mineralogy and structure of those portions of the lodes once exposed but now invisible. The descriptions of the mineralogy and structure given below are thus sufficient to justify certain economic conclusions and to supply a definite contribution towards the ultimate conclusions as to genesis persisting and commercial value of the auriferous lodes of North Eastern Tasmania.

## 2. PRIMARY ORE DEPOSITS

## A. MINERALOGY OF THE GOLD-QUARTZ LODES.

The mineralogy of the auriferous lodes of Mt. Victoria is relatively simple.

Quartz is the predominant component, constituting the main body of the lodes. It is uniformly white in colour except where the galena and sphalerite are relatively abundantly developed when it assumes a darker hue. It possesses the characteristic structure and habit of vein quartz varying in the different lodes from a dense homogeneous quartz with occasional crystal-lined vugs to a sugary structure in pyramidal forms.

The gold does not seem to favour any of the various habits of quartz more than the others as the precious metal at times occurs in even the generally unpromising "buck quartz". In general however the richer gold values are confined to the normal lode quartz. In these portions of the field in which the gold lodes occur in black slate, as at the Ringarooma and Mercury groups, the gold values are higher than the average. In these latter lodes angular fragments of black slate occur within the quartz lode in addition to black seams and stringers. These are fragments of the country rock included within the lode material as it was deposited from solution. Their relationship to the gold content will be discussed at a later stage.

Pyrite is a constant constituent of the primary lodes. It is never very plentiful, however, being in places extremely small in amount. At times it carries free gold as inclusions but throughout many of the lodes it is absolutely non-auriferous. It has throughout the normal cubic habit.

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Arsenopyrite is really a characteristic mineral of the gold-quartz lodes of this field. It is absent from some lodes but in others it is so highly developed as to constitute a quartz-arsenopyrite lode. This arsenopyrite does not seem to be associated with gold as in those lodes richest in this mineral the gold content is quite negligible. Nevertheless in some lodes as for example the Rosalind-Gumsucker the appearance of arsenopyrite as a lode constituent coincides in general with an increase in the gold content.

This mineral occurs as crystal aggregates spasmodically distributed in the quartz mass of the lode.

Galena is a very important mineral component of the lodes although it is by no means an invariable constituent. Its importance lies in the fact that with only one exception its presence accompanies a high gold content. The one exception is Cash's lode near the Pyengana Track at the head of the New River Valley where galena is highly developed but carries silica and practically no gold. In all other lodes in which galena occurs the gold content is appreciable this being especially marked in the Mercury group. In these lodes the galena occurs as very small disseminated crystals and crystalline aggregates producing in the lode quartz a dark bluish-black tinge. This is in marked contrast to the Cash's Lode type wherein the galena occurs as coarse aggregates up to one inch in diameter.

Free gold occurs in the bluish-black galena rich quartz but a portion of the total gold content is contained within the galena itself as disseminated free gold.

Sphalerite or zinc blende generally accompanies the galena except in the case of Cash's Lode. This mineral is less plentiful than the galena but like this latter is accompanied by a higher gold content and constitutes to the dark colour of the bluish-black gold-rich quartz so typically developed at the Mercury Group.

Carbonate minerals of the ankerite type are also developed but in the lodes so far exposed only to a very slight extent. The relative paucity of exposures below the oxidised zone probably accounts for this and as exploitation in depth proceeds minerals of this class will become more plentiful although always much subordinate to the quartz.

## B. GEOLOGY OF THE GOLD-QUARTZ LODES

### 1. DISTRIBUTION

The gold-quartz lodes are confined to a narrow belt  $\frac{3}{8}$  miles in width and 5 miles in length. The auriferous belt does not cease with this length but continues southwards into the Mathinna field. The belt has a general orientation of  $340^{\circ}$ . In the area dealt with in this bulletin there have been located 100 lodes.

The lodes occur exclusively in the Mathinna slates and sandstones and have been observed in all members of that series excepting the uppermost felspathic sandstones. They are perhaps developed in their most important phase in the black slates of the lower portion of the sedimentary series but numerous well developed lodes occur in the yellow sandstones. 50

## 2. STRUCTURAL FEATURES

The general lode-structure is that of relatively short and rather narrow bodies of quartz which can be referred to as tabular ore-bodies. They are of the type which is very common in surfiferous belts and possess no extraordinary features which would warrant a distinctive name. Extremes occur from a well-defined lode persistent in length for several hundred feet to lodes which are but a few feet in length and which may be more correctly termed lenses. A typical example of the former type is the Rosalind-Gumsucker lode and the latter type is well represented by the rich levels at the "Bank" on the Ringarooma Coy's leases.

In general, the walls of the lodes are clean and well defined. Occasionally a clay selvage occurs between the wall and the quartz filling but this is by no means characteristic although observable in many places. It often happens that one wall is well defined, the quartz abutting on a smooth straight wall, while the other wall is irregular and much irregular penetration of the quartz into the wall rock occurs.

In some cases neither wall is well defined and it is therefore desirable to confine our attention for the moment to those cases in which there is one clean wall to the lode. Moreover in several instances as for example the Long Struggle Lode both footwall and hangwall are clean and well defined and these must be considered here.

Examination of such clean-cut walls in many localities shows definite striation and occasionally polishing. Obviously, therefore, the locus of ore deposition is on lines of faulting and this group of quartz lodes occupy fault fissures.

The details of structure of these fault-fissure lodes do not call for any special comment excepting perhaps that they are in general of rather short length as compared with other fields. The endings of these lodes are of three kinds. One very common ending of the lode is a sudden cessation of both fracture and filling at a crosshead which is a well defined plane. In this case the quartz sometimes ends abruptly at the "head" as rapidly diminishing quartz stringers. An example of the former type is the Troy Lode at its northern end while the latter is exemplified by the Jans Lode on the Forest King property.

The second general kind of ending of the lodes is by "feathering out". This is particularly well shown at the northern end of the Pieman Lode as well as the Gumsucker-Rosalind. In this kind of ending the lode splits into several small branches which continue in the general direction of the lode but with a meandering course accompanied by a gradual decrease in thickness down to a mere

The third kind of ending is by the convergence of both walls and the tapering of the lode to a point. This is relatively rare.

In connection with this type of lode the details of the structure of the Gumsucker-Rosalind, Pieman, No. 3 and Mercury Lodes must be pointed out. These lodes are not simple fissure-fillings as they are characterised by an abundance of black slate occurring either as inconstant bands within the lode or as irregular blobs and masses scattered through it. These lodes in fact resemble the laminated quartz lodes described by Dr. Stillwell in the Bendigo field and as pointed out by him must be due to the solutions exerting great pressure while penetrating the walls of a relatively narrow fissure and enlarging what was originally a number of small cracks or cleavages.

We now have to consider the type of lode which shows no clean-cut wall continuous for any appreciable distance. Such lodes are of frequent occurrence in the Mt. Victoria Field and are characterised by very limited dimensions longitudinally and vertically although possessing occasional appreciable bulges in width. A further characteristic is their irregular orientation for in many cases they are of varying strike and dip.

One variant of this type possesses the general characters of the "saddle reefs" and clearly occupy the openings between the bedding planes at the crests of anticlinal folds. Such are some of the small lodes cut in Hannah's Tunnel beneath the "Bank". They are not complete saddles and are of small extent, being either small curved lenses at the crest of the anticline or small lodes on one of the limbs, which sometimes extend to the crest of anticline and flatten out there without continuing down the other limb.

Another variant of the type we are now considering is that in which the quartz lode with no clear-cut walls occupies a fracture which has not been the locus of relative movement. Such lodes are not persistent in any dimensions, a characteristic which naturally results from the origin of the fracture which may be a simple joint plane opened by a compressive force operating parallel to the strike or a definite bedding plane as in the case of Cash's Lode and the small offshots at the northern end of the Troy Lode.

In all these lodes there is an irregularity and inconstancy in all directions excepting perhaps in the case of Cash's lode which however has been so little explored that a definite statement in this regard cannot be made. There is much penetration of the lode material into the walls although clean walls are by no means absent.

## 2. SECONDARY ORE DEPOSITS

### A. SUPERFICIAL ALTERATION OF THE LODS

The gold-quartz lodes occurring as they do for the greater part on the pronounced ridge which spreads from the northern end of Mt. Victoria and runs towards Cemetary Corner, outcrops well above water-level.

