REPORT ON THE GODKIN SILVER MINE, WHYTE RIVER.

Geological Surveyor's Office, Launceston, 30th December, 1892.

SIR,

I HAVE the honor to report having followed your instructions as to visiting the Godkin Mine at the Whyte River. Leaving Launceston on the 12th instant, I reached the Whyte River on the evening of the 13th, spent the next four days in examining the property, and returned on the 18th to Waratah, and on the 20th to Launceston.

The Godkin mining property includes two mineral leases, Nos. 1599-87M and 1615-87M, of 40 acres each, situated on the right bank of the Whyte River. There is a good road from Waratah to within three miles of the mine, and the latter is connected with the road by a wooden tramway; this has also been continued right up the slope of the Magnet Range to the Arthur River, six miles from Waratah.

The surface of the ground is very uneven, showing several high spurs separated by gullies. The north boundary of the north section is from 240 to 330 feet above the level of the Whyte River where it crosses the south boundary of the south section. The general slope of the ground is to the south west, towards the Whyte River.

The principal mining workings are situated in the south section, 1615-87M, towards its north-west corner, in the valley of a small stream known as Silver Creek. Here a main engine shaft has been sunk, and three adits, Nos. 1, 3, and 4, have been driven. In the north section, 1599-87M, a long adit, No. 5, has been driven, and a small one, No. 2, and No. 5 has been connected by a drive along the lode with a shaft called the north shaft. Some trenching has also been done on this section.

At the north shaft there is a very large outcrop of ferruginous gossan, consisting of oxides of iron and manganese intermixed with a good deal of clayey matter and fragments of country rock, and containing a little silver at times. This outcrop can be traced with but few breaks south-easterly to the workings in the south section, and north-westerly through the Godkin Extended, Smith's, and the Bell's Reward Sections: it is not always so massive as at the north shaft, but is generally large and distinct. The work that has been done on it by the various mining companies shows the line of gossan to lie at the contact of the two main formations of the district, sandstone, slate, and limestone lying to the west of it, and decomposed igneous rock to the east. When I formerly examined the district, in March and June, 1890, the occurrence in Bell's Reward and the Godkin No. 4 tunnels of limestone on the east side of the soft igneous rock led me to believe that there was a dyke of the latter running parallel to the main contact of the two formations; but the knowledge now gained shows this to be erroneous, and that the masses of limestone and sandstone lying east of the supposed dyke are either portions detached from the main mass or tongues projecting from it into the igneous formation. The line of gossan closely coincides with the edge of the latter, and the lode therefore is a "contact lode." The features presented by it in the underground workings, as will be seen hereafter, quite agree with this interpretation, and a proper understanding of the conditions under which the ore is found and is likely to be found can only be attained by remembering this, and discarding the belief that the lode is of the ordinary "fissure vein" type. Instead of having to deal with a mass of lode-stuff deposited in a comparatively regular and even plane, as in the case of typical fissure veins, we have here a lode formed at the irregular contact surface between a mass of once molten rock and the older sedimentary strata through which it has been thrust. Except for the main fact that the ore-bodies are likely to lie between the two rock formations, no regularity of occurrence may

be expected, the course and underlay of the lode being liable to sudden and erratic changes. Detached peices of the sedimentary rock may often be met with inclosed in the igneous matter, and round these there may be ore; and, again, tongues and dykes of the plutonic rock are to be expected penetrating into the sandstones and limestones, and ore may often lie along the boundaries of these. The main cause of formation of a contact vein between a plutonic and an aqueous rock appears to be that the heated masses shrink in cooling, leaving at the contact surface space for the circulation of water carrying metalliferous solutions. The main vein is likely to follow the main line of contact in consequence, the opportunities for deposition of ore being there greater than along the boundaries of small dykes.

When I formerly examined the White River District I was in great doubt as to the true nature of the igneous rock found in the Godkin and other mines. At the surface it is extremely decomposed, and its constituent minerals quite unrecognisable. The mine workings and the cuttings on the Main Road and the Godkin Tramway have now made the matter clear. The rock was locally termed "diorite," from its resemblance to some of the decomposed diorite dykes found in Victoria, but it is now seen that this is a misnomer. "Dolerite" would be more correct, as the rock is a basic one and belongs to the group of which gabbro and dolerite are the most thoroughly crystalline members. It is very difficult to give a thoroughly satisfactory name to the formation because it varies very much, and one name will not cover all the varieties. The main body of the igneous body lies to the west and north west of the Heazlewood field, and there is often very coarsely crystalline, becoming a gabbro, but between the Godkin line of lode and the Magnet Range, on the eastern side of the silverfield, it is generally quite fine-grained, and would rather be termed basalt. Throughout the whole district there is a great deal of serpentine in it, the result of chemical alteration of the original rock, but this, too, varies very much, some specimens being almost pure serpentine rock and others not containing much. In the eastern portion of the silverfield we appear to be on the outskirts of the plutonic outburst, the cuttings on the main road showing frequent alternations of igneous rock with slate and sandstone. The slate is frequently brick-coloured and hardened by heat, and in the vicinity of the dykes is often altered to hornstone. In this part of the field the intrusive rock appears to have issued in numerous dykes which broke through the slates; but in the western part we have the main central mass of plutonic matter, and, as is usual in such cases, the large mass is the most thoroughly crystalline and the most homogeneous in composition. Probably the dykes on the outskirts have absorbed much of the strata through which they passed into their own substance, which would account for many of the differences now observable in their texture and composition. The main fact to be noted is that the weathered, somewhat fine-grained igneous rock found in the Godkin and other mines is only a variety of the serpentine rock found in the Heazlewood mine and westward from it. The clayey character is merely the result of atmospheric influences, and will disappear soon after the mines reach the water level of the District, when the soft rock will change to a more or less serpentinous dolerite. This change is already visible very plainly in the Whyte River mine, in the lower levels driven from the Godkin shaft, and in the eastern end of the No. 5 tunnel.

The sedimentary strata on the west side of the Godkin lode consist of sandstones of generally white colour and harsh feel, quartzites, limestones, and slates. They are often fossiliferous, encrinital stem joints being very common. Two or more species of trilobites, and several small brachiopods have been collected, but not yet described and named. The fossils show the strata to be of the same age as those of the Zeehan field, where identical species are found. There is a somewhat large patch of these strata lying immediately west of the Godkin line of lode, of roughly triangular shape, running to a point towards the north, and widening going south. Along the Whyte River they extend from the Godkin mine to within half a mile of the junction with the Castray River. To the north they are seen crossing the main road at the Saddle, about half a mile east of the Heazlewood Extended Company's sections. The formation here, however, is only about a quarter of a mile wide, and runs out altogether, and is replaced by the serpentinous dolerite to the northward.

It may be here noted that in the Heazlewood