

GEOLOGICAL SURVEY OF THE LEFROY GOLDFIELD.

PROGRESS REPORT.

Mines Office, 1st July, 1896.

SIR,

I HAVE the honour to report as to the progress made with the geological survey of the Lefroy Gold Field during the year ending 30th June, 1896. Owing to other calls upon my time it has not been possible for me to go on with this work continuously, and it has had to be put to one side for months at a time. Six weeks have been spent on the ground, however, and quite two months have been devoted to plotting the fieldwork and preparing plans and sections of the various mines in the Office.

The object of the survey is to get together for publication all information that will assist the further development of the field, and so add to the Colony's production of gold.

It is intended to prepare a general topographical plan of the district, showing the shape of the surface, the position of the various lines of lodes, and the location of the various mining leases and the workings upon them. About one-fourth of this map, showing the south-western quarter of the field, is all but completed, and the remainder is partly plotted. There will also be plans and sections of the workings on the various lodes to as large a scale as is conveniently practicable. Those of the mines on the Chums, Pinafore, Morning Star, Land o' Cakes, and Volunteer lines of reef are partly drawn, and could be completed without much further work. The plans of the mines furnished annually to the office of the Inspector of Mines have been used as much as possible in compiling these maps, but a good deal of actual surveying has in some cases to be done to connect them and to supply deficiencies. It is considered that the publication of fairly complete plans of the workings of the mines would be of great service to all investors interested in the field, and especially to those outside the Colony who might wish for full information.

Special attention will be given to mapping the system of "deep leads" which traverse the field, and to getting together such facts as will be useful in determining whether there is any likelihood of it being possible to work them profitably for alluvial gold. At this stage it may be said that so far as the examination of the field has gone, there seems considerable probability that some of the sub-basaltic "leads" will be payable, but that there will be a serious difficulty to contend with at the outset in the water in these old channels, as some of them lie below sea-level. Once the water accumulated in the "leads" is pumped out, it is not likely that the ordinary influx will be at all formidable.

As soon as circumstances will permit, it is now my intention to complete the topographical survey and examination of the underground workings, next to complete the maps, then, finally, to revisit the field for the purpose of getting any fresh information brought to light in the interim, and to finish the Report. This will require about three months' undivided attention.

Though the examination of the district is yet very incomplete, it may be of service to make known one or two of the conclusions already come to especially bearing upon the question of the lodes carrying gold in depth. In every instance hitherto the gold-bearing stone found near the surface has, sooner or later, been lost at depths from 300 to 500 feet, and the lowest levels on the reefs have been unprofitable, from which has arisen a belief, strongly held by many investors, that it is no use expecting to get gold below a comparatively shallow depth. This pernicious notion has retarded the progress of the district very considerably, destroying confidence in the minds of investors, and preventing them from going into the deep-sinking operations, which would otherwise have been boldly and energetically entered upon. The sections of the workings that have been prepared show very strikingly the very small foundation upon which the belief rests, for in all cases where the shafts have been sunk into the supposed barren parts of the lodes it is seen that the amount of exploration work that has been done has been so little as to be quite inadequate to allow of the proper testing of them. Granting that in these lower levels the lodes have been poor, there is, nevertheless, so little done that a wholesale condemnation of them is very premature. And even if it should become established that there is a barren zone in the reefs, say below 400 feet, experience elsewhere, in Victoria for example, gives us support in believing that at some lower depth they will again carry gold. In the case of the Lefroy reefs there are certain considerations now to be mentioned which supply somewhat probable reasons for an alternation of auriferous and barren zones in them.

The reefs, with a few exceptions, belong to a group of nearly parallel lode-fissures running about N. 75° E., and usually underlaying to the southward; there are also a number which run more or less north and south, but these have hitherto been barren, and it seems probable that they belong to quite a different system of fractures from those which have formed the auriferous group; the latter were originally fault-fissures, dislocating the strata traversed, so that at any given point we usually find that the country on the hanging wall does not correspond exactly with that on the