Consequently it would be expected that they would have been subjected to considerable alteration by descending meteoric waters. This has certainly taken place to a noticeable degree in the upper part of the lodes wherein the sulphidic materials have become converted to oxides and hydrates.

Pyrite has become converted to limonite or has been completely removed and in the honeycombed quartz resulting from this alteration the gold originally present in the pyrite is now in the form of minute particles lining the cavities. Such gold is thus of secondary origin.

In those lodes in which arsenopyrite is prevalent oxides and hydrates of arsenic are to be observed in the oxidised zone.

It is important to note however that the zone of secondary alteration is relatively shallow and practically unaltered lode material with the original sulphides in their primary form persist nearly to the surface in many cases and in any case are encountered not very far below the surface and certainly well above permanent water level.

The oxidising of the upper portion of the lodes has had a certain effect in enriching the lodes by elimination of the sulphides and the retention of the gold content, but there is no evidence of secondary enrichment in any of the lodes so far exploited. Whether it has occurred to any extent in lodes so far not completely explored, only further work can show. It is unlikely, however, that greater concentration of gold than those already located will be found.

B. ALLUVIAL GOLD DEPOSITS

There occur in the Mt. Victoria gold field alluvial deposits which carry gold. This alluvial is of recent age and has been described above.

It represents the eroded portion of the catchment area of the various rivers and in the Dorset and New River valleys such eroded areas containing the gold lodes have supplied to the alluvial material a certain amount of free gold.

This gold has been freed from its quartz matrix during the erosion and its present distribution within the alluvial deposit is the result of the adjustment of stream velocity and relative specific gravity of the gold particles and rock fragments. Occasionally specimen gold is found i.e. gold still attached to portion of its quartz host. Generally, however, the gold is fine, and anything approaching coarse particles is very rare. In general also the gold is of the same composition as that of the lodes.

As indicated in a previous part of this bulletin the alluvial deposits consist very largely of coarse shingle especially in the main Dorset and New River valleys. Finer gravels and sands are interbedded with the coarser shingle and it is in these beds that the alluvial gold is found. Further than this it would be in accordance with general experience elsewhere if the gold were found in the deeper part of the alluvial and especially on the bedrock itself. In neither the Dorset or New River valleys however has the

In general it would be expected that some concentration of gold would have taken place on the upstream side of a rock barrier in the original river course. Such a barrier in the original exists at the Alberton township. As important gold lodes occur upstream of this point it is quite possible that much alluvial gold has accumulated on the valley bottom on the upstream side of this barrier. Only boring can definitely establish this.

Some alluvial gold has been obtained in the creeks below the Alberta and Pieman lodes but all attempts made to sink to rock bottom at the locality where these cracks junction and join the Dorset River have so far failed although shafts have been sunk as deep as 40 feet. Systematic boring will show whether sufficient gold has become concentrated at this confluence to pay for working.

Alluvial gold has also been worked further down to Dorset valley to the left of the road running from Cemetary corner to Ringarooma. This is a fine gravel and sand and is at a higher level than the shingle deposits. It is probably an older terrace deposit. Under these circumstances its extent may be expected to be limited.

In the New River valley the relative absence of gold lodes within the catchment would indicate that the main valley alluvial would not be expected to contain as much gold as that in the Dorset valley. Nevertheless in a couple of the subsidiary valleys alluvial gold has been located and worked to some extent. These valleys are located on Donovan's freehold and occur in the two valleys which junctioning just below the homestead extend upstream towards the Prindujust and Tiger lodes respectively. The former valley has been worked but a shaft recently sunk in a terrace indicates that good gold values occur in a terrace deposit of appreciable extent. The valley extending towards the Tiger and neighbouring lodes has not been explored and the flat in this valley should be systematically bored, as gutters probably occur in it carrying gold contents.

### 3. GENESIS OF THE GOLD-QUARTZ LODS

#### A. RELATIONSHIP TO ADJACENT TIN AREAS.

In the description of the general geology it has been pointed out that both in the eastern and western portion of the area, there occur outcrops of granite. Associated with both of these granite outcrops are tin deposits. Approximately midway between these granite outcrops, the suriferous belt is located. In view of this geographic relationship and the distinctive difference in mineralogic character of the respective lodes, the question naturally arises as to the genetic relationship between them.

In considering such a genetic relationship the geological section shown in Plate IV. must be studied. This section shows the suriferous belt as lying in the trough situated between two cupolas. These cupolas or upwardly projecting portions of the main batholith have been very largely truncated and only the lower portions still remain.

The existence of the trough is a natural assumption but the actual depth of the granite below the surface has not been determined and is only shown in the section as a tentative approximation.

In a recent work completed by the writer it is demonstrated that

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Loftus Hills "The Metallogenic Epochs of Tasmania" the ore deposits of the acid phase of the Epi-Silurian metallogenic epoch are divisible into two distinct types - those associated with the Cupolas and designated as the Cupola Horizon and those derived from the Inter-Cupola troughs and termed the Inter-Cupola Trough Horizon. The former are pre-eminently characterised by tin and the latter by the metals copper, lead, zinc, gold, silver etc.

In this area therefore the relatively close proximity of the tin and gold deposits and the clear demarcation between them can be explained on this basis of the two distinct horizons - the gold-quartz lodes belonging to the Inter-Cupola trough Horizon while the tin deposits represent the lower portion of the Cupola Horizon the greater part of which has been removed by denudation.

The conclusion of economic value to be drawn from this relationship is that the gold-quartz lodes need not be looked for outside the Inter-Cupola Trough area. The recognition of this area involves the study of the original surface configuration of the granite batholith. In the Mt. Victoria goldfield the limits of the trough control is approximately 1 mile to the east and west respectively of the western and eastern granite contacts shown in the general geological map.

#### B. THE MECHANICS OF THE FISSURE FORMATION

In describing the structural features of the gold-quartz lodes in a previous part of this bulletin it has been indicated in a general way that the more important lode channels have been developed by faulting and that others have been likewise the result of pressure reopening or widening existing fissures.

In developing this problem of the mechanics of the formation of the fissures now filled with lode material attention must be drawn to the structural geology of the Mathinna slates and sandstones delineated in the preceding portion of this bulletin.

It has there been shown that the main structural feature of that rock series is a double thrust fault the plane of which strikes from  $330^{\circ}$  to  $345^{\circ}$  and dips westwards at a comparatively low angle. Superimposed on this thrust plane occurs a main anticlinal fold which is the direct result of the pressure acting from the westwards not being completely adjusted by the movement along the thrust plane owing to frictional drag. It is this pressure producing the bending of the strata into the anticline which has been impossible for the development of the fault fissures and the opening of many joint and bedding planes.

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The axis of the anticline is a slightly bent line. In the northern portion of the area the strike of this axis is  $330^{\circ}$ . At the locality of the Ringarooma Mine a bend to a strike of  $345^{\circ}$  takes place the axis continues northwards with this bearing until the Mercury Mine is reached when its original bearing of  $330^{\circ}$  is resumed and continued until the Everetts Lode is reached when it bends again to  $345^{\circ}$  and continues with the strike as far as the Una group.

It is particularly to be noted that it is at these bending points that the lodes are most numerous and best defined and it becomes clear that it is the strain at these bends which has resulted in the marked development of fissures now represented by quartz lodes.

The greater number of such fissures have been developed on the limbs of the main anticline and to some extent on its crest. Of the fault fissures there are two groups with strikes approximately at right angles to each other. These constitute a conjugate system which is a well known consequence of lateral pressure and is characteristic of many mining fields carrying fissure lodes. The general average strikes of these two systems are  $330^{\circ}$  and  $60^{\circ}$  respectively.

It does not necessarily follow, however, that every lode possessing a strike approximating to these bearings belongs to the conjugate system, for these bearings are reproduced in some of the other types although these latter in general are widely divergent from the two conjugate bearings.

The mechanics of the lode systems in the Mt. Victoria goldfield are in no way unusual, conforming as they do to conditions which obtain in other mining fields. The important point, is the distinguishing of the lodes of the conjugate system from the less persistent and less important enlarged joint and bedding plane lodes and the embryonic saddles.