footwall. In most of the mines we find proof that after the lode channels had been filled or partly filled with more or less auriferous quartz, which would no doubt present the usual phenomena of richer chutes and poorer intermediate portions, further motions of the wall rocks have taken place, striating and smoothing the surfaces of the quartz sheets already formed, crushing them at times to rubble, and in places tearing them altogether asunder. The large slickensides seen in the Volunteer reef show this action particularly well, and in the mullocky portions fragments of slickensided auriferous quartz have at times been found, showing that the original main sheet of quartz had been torn asunder. The occurrence of "splices" of barren quartz lying alongside rich stone, which have often been noticed, would probably be due to the same cause, the barren stone being formed at a later date, subsequent to the movement which had smoothed and striated the surface of the auriferous portion. The wide mullocky portions of the lodes, so common throughout the field, would also probably be due to the repeated faulting movements along the planes of weakness afforded by the reefs.

The effect of faulting movements along the planes of the reefs must necessarily be frequently complete disruption of the previously formed sheets of quartz, and the distance to which parts of the sheets formerly in contact would be separated would depend on the amount of downthrow of the faults. We should therefore expect to find blank spaces in the reefs where the auriferous quartz sheet has been more or less torn apart, leaving only mullock in its place or possibly non-auriferous quartz of a later period of formation. Below these spaces we should again come upon the stone that has been torn away from them. This explanation is rather strikingly supported by the experience of the Volunteer mine. In this there was good quartz above No. 1 level, and again below No. 3, but comparatively little between, though there were some very curious detached patches. No. 2 level showed hardly any payable stone from end to end, but was mostly in mullock. If we fold the longitudinal section of the mine showing the stoping done so that No. 3 level is superimposed upon No. 1, it will be seen that the shoot of gold worked becomes practically continuous, and it seems probable that really the good stone below No. 3. level was once continuous with that above No. 1. Below No. 5 level there has been another blank in the lode, which may be due to another rupture of the original continuous auriferous sheet, which would then be found at some lower level.

It has sometimes been supposed that the loss of the gold in the Lefroy reefs in going downwards might be due to their passing out of a group of favourable strata into underlying unfavourable beds, as it has often been noticed on many fields that the character of the enclosing country appears to influence the value of lodes. In support of this theory, it has been pointed out that the strata in Lefroy lie at flat angles. In making the geological survey, special attention has been given to this question, with the result that there does not appear to be any connection between the shoots of gold and the country enclosing them. The strata are not lying at very flat angles after all, but dip at about 15° to 20° on the average, and the planes at which the gold appears to have died out in the reefs do not correspond with the bedding-planes of the country. Furthermore it appears likely that certain strata which have enclosed gold-bearing portions of one reef in one mine have not carried auriferous quartz in an adjoining reef in the next mine.

The conclusion arrived at after studying the Lefroy reefs is that there is no reason to think that gold will not be found in them to any depth to which they may be followed, though probably in more or less detached patches owing to disruption of the auriferous sheets by faulting. There is certainly no sufficient evidence of the gold dying out in depth to warrant the idea that sinking is useless; on the contrary, there is much inducement to put down deep shafts in the confident belief that they will be remunerative.

Seeing that a large number of parallel reefs, some fifteen or more, have been discovered in the district, and that much of the surface is so covered with alluvial matter as to make prospecting a matter of difficulty, systematic cross-cutting on lines running north and south is much to be recommended. When deep-sinking operations are commenced it will be desirable to amalgamate as many adjacent properties as can be conveniently worked from each main shaft, so as to save expense, and it will be necessary to do a good deal of cross-cutting to connect the workings on adjacent lines of reef. Should three or four deep main shafts be sunk it would not be a very heavy work to connect them right across the field by a system of cross-cuts, and in opening out from each it would be well to preserve as much as possible corresponding levels in adjacent mines to permit of connections being made. Probably systematic cross-cutting in this way would result in the discovery of reefs yet unknown. Ventilation and drainage would also be much facilitated.

The production of gold from the Lefroy reefs compares favourably with that from other known fields, having regard to the amount of ground laid open on the lodes by mining works, and I have much confidence that future exploitation will result quite as well on the average as that in the past. The field presents very good opportunities for the investment of capital in legitimate mining ventures.

I have the honor to be,
Sir,

Your obedient Servant,

The Secretary for Mines, Hobart.

A. MONTGOMERY, M.A., *Geological Surveyor.*