### C. THE FACTORS CONTROLLING GOLD DEPOSITION

In the Mount Victoria Goldfield there is practically no evidence available on which conclusions can be drawn as to the causes which have determined the distribution of the gold within the gold-quartz lodes. This is due to the smallness of the mining operations and the fact that even those lodes penetrated by workings are not now visible owing to the filling of the stopes on the collapse of the workings as a whole.

It is, moreover, in the present undeveloped state of the field, impossible to form anything approaching a correct conception of the distribution of the gold values within the lodes. One general conclusion which seems to have been made by the miners who have worked on the field for years is that the gold shoots pitch southwards. Even this conclusion however is disputed in some cases as in several localities gold shoots have been known to pitch northwards.

The observed impoverishment of a lode when followed downwards for a few feet is due not to original variation in the gold deposition but to a local enrichment due to removal of sulphides by oxidation. No lode on the field has yet been penetrated at sufficient depth to permit of a statement as to the effect of depth on gold values.

Under these circumstances it is quite impossible to discuss in detail the factors which have controlled the deposition of gold as distinct from that of the main quartz lode. Nevertheless one or two facts are worthy of recording as contributions of data towards the anticipated ultimate thorough delineation of the factors controlling gold deposition throughout the gold metallogenic province of north eastern Tasmania.

The first of such observations is that the richer and more persistent lodes such as the Pieman, Gum-sucker-Rosalind and Mercury lodes occur in the black somewhat graphitic slates. The manner in which slate inclusions occur in some parts of the lode material resembles that described by Dr. Stillwell as occurring in the Bendigo field\* and interpreted by him as indicating the enlargement of the lode fracture by the pressure due to the force of crystallisation on rather molecular re-adjustment accompanying change from solution to solid state and under such conditions the carbon component of the graphitic slate is enabled to precipitate gold from the ore-bearing solutions. Such an explanation would account for the comparative richness of these lodes in the Mount Victoria field which occur in the black slates.

Another characteristic of the gold-quartz lodes which has been previously indicated is the association of galena and blende with high gold values. High gold values, however, occur quite apart from the presence of galena or blende but in only one case is the presence of galena unaccompanied by appreciable gold content and in this case the quartz-galena lode belongs not to the gold inter-cupola trough group but to the lead phase of the Cupola group. There seems, therefore, to have been a close connection between the deposition of the gold and galena.

The influence of cross fractures and faults on the deposition of gold in the quartz lodes cannot as yet be determined in this field in view of the absence of comprehensive exploration work and the failure in the part to keep accurate data as to the distribution of the gold values and the structural geology.

At the present stage, therefore, we must content ourselves with the statement of the above facts and postpone any attempt at an adequate study of the factors controlling gold deposition until all of the gold fields have been studied.

#### 4. PERSISTENCY OF THE GOLD-QUARTZ LODES.

The question of the persistency of the auriferous lodes in depths is the most important economic factor in the future of the field, and the scale on which operations will be conducted in the immediate future must be largely dependent on the conclusions in this

\* Stilwell, Dr. F.L. Ad. Council of Science & Industry Bull. Nos. 4 & 8.

regard which can be reasonably drawn from the facts presented above as to the structural geology mineralogy and genesis of the gold-quartz lodes. 66

The question which exercises the minds of those hesitating to invest capital in this field is this:-

Will, the more important lodes at least continue downwards with either a continuance of or an increase in both size and value or will either size or value decrease as depth is attained?

The first unit of this question is obviously as to whether the lodes will continue downwards at all and if so to what depth can they be expected to persist. In answering this question the main broad deductions as to genesis must be considered. In dealing with the structural geology it was pointed out that the main structural feature of the Mathinna slates and sandstones is the double thrust fault which has a rather flat westerly dip.

This thrust fault was developed before the appearance of the ore bearing solutions and practically simultaneously with the formation of the fissures now occupied by the gold-quartz lodes. It is extremely probable therefore, although no direct evidence is available to prove it that the thrust plane has been the main channel through which the magmatic solution rose in part at least of its passage from the magmatic hearth to the surface. From this main channel it escaped upwards along fault fissures and joint and bedding planes in the vicinity of the main anticlinal axis accompanying the folding. In the openings thus invaded the gold-quartz lodes were deposited.

If this conception is correct the lodes in general will continue downwards to the thrust plane and thence probably down the thrust plane or shear zone to a greater depth still. On this basis therefore the zone of gold-quartz deposition may be expected to persist vertically to appreciable depths.

Considered from another point of view, the vertical extent of the gold-quartz zone must be appreciable in view of the fact that the granite which lies above the magmatic hearth is at an appreciable depth below the inviting surface. This fact must be taken into consideration along with the observed vertical range of gold-quartz lodes in other fields such as Beaconsfield in Tasmania and Bendigo, Victoria.

It is justifiable to conclude, therefore, on the evidence that the gold-quartz lodes in general will continue to appreciable depths of the order of some thousands of feet.

Continuance to appreciable depths of both the channels and gold quartz filling does not necessarily imply a continuance in size of a particular lode. In this case however in view of the fact that as the thrust plane is approached the forces and therefore the fissures grow greater, it may be expected that in many cases particular lodes will increase in size as sinking is carried on downwards towards the thrust plane. When the thrust plane itself is reached it is quite possible that gold-quartz ore-bodies of larger size will be encountered

due to metasomatic replacement along the shear zone.

In addition, although the lodes themselves continue to appreciable depths with retention or even increase in size the gold content cannot be expected to persist concurrently. It is a well known fact that as auriferous deposits are followed downwards a gradual decrease in the gold contents takes place. Nevertheless when it is remembered that such impoverishment is in most mining fields spread over several thousand feet and the maximum depth reached in the Mount Victoria field is only about 3,020 feet the justified expectation must arise that appreciable gold values may be expected to continue downwards well below the maximum depth yet attained.

Summed up therefore the evidence points to the conclusion that there is every justification for undertaking on a comprehensive scale the sinking on those lodes which possess structural characteristics which indicate the greater permanency. It is on the well defined fault fissures that downward exploration is most likely to encounter zones of intensive deposition of lode material either by crystallisation cavities or by replacement particularly in the black slates which underlying the yellow slates and sandstones can only be encountered in depth.

#### VI. HISTORY OF MINING ON THE FIELD

The first discovery of gold on the Mt. Victoria field was made in 1882. Immediately there occurred the usual rush to the new discovery and the whole of the ground on which any kind of quartz lode could be seen was pegged and numerous small syndicates and companies began operations on a more or less comprehensive scale.

The principle on which all of these companies were conducted was that of the subscribing of a little capital and the initiation of operation on the various lodes with the objective of developing the mine on the products of the lodes themselves. Accordingly one of the undertakings after a small parcel of quartz was obtained consisted of the erection of a small battery. In many cases the funds of the company represented by the combined capital and yields from the progressive crushings, were depleted before the lode was thoroughly exploited or at the time when the working face or faces were in very poor material. When operations had reached this stage work was suspended and in most cases has never been resumed.

Up to the year 1894 such operations had characterised the field. In that year the Ringarooma Gold Mining Company was formed and acquired a number of mining sections which worked under one management with a central battery. Under these conditions with Mr. William Brown as Mine Manager a period of active and successful operations carried for about 10 years. With a limited amount of capital quite extensive mining operations were carried out and a considerable amount of machinery was erected with the aid of the gold yields from more or less continuous crushing. With the progress of sinking below water level, however, pumping and other difficulties were encountered which proved beyond the capacity of the company and operations ceased.

During the course of activities of the Ringarooma Company many properties were worked by them on a limited scale and parcels of quartz of various sizes obtained and carted to their central battery. In this way many lodes had a testing on a limited scale which would have otherwise been neglected, but in most cases such testing was far from sufficient to give a correct idea of the value of the lode.

With the cessation of operations by the Ringarooma Company which coincided with the burning down of the battery the whole field sank into a dormant and almost deserted state. The four main companies which had operated up to that time had experienced a similar career, - the Ringarooma, Mt. Victoria, Long Struggle and Mercury companies - and their failures gave the field such a bad name that it has been neglected by investors until quite recently. The impression had become general that the lodes were either of no value at all or were payable or barely payable down to water level but no further.

A group of miners remained on the field however, and in groups of two or more worked many of the lodes during the twenty years following on the burning of the Ringarooma battery. In this way several men made a bare living following rich shoots of ore and crushing their output in small batteries. This continued up to the year 1919 when Mr. S. Wallace after carrying out some prospecting work succeeded in interesting Mainland capitalists in the field.

As a result the Ringarooma United Company has been formed and the group of lodes in the neighbourhood of and including the old Ringarooma Gold Mining Company's lodes have been acquired by them and preparations have been started for comprehensive exploratory work.

Recently also a local group subscribed some capital for working the Long Struggle Lodes. The old policy of constructing a battery in the early stages of development was repeated here with the result that funds ran out before either the exploratory work at the Main Audit level or the battery itself was completed.

The renewed attention to the field which has developed during the last two or three years is evidenced by the number of leases taken up and the exploratory work although on a rather limited scale carried out, by the Miners Dream, Forest King and other small companies and syndicates. To give the field such a testing as will definitely establish its value, however, calls for more than repetition of the policy and practices which only brought about the failures in the past. History tends to repeat itself but it would be a great pity if the lessons to be learnt from the past history of the Mount Victoria Field were not thoroughly grasped and applied in the design of future operations. How this can be done is indicated in Chapter VIII.

The total amount of capital invested in the field up to date cannot be ascertained but the total output of gold from the field is approximately

£60,000 equivalent to 15,000 ounces of gold. 69  
Roughly this corresponds to about 30,000 tons of lode material. No less than six batteries have been in operation in the field to deal with this output. It is thus obvious that battery construction and therefore expenditure on batteries has been out of all proportion to mining operations. The lesson to be learnt is perfectly clear.

## VII. THE MINING PROPERTIES AND ECONOMIC LODE GROUPS

### 1. The Ringarooma United Coy's Group

This group of lodes is included within the area embraced by a number of leases under the control of the Ringarooma United Gold Mining Company. The boundaries of this economic lode-group indicated in Plate III does not coincide with the mineral leases controlled by that Company and embrace a much smaller area. Nevertheless, it so happens that all of the lodes are included in this smaller area and constitute a series of lodes which can be operated as one economic group.

The number of lodes in this group is 25. Such a concentration of lodes is the result of this area being the locale of a bend in the anticlinal axis as previously explained.

The following are the lodes in this group with concise particulars of each:-

PREMIER LODE: This lode has a strike ranging from  $358^{\circ}$  to  $330^{\circ}$  according to its depth below the surface, the latter being the bearing at the Long Tunnel level. Its length is 140 feet at the surface but at the Long Tunnel Level only about 20 feet has been proved. The width of the lode-channel carries from 1 foot to 6 feet. Values vary according to available records but on the whole the quartz was low-grade being apparently in the vicinity of from 7 to 8 dwts. per ton. The dip is about  $80^{\circ}$  to the westwards.

GUMSUCKER-ROSALIND LODE: This lode was originally discovered in two different places and these were thought to be separate lodes and were given two different names. Development work however soon demonstrated that they junctioned and constituted in reality one lode.

The strike is  $17^{\circ}$  and the dip  $75^{\circ}$  to the eastwards. This lode is a fault-fissure one.

The length varies from 150 to 320 feet as depth is gained. The width varies from a few inches up to 2 feet and at the bottom of the winze up to 5 feet and the values from a few dwts. to 3 ozs. per ton. What was the average value of the quartz extracted cannot be ascertained but it seems to have been in the vicinity of 1 oz. per ton. At the lowest level reached namely 65 feet below the main adit this lode is looking stronger and better defined than at the higher level. This is a fault-fissure lode.

NO. 3 LODE: This lode has no surface outcrops petering out upwards at about 18 feet below the surface. The strike varies from  $5^{\circ}$  at the Premier Adit to  $320^{\circ}$  at the Rosalind Adit and Long Tunnel levels. The dip is slightly to the west in the upper levels but as depth is gained it becomes

definitely easterly. The length as far as exposed varies being 40 feet in the Premier Adit, and 120 feet in the Rosalind Adit but decreases in the Long Tunnel to 40 feet where it junctions with the Premier lode at its southern end. Width varies from a few inches to 3 feet and the average value is about 1 oz. per ton. This is also a fault-fissure lode.

CROSS LODE: This is a short lode apparently an offshoot from the Premier with which it junctions. Strike is  $320^{\circ}$  and the lode is vertical. The length is only about 10 feet as far as present exploration has disclosed.

LONG SHAFT LODE: This lode was encountered in a shaft put down by C. Krushka to the southwards of the southern end of the Gumsucker-Rosalind Lode. At the shaft the strike is about  $15^{\circ}$  and it would appear to be a continuation of the Gumsucker-Rosalind Lode line although the lodes themselves do not seem to be continuous. The lode channel as it gains distance from the shaft swings very definitely until it assumes a strike of  $305^{\circ}$  which it maintains for a distance of 190 feet. At two points along this straight portion offshoots occur at right angles to the main fracture. These are only a few feet in length but contained a few tons of good grade quartz. The dip of the lode is to the eastwards at  $35^{\circ}$ . Very little work has been done except at the shaft. This is a fault-fissure lode and the offshoots are enlargements of bedding or joint planes.

BIG BLOW LODE: This formation can be traced for about 200 feet with a strike of  $360^{\circ}$ . It consists of quartz veins and stringers and apparently represents a series of small gash veins distributed along a line of incipient fracturing. Values are low.

SOFT SPUR LODES: There is a group of six lodes all in close proximity to each other on the spur which lies to the north of the Creek flowing over the outcrops of the Premier and Gumsucker-Rosalind Lodes. Two of these are known as Nelsons and McCauls lodes but the others have no definite names. The country rock in which they occur and which seems to constitute this spur is a very soft yellow sandstone. The lodes are approximately parallel the general strike being  $310^{\circ}$  to  $340^{\circ}$  and the dip towards the east. The length is from 25 feet downwards and the width up to 12 inches. Values are in general good, yields up to 5 ozs. per ton having been obtained from crushing.

These lodes are not fault-fissures but probably represent re-opened bedding planes. They cannot therefore be expected to persist but their close spatial arrangement combined with the softness of the country rock prevent possibilities of their being worked as a group as most probably many similar quartz bulges ensue in the immediate vicinity.

THE BANK LODES: There is a group of four lodes located on the spur above the Premier Lode from which in the past very rich quartz has been obtained. Some of the crushings from this spot were so rich that the locality became known as "The Bank". The lodes are really indefinite

developments of quartz near the crest of the anticline, constituting partial saddles at times but at other points, as far as present developments show, having no definite structural feature. The irregular lenses are from 15 feet to 30 feet in length and have been followed downwards to as much as 75 feet. The width varies from a few inches up to 4 feet. Values vary from  $\frac{1}{2}$  oz. to 11 ozs. per ton but the average was several ounces to the ton.

Hannah's tunnel has been driven recently to intersect these lodes at 125 feet below the surface and similar indefinite quartz-lodes to some extent partaking of the character of saddles have been encountered.

These lodes not being fault-fissure lodes cannot be expected to possess appreciable continuity.

MCCAUL'S LODE: The strike of this lode is  $1^{\circ}$  and the dip to the east at  $70^{\circ}$ . Its length is 94 feet and width from 12 to 15 inches. Two shafts have been sunk one to 50 feet and the other to 15 feet. It is a fault-fissure lode.

PLUM PUDDING AND CAKE LODES: These two lodes are close together and have a strike of  $350^{\circ}$  and dip eastwards at  $75^{\circ}$ . They are 20 feet and 40 feet in length respectively. They are narrow being 8 inches and 4 inches on the average. Surface outcrop was rich but values did not persist. They have been worked to a depth of 10 feet approximately. The average yield was in the vicinity of 1 oz. per ton.

Both of these lodes are fillings of joint or bedding planes.

FOWLERS LODE: With a strike of  $330^{\circ}$  this lode dips eastwards at  $75^{\circ}$ . The length is 30 feet and the width varies from 4 to 6 inches. Shafts have been sunk to 10 and 15 feet.

It is doubtful whether this is a fault-fissure lode but future work will enable this to be determined. Good gold values have been obtained but no figure can be given for the average value.

STRAHAN LODE: This is an important lode being of fault-fissure origin. It has a strike of  $308^{\circ}$  and a dip eastwards of  $80^{\circ}$ . The length is 160 feet and the width varies from 1' 6" to 2' 6". Its average value as indicated by past crushings is about 1 oz. per ton. The lower tunnel driven on this lode shows the lode porer but continuing underfoot.

ENDEAVOUR LODE: This is a short lode of about 20 feet in length and a width of 6 inches. It strikes  $360^{\circ}$  and dips eastwards at  $80^{\circ}$ . It cannot be definitely determined whether this is a fault-fissure lode but it is rather doubtful.

MAGG'S LODE: This is a fault-fissure lode striking  $300^{\circ}$  and dipping eastwards at  $80^{\circ}$ . Width varies from 9 inches to 2 feet. An adit 80 feet below the outcrop driven along the lode shows 9 inches of lode. The length is about 60 feet. Yields from crushings in the past averaged about  $1\frac{1}{2}$  ozs. per ton some being as high as 3 ozs. per ton.

CANNON LODE: This is a very important lode on which in relation to its promise very little work has been done. It is a fault-fissure lode with a strike of 30°. The dip is south-eastwards at 50°. The length is 200 feet and the width 2 feet. Values up to 4 ozs. per ton have been obtained but workings do not go more than a few feet below the surface.

This lode-group consisting of the above-mentioned lodes in one of the most important of the field. It is on the results of exploratory work thereon that the future of the whole field so very largely depends.

By far the most important portion of such development work is the continuation of sinking below the Long Tunnel level to some hundreds of feet in order to determine the value of the Premier, Gumsucker-Rosalind and No. 3 Lode as depth is gained. The two former lodes should junction on their dips somewhere about 220 feet below the Long Tunnel level. The work of sinking at the old winze recently started should be continued and this undertaking should be the main objective of the Company. If values as depth is gained do not prove to be payable then the future of the property will be definitely limited and will lie in the lodes indicated above down to the Long Tunnel level if they carry their values to that depth. In that case - and this procedure will also apply if sinking discloses payable values - it would seem to be most desirable to attack the lodes by continuing the Long Tunnel towards the Strahan-Cannon group, picking up the various lodes by crosscutting from the main tunnel. Nearly 700 feet of backs would thus be available at the Cannon lode as can be seen in Plate III.

Such would be the comprehensive way of attacking the problem but it may be thought more expedient to continue Hannah's Tunnel to cut the Strahan and neighboring lodes.

Finally in regard to this group it may be concisely indicated that expenditure on sinking below the Long Tunnel level is justified on the geological evidence particularly as the size and character of the lode at the present bottom of the winze is so favourable an indication of improvement in depth.

2. MERCURY LODE GROUP

This lode group comprises the lodes originally worked by the old Mercury company together with the group of lodes which include the Reform and Ragged Youth lodes. There is also included in it the lode recently worked by the Golden Leader Syndicate and known as the Frog Lode. A study of Plate III which shows the topographic features will explain why this grouping has been adopted as it is obvious that the surface configuration and their spatial proximity permits of their being attacked as one economic unit.

MERCURY NO. I LODE: This is the more westerly of the Mercury Lodes and is of fault-fissure origin. It has a strike of 325° and dips towards the east. It has been worked down to the lowest adit level over a length of about 100 feet. The width

is very variable and on the average is under 1 foot. The values are rather lower than the No. 2 lode but no figures can be given with any approach to accuracy. The important point however, is that the lode is continuing below the lowest level yet opened up.

MERCURY NO. 2 LODE: This lode lies 230 feet east of No. 1 Lode. It is definitely a fault-fissure lode. The strike is  $313^{\circ}$  and the dip towards the north-east at  $45^{\circ}$  to  $50^{\circ}$ . The length of the lode is about 100 feet and the width varies from about 4 inches to 15 inches. The values have been good from the surface downwards and crushings of 3 to 5 ozs. per ton have been obtained but the average is slightly above 1 oz. per ton.

A winze has been sunk to a depth of 45 feet below the lower adit level and the lode was found to be going strong underfoot when water difficulties were encountered since when no further exploratory work has been carried out. The lode is 4 feet in width and over 200 feet in length and shows rich gold values. The continuation of this sinking is the procedure which is essential to the future development of this lode group as well as the whole field. There is every justification on the geological evidence to warrant adequate expenditure in this direction as lode is looking better at this level than above.

POINT LODE: This lode is situated to the westwards of the two former on the steep slope which rises from the Dorset River in this locality. It strikes  $322^{\circ}$  having a distinct westerly tend at its northern end and dips easterly at  $75^{\circ}$ . The length of lode is 190 feet and the width ranges from 4 inches to 1 foot. Two shafts have been sunk on it to 12 feet and 15 feet. Very rich ore was obtained near the surface one pocket giving 17 ozs. of gold from a bucketful of ore. The average value cannot be stated. Its value at a depth of 150 feet could be cheaply ascertained by driving an adit from just above the Dorset River into the steeply sloping hill.

BOUNDARY LODE: This lies to the south of the former lode and strikes  $2^{\circ}$ . The dip is to the east at  $80^{\circ}$  with a definite flattening a few feet below the surface. Its length is 40 feet and the width about 9 inches. A crushing of 5 tons yielded 4 ozs. No further work has been done on it beyond extracting that one parcel.

It is doubtful whether this is a fault-fissure lode and further work is needed before a definite opinion can be formed.

FROG LODE: A shaft was sunk on a lode on the northern slope from the creek situated to the north of the No. 2 Mercury Lode. In sinking about 35 feet crushings amounting to 10 tons were obtained giving a yield of 33 ounces. When followed downwards and northwards the lode came to an end against a well-defined head. An adit has been driven recently 110 feet below the top of the shaft along a lode which outcropped at the point from which the adit started. The objective was to get below the lode in the shaft but this latter does not seem to have continued down to this level as the tunnel is well past

the point at which it ought to occur. Certainly the irregular make of quartz followed in the adit does not carry gold content which could be regarded as payable. 74

Although the walls of the lode in the shaft show signs of definite movement the lode itself does not fill, a fault-fissure as it occurs in a joint plane along which a slight readjustment has taken place.

REFORM LODS: There is a group of small lodes higher up the belt than the Mercury Lodes. In this locality six lodes occur known as Mattins, Nos. 1, 2 and 3 Reform, Black Horse and Cotton's Lodes. These lodes have bearings of  $29^{\circ}$ ,  $315^{\circ}$ ,  $290^{\circ}$ ,  $50^{\circ}$ ,  $320^{\circ}$ , and  $280^{\circ}$  respectively, and dip easterly at steep angles. They are all short varying from 10 to 40 feet in length and are about 6 inches in width. These lodes do not seem to be definitely fault-fissures although Martin's and Black Horse lodes may possibly be so. A deep-level drive put out from the Mercury workings would serve to establish this definitely. The values obtained at the surface in these lodes are certainly sufficient to warrant further attention. Their close proximity to the two Mercury lodes and the necessity to test them down to the present level in those workings brings them from the economic aspect into the Mercury lode-group.

#### LONG STRUGGLE LODE GROUP

There exists a group of lodes in the vicinity of the lodes originally operated by the Long Struggle Company, which from their close juxtaposition and the topography of the locality constitute one economic unit. The group consists of the following lodes:-

CROSS LODE: This is fault fissure lode having a bearing of  $45^{\circ}$  and a dip south-easterly at an undetermined angle as any data obtainable from the work done in the past is unavailable owing to collapse of workings and absence of records. The length of the lode is 300 feet and the width varies from 4 to 16 inches averaging 6 or 7 inches. Two shafts have been sunk to depths of 90 to 40 feet respectively and the ground stopped to surface. The average of the crushings was about 27 dwts. per ton. The lowest adit started at a point about 200 feet below the outcrop is at about the point where the downward continuation of this lode should have been encountered. In the absence of accurate figures in regard to the dip however it is necessary to drive from the adit at the end in a direction of  $45^{\circ}$  cross-cutting at intervals to right and left to locate the lode in its dip. This will prove whether the lode continues to this depth.

LONG STRUGGLE LODE: This lode is conformable with the bedding planes and it is therefore somewhat difficult to determine whether it is a fault fissure or merely a localised opening of a pronounced bedding plane. There is, however, evidence of movement on the walls and it is most probable that the faulting movement has fortuitously coincided with the bedding planes at the locality. The fact that at the floor of the adit along this lode it has dwindled to a mere thread does not necessarily disprove this conclusion as the dip is a wavering one carrying from  $60^{\circ}$  to  $80^{\circ}$  to the eastwards; a movement on this plane could easily bring about a local coincidence of the two walls.

According to this explanation the lode would resume its normal width below this constriction.

The strike is  $315^{\circ}$  and the length 327 feet. The width is from 12 to 15 inches and the average value about 30 dwts. per ton.

CAXTON LODGE: This lode is parallel and similar to the Long Struggle Lode being distant therefrom about 150 feet. Its length is 340 feet and the width varies greatly but averages about the same as the Long Struggle. Values are down, however, figures of 5 to 15 dwts. representing the results obtained in part work,

SHORT STRUGGLE LODGE: This is short but rich lode having a strike of  $280^{\circ}$  and a dip northwards of  $80^{\circ}$ . Its length is about 50 feet and the width varies from 15 inches to 3 feet. It has been sunk on for 180 feet and crushings have given several ounces to the ton.

This is a fault-fissure lode.

NEW WILSON LODGE: This is a fault-fissure lode of a pronounced type. It has a bearing of  $320^{\circ}$  and an easterly dip of  $80^{\circ}$ . The length is about 200 feet and the width from 2 feet to 2 feet 6 inches. Average value unknown but it has been stoped to the outcrop from a tunnel 150 feet below.

All of these lodes so far mentioned can be exploited from the Long Struggle Lowest Adit as can be easily seen from Plate III.

RAGGED YOUTH LODGE: This lode has a bearing of  $24^{\circ}$  and dips northwards at  $70^{\circ}$ . Its length is 40 feet and width from 1 foot 6 inches to 3 feet. A shaft has been sunk on it to a depth of 60 feet and 14 tons of quartz extracted which yielded 12 ounces of gold.

This lode is of fault-fissure origin.

RICH YOUTH LODGE: This lode lies on a continuation south-westwards of the bearing of the previous lode but no connecting run of quartz-filled fissure has been definitely proved. It has a bearing of  $31^{\circ}$  and dips in the opposite direction to that of the Ragged Youth lode at about  $55^{\circ}$ . Its length is 100 feet and the width 1 foot to 2 feet 6 inches. Its average value was shown by crushings to be 2 ozs. per ton. On the hanging wall of this lode 20 feet below the surface there was found 1 inch of lode material for a depth of 5 feet exceedingly rich in gold as much as  $1\frac{1}{2}$  ozs. of gold being obtained from 1 lb. of ore.

Exploration of this lode at depth is justifiable since it is clearly of fault-fissure origin.

TELEGRAPH LODGE: This lode strikes  $3^{\circ}$  and dips westwards at  $80^{\circ}$ . Its length is 80 feet and the width from 10 to 12 inches. On the evidence the origin of this lode cannot be definitely stated. Further work is needed to settle this question.

BATTERY LODGE: This lode is below the previous lode and on the bank of the Creek. It strikes  $35^{\circ}$  and dips south eastwards at  $75^{\circ}$ . The length is 40 feet and the width 9 inches. Value is unknown as very little work has been done.

In this case also no definite opinion as to

genesis can be given at present.

BECKER'S LODE: To the southwards of the Short Struggle Lode and between it and Victoria group there occur three small lodes the first of which has been termed Becker's lode. This is a lode about 40 feet in length and from 1 foot to 1 foot 6 inches in width. It has a strike of  $46^{\circ}$  and dips north-westwards at  $75^{\circ}$ . A crushing of 5 tons returned 7 ounces of gold. This is a fault-fissure lode of promising appearance.

SCOTSMAN'S LODE: Another small lode is visible being 10 feet in length and about 4 inches in width. The strike is  $30^{\circ}$  and the dip to the south-east at  $75^{\circ}$ . No information is available as to its value and its origin is doubtful although the evidence rather points to its being a fault-fissure lode.

CLARK'S LODE: This is a small lode 10 feet in length with a strike of  $290^{\circ}$  and dips northwards at  $85^{\circ}$ . Practically no work has been done on this lode.

#### 4. VICTORIA LODE GROUP

This group consists of two lodes which can be regarded as constituting one economic unit. These lodes were operated by the old Mt. Victoria Company but practically no work has been done since that Company ceased operations, with the exception of a small amount recently by the present lessees on a small offshoot from the main lode.

VICTORIA LODE: This is a fault fissure lode striking  $35^{\circ}$  and dipping north-westwards at  $70^{\circ}$ . Its length varies with the depth from 100 feet to 300 feet and the width from a few inches to 5 feet. The value varies but was in the vicinity of 15 or 16 dwts. per ton.

At a depth of 180 feet below the outcrop the northern end of the lode was cut off by a fault and proper steps have not been taken to search for the faulted continuation as pointed out by the late W. H. Twelvetrees, in 1900.

At the low level adit the lode has not been located, being out off by a flat floor 25 feet above the back of the level. In this case also the recommendations of the late W.H. Twelvetrees have not been carried out in regard to cross-cutting exploratory work at this level. Such work should be carried out. Sinking must follow this work and be dependent upon the result of deep-sinking at the Ringarooma and Mercury groups.

#### 5. DONOVAN'S LODE-GROUP

PRENDERGAST LODE: This is a fault fissure lode with a strike of  $55^{\circ}$  and a dip south-eastwards of  $80^{\circ}$ . The length of the lode at the surface is 130 feet which had increased at the No. 2 Level to 160 feet. This lengthening was due to the pronounced easterly pitch to the eastern end of the lode which ends abruptly against a well-defined "head" having a dip corresponding to the above-mentioned pitch. A shaft sunk towards the eastern end of the lode to a depth of 80 feet did not cut the lode but a north drive located the lode which at that point was much split up and only 40 feet of driving was done on it.

The width of the lode was from 2 to 5 feet with an average of about 3 feet. At the bottom level the

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lode formation was 2 feet in width.

The average yield on the ore produced was between 20 and 25 dwts. per ton. A total yield of approximately £18,000 is stated to have been achieved. The value of the lode at the lower level cannot be ascertained but the work done at that point was insufficient to satisfactorily explore it as only 40 feet of driving on the split lode was carried out.

Another lode occurs not far from the main lode which is about 30 feet in length. This has only been exposed in a surface trench and no attempt made to attack it from the levels on the prendergast lode although only a few feet distant from it.

CENTRAL LODGE: The strike of this lode is  $313^{\circ}$  and the dip south-westwards at  $70^{\circ}$ . The length is 100 feet at the No. 1 Adit level and the width 9 inches to 18 inches. Values were about 2 ounces per ton. The lode was never stoped to surface but a winze was sunk from this No. 1 Level to a depth of 25 feet when the water rendered further sinking impracticable with the equipment available.

Up to this point in its career the syndicate operating this lode showed a profit but with a change in management and the starting of the No. 2 Adit losses commenced and operations were ultimately ceased before the lode was cut at this lower level. Continuation of this tunnel would certainly be justified.

In the No. 1 Adit a lode was encountered to the west of the main lode which does not appear at the surface. This was 4 feet wide and a parcel of 45 tons taken from it but the results of this test are not available.

These lodges are fault-fissure origin.

PENNEFATHER'S LODGE: This is a fault-fissure lode having a strike of  $306^{\circ}$  and a dip towards the south-west of  $45^{\circ}$ . The length of lode is about 70 feet and the width from 9 inches to 1 foot. A shaft 120 feet in depth has been sunk on the lode. Crushings averaged 25 dwts. at the start but decreased to 22 dwts. at the end of operations. Operations were conducted in a crude manner and ventilation troubles caused the cessation of operations although values of 22 dwts. still remained in the bottom.

MONTANA LODGE: This is a fault-fissure lode having a strike of  $30^{\circ}$ . The dip is to the north-westwards at  $70^{\circ}$ . Its length is 150 feet and width varies from 6 inches to 3 feet. The workings have fallen in and no details as to the amount of work carried out are available. One tunnel at least was driven on it but in this tunnel the northern end of the lode was at a supposed fault but this cannot now be confirmed.

CREST LODGE: This is apparently a fault-fissure lode but the evidence is not as complete as could be wished. The strike is  $45^{\circ}$  and the dip is north-westwards at  $75^{\circ}$ . The length over which the lode has been located at intervals of 40 feet is 130 feet and this width is in the vicinity of 1 foot. Values as far as exposed are low.

STANDARD LODE: This lode is not of fault-fissure origin. It consists of quartz leaders along a line striking from  $70^{\circ}$  to  $90^{\circ}$ . The quartz extracted yielded about 1 ounce per ton but the veins are so irregular and inconstant that it is somewhat doubtful whether this lode will ever prove of any special importance.

RESERVED LODE: This lode represents a local fissure and is not a zone of fault displacement. The strike seems to be about meridional. Very little quartz has been extracted although it is stated to have yielded 2 ozs. per ton. A shaft 15 feet deep has been sunk on this lode and a trench 40 feet away also discloses the lode which is therefore 40 feet in length. The same remarks can be applied to this lode as to the Standard lode.

SULPHIDE, BROWN'S & MYSTERY LODES: These three lodes form a small group which lies to the northwards of the lodes just described. They are of indefinite strike and structure and probably represent the irregular fracturing near the crest of the anticline. The Sulphide lode has a strike of  $5^{\circ}$  but practically no work has been done on it. It is very rich in sulphides particularly arsenopyrite but at the outcrop gold values are low. What they are below only future work will disclose.

Brown's Lode is small and strikes  $45^{\circ}$ . Ten tons of quartz obtained from here yielded 25 ounces of gold. The length of the shoot is about 20 feet. The Mystery Lode is of indefinite structure and as far as can be seen consists of quartz stringers and off-shoots.

All of the above lodes could be attacked by means of a low level adit from about 1000 feet contour. This would give up to 360 feet of backs on the several lodes. In the case of the Prendergast Lode the behaviour at that depth could be thus determined without the necessity of dealing with the abandoned shaft.

The consideration of the exploration of these lodes below such an adit level should be dependent on the results of deep sinking at the Ringarooma and Mercury groups.

## 6. ALMORA LODE-GROUP

ALMORA LODE: This is a fault-fissure lode with a length of 290 feet and a width varying from 9 inches to 2 feet. The lode has a distinct bend at about its middle portion the northern part striking  $42^{\circ}$  and the southern part  $20^{\circ}$ . A couple of shallow shafts have been sunk on it but no accurate information is available as to the amount of stoping carried out.

MALUNNAH LODE: This lode strikes  $20^{\circ}$  and dips southwards at  $70^{\circ}$ . It is probably a fault-fissure lode but is only 20 feet in length at surface. This length has increased to 90 feet in the adit 55 feet below, but the lode here is merely a stringer. The width varies from 4 feet maximum near the surface to 7 or 8 inches in the tunnel. Crushings yielded about 6 dwts. per ton.

A1 LODE: This is a fault-fissure lode and has a strike of  $45^{\circ}$ . It dips northwards at  $80^{\circ}$ . Length is 30 feet and width about 15 inches. Value of crushings has been

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a little under 1 oz. per ton average. A shaft 35 feet in depth has been sunk but very little stoping carried out.

HOLLOWAY'S LONG LODE: This is a recent discovery and a little work has been done on it. Trenching has shown this lode to be 233 feet in length. At the surface the width varies but in a shaft sunk by Holloway it shows an increase in width which seems to be in the vicinity of 1 foot. The strike is  $15^{\circ}$  and the dip eastwards at about  $80^{\circ}$ . Good gold values have been obtained in dollying tests but not sufficient work has been done to enable anything approaching a definite opinion to be formed as to value.

Similarly the work done is not sufficient to enable a decision to be made as to the nature of the lode although it is most probably of the fault-fissure type.

HOLLOWAY'S SECOND LODE: This lode is nearly parallel to the previous lode having a strike of  $11^{\circ}$ . It is 172 feet in length at the surface and about 1 foot in width although a brecciated zone of 5 feet in width lies to the west of and adjacent to the actual quartz-lode. The dip is to the east at  $70^{\circ}$ . Very little work has been done and except for a few trenches and a shallow shaft there is no change of studying the lode. It is probably however of fault-fissure origin.

These lodes can be explored by means of an adit or adits driven from the Creeks below the Alanah and Malunnah lodes.

#### 7. FOREST KING LODE-GROUP

JANS LODE: Lying to the south of Holloway's recent discoveries occurs a lode known in the early history of the field but on which work has recently been carried out by the Forest King Syndicate. The strike is  $25^{\circ}$  and the dip easterly at  $70^{\circ}$ . The length is at least 180 feet and the width 1 foot together with another 1 foot 6 inches of soft country rock rich in quartz veins and stringers. A branch lode springs from within 50 feet of its southern end and this has a strike of  $360^{\circ}$  and an easterly dip of  $80^{\circ}$ .

A shaft recently put down at the northern end reached a depth of 60 feet when operations had to cease owing to water trouble. Subsequently an adit has been driven along the lode showing it to be persistent although deflected by a north-south fracture paralleling a bedding plane.

Ore extracted from the whole 2' 6" width averaged 9 dwts. per ton while the quartz lode itself averages  $2\frac{1}{2}$  ozs. per ton as shown by 30 tons of surface stone crushed in the past.

Recent work on the shaft and the adit just driven have shown an average of from 15 to 20 dwts. per ton.

This is a fault-fissure lode.

ALBERTON LODE: With a strike of  $40^{\circ}$  this lode dips south-eastwards at  $80^{\circ}$ . The length is 60 feet and the width about 1 foot. The value shown by a 12 ton parcel crushed many years ago is 6 or 7 dwts. per ton. This also is probably a fault-fissure lode.

ALBERTON NO. 2 LODE: A considerable amount of work has been carried out on this lode in the past and a tunnel driven along it and stoping carried out to the surface. The strike is  $54^{\circ}$  and the dip south-eastwards at  $70^{\circ}$ . The length is 318 feet and the width 2' 6" to 3' 6". The average of all the crushings from this lode was about 5 dwts. although the eastern end was richer giving 1 oz. per ton. Good values of about 25 dwts. were obtained in holes sunk below the adit level.

This is an important lode of fault-fissure type and deserves close attention.

STAKE LODE: Lying to the south of the previous lode is a small lode 20 feet in length. The strike is  $27^{\circ}$  and the dip south at  $80^{\circ}$ . The width is 2' 6" but the value cannot be now ascertained.

All of the abovementioned lodes constitute one economic unit as they can be attacked by an adit at the locality of the old Alberton lower adit or somewhat lower if desired. The question of sinking below water level should be postponed until the results of the deepsinking at the Ringarooma and Mercury are known.

#### 8. SINGLINE LODE GROUP

NO. 1 LODE: Strike of this lode is  $40^{\circ}$  and the dip south-eastwards at  $60^{\circ}$ . Length is 40 feet and stoping has been carried to a depth of 10 feet showing the lode to be 1 foot in width. A parcel of about 8 tons yielded 1 oz. per ton.

This is probably a fault-fissure lode.

NO. 5 LODE: This lode has a strike of  $45^{\circ}$  and a south easterly dip of  $80^{\circ}$ . The width is from 4 inches to 1 foot. Length is 40 feet. The value is stated to be about 2 ozs. per ton.

This is also most probably a fault-fissure lode.

NO. 3 LODE: With a strike of  $60^{\circ}$  this lode is practically vertical its length is only 20 feet and width about 3 or 5 inches. A shaft has been sunk on it to a depth of about 60 feet and the value is about 12 dwts.

It is doubtful whether this is a fault-fissure lode.

DRUNKARD'S DREAM LODE: This lode has a strike of  $39^{\circ}$  and seems to be of fault-fissure origin. The dip is westerly at  $80^{\circ}$  and the width from 2' 6" to 3 feet. Length is 75 feet. Two shafts - one at each end of lode have been sunk and the stone in bottom is stated to go 3 ozs. per ton. It is also stated that crushings in the past gave 3 ozs. per ton. Why under these circumstances work ceased is to be wondered at unless water or bad air was the trouble.

TIGER LODE: This is an important lode and is of the fault-fissure type. It has a length of 80 feet and a width varying from 1 to 2 feet. The strike is  $40^{\circ}$  and the dip south-easterly at  $85^{\circ}$ . Shafts have been sunk at both ends of lode and stoping carried out down to 70 feet with an unworked portion between the two ends. The output has been 100 tons which yielded 1 oz. per ton. Values are stated to have

All of this group must be operated by shaft-sinking which again must depend on the results at the Ringarooma Mercury groups.

#### ISOLATED LODES

HOMESTEAD LODE: Situated near Donovan's homestead and outcrops in the creek bed. It has a bearing of  $340^{\circ}$ . It has only been exposed for about 15 feet which shows a width of from 4 to 5 feet. A crushing of 5 tons yielded 5 or 6 dwts. per ton.

BATTERY LODE: This lode is situated on the left of the road behind Donovan's homestead. It has a strike of  $30^{\circ}$  and a width of about 3 feet. It has been stoped for a depth of 15 feet over a length of 45 feet. A continuation was located in a hole sunk near the stump in Donovan's garden. It is probable that this lode continues and junctions with the Homestead Lode at the point where a shallow trench has been sunk on the creek bank. This cannot be decided without further work, which will have to be by shaft sinking below water level.

CROWN PRINCE LODE: This lode is situated above and to the east of the Forest King Group and to the east of Hall's Track. It strikes  $43^{\circ}$  and dips south-east at  $65^{\circ}$ . Length is 100 feet.

CARLTONS LODE: This lode is situated at the northern foot of the spur up which the Pyengana Track rises to Cotton's Plains. It is on a 50 acre block charted in the name of Heathorn but now held by Stingel.

The lode is upwards of 300 feet in length and the strike is  $320^{\circ}$ . It is not far removed from the outcrop of the double thrust fault. The quartz is heavily mineralised, arsenopyrite being prominent but the gold values obtained during prospecting carried out some years ago are not available. Alluvial gold has been found in the flat below and further work either by means of a shallow adit or by shaft sinking is certainly desirable.

It appears to belong to the fault-fissure type.

CASH'S LODE: This lode is higher up the above-mentioned Spur and crosses Hall's track. The lode is conformable to the strata which strikes  $30^{\circ}$  and dips south-eastwards at  $15^{\circ}$ . Lode is rich in galena which carries silver but very little gold.

This lode does not belong to the gold-quartz group but is a variant of the tin zone. It is scarcely worth exploring as a gold-producer.

BOULTBEE'S LODE: This lode has been exposed on Boultbrees property, a few chains west of the homestead in several trenches. It strikes  $17^{\circ}$  and dips westwards. Width in one trench is 5 feet but values are practically nil. This lode is out of the main line of fracturing and it is not justifiable to expend money on it at present.

MARR'S LODE: This lode is situated to the west of the Victoria Group. It strikes  $353^{\circ}$  and dips westwards at  $60^{\circ}$ . It has been exposed for a length of 10 feet but practically nothing is known of it. It is apparently

an unimportant occurrence.

BRIGHT STAR LODE: On the west bank of the Dorset River about half way between the old Victoria battery site and the end of the road is the Bright Star Lode. This has a strike of  $326^{\circ}$  and a dip westwards at  $80^{\circ}$ . The length is 100 feet and the width 9 inches to 1 foot. The value from a crushing of 15 tons was 25 dwts. per ton.

This is fault-fissure lode but as sinking below the water-level will be costly it must be postponed until the work on the Ringarooma and Mercury groups has shown that sinking is justified on the type of lode.

ESK LODE: Extending over a length of 200 feet trenches have shown the existence of a lode having a strike of  $100^{\circ}$  with a northerly dip of  $50^{\circ}$ . Values are not available. It is very doubtful whether this is a fault-fissure lode.

SOUTH STAR LODE: This lode strikes  $320^{\circ}$  and dips south-westwards at  $80^{\circ}$ . Width is 1 foot and values are low. Adjacent to this lode is a zone of gash-veins in the country rock some of which carry good gold. There is no indication, however, that this stockwork would ever be workable. The lode itself must be left for exploration until the seep sinking tests have been completed.

EVERETTS LODE: Below the Mathinna Track near the valley bottom at about 1500 foot contour a well defined lode occurs with a strike of  $320^{\circ}$  and a dip westwards at  $80^{\circ}$ . An offshoot from the south end has a strike of  $330^{\circ}$ . In the past some work has been done on this lode but the workings have now collapsed. The lode is 4 feet in width and seems to be of a fault-fissure type. It is worthy of special attention in the future.

UNA LODE: This lode is situated on the southern slope towards Mathinna some chains to the west of the Mathinna Track. It is a well defined lode of the fault-fissure type. The strike is  $328^{\circ}$  and the dip westwards at a higher angle. It is 190 feet in length. The width is about 2 feet. Values have varied but something under 1 oz. per ton has been the average of the crushings.

One other lode at least exists here as the outcrop rich in sulphide located in the creek distinctly shows but very little can now be seen.

This is a very promising lode but further exploration will have to be by sinking. It is well worth further exploration.

#### VIII. THE PROCEDURE ESSENTIAL TO EFFICIENT DEVELOPMENT.

In the preceding pages it has been shown that certain definite conclusions in regard to the Mount Victoria Goldfield are possible. Such conclusions are:-

(1) Of the 100 lodes either partially worked or merely located some are of no economic importance while others possess characteristics which indicate an appreciable potential value.

(2) The lodes of greatest permanent value are structurally distinguishable from those which are

non-persistent in depth. These more valuable lodes are the fault-fissure lodes. 83

(3) The fault-fissure lodes on the geological evidence may be expected to persist in general to appreciable depths of at least 2,000 feet.

(4) The maximum depth reached up to the present in mining operations on this field is 390 feet below the outcrop.

(5) The absence in most of the lodes of long shoots of payable quartz in the direction of the strike of the lodes at the surface demands as an essential to the success and stability of mining operations that deep sinking should be the primary undertaking in the revival of the field.

(6) Much capital has been uselessly expended in the erection of batteries to the comparative neglect of exploratory work.

(7) Neighbouring lodes which could be most economically worked by one organisation have been attacked by two or more companies which duplicated or triplicated expenditure on equipment and ultimately failed without accomplishing very much when the amalgamation of interests would have permitted of far more efficient operations.

(8) Without exception the mining ventures on the field have been undercapitalised.

Consideration of these conclusions results in the conviction that the development of the Mount Victoria goldfield demands the following procedure.

It being clear that the future of the field depends on the value and extent of the gold-quartz lode below the level yet reached, it follows that the expenditure of whatever capital is available for the field should be concentrated on deep sinking.

Further, it is apparent that such expenditure on sinking and exploring the lodes at a depth should be concentrated on a few carefully selected spots. Indiscriminate sinking must only reproduce the unfavourable opinion in regard to the field which resulted from the previous misdirected operations. On the results of the sinking at carefully selected points the future of the field wholly depends. If such exploratory and development work demonstrates the existence to appreciable depths of lodes possessing dimensions and values which can be used as the basis of a successful mining enterprise, then the future of the field will be assured and sinking could then be undertaken at other points where the geological factors are favourable.

Since the future of the field depends on the results of such deep sinking it is very important that the location of such testing should be carried out where the greatest chances of success lie. On the geological evidence the two localities which stand out prominently as giving justification for expenditure in this direction are the Gumsucker-Rosalind group at the Ringarooma Mine and the Mercury No. 1 and No. 2 group at the old Mercury mine. It so happens that at both of these localities winzes have been sunk to about 65 and 45 feet respectively below the lowest adit level. In both cases this work could be utilised in connection with more comprehensive sinking campaigns. As a matter of fact, the winze of the old Ringarooma Company is now being used in this

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way in connection with the operations of the Ringarooma United Company. In both this mine and the Mercury the lodes look better than at the upper levels being well defined and strong bodies of quartz 5 feet and 4 feet in width respectively. The appearance of these lodes at this depth certainly justifies an active campaign of sinking.

It cannot be too strongly urged that all capital now available should be utilised in sinking at these two points.

If the results of such sinking are favourable then the field will have a definite future for the operation of mining companies. On the other hand if it should so happen that gold values do not continue downwards to a sufficient degree then the Mount Victoria goldfield will only support in the future small syndicates operating on the lode systems down to similar depths as those already reached.

In any case it is advisable that the numerous lodes should be exploited in groups. These groups have been indicated in the Chapter preceeding this. They are the natural groupings which provide facilities for the cheapest operating and it is strongly recommended that the amalgamation of interests necessary to effect such groupings should be arranged before appreciable expenditure on plant and workings is undertaken.

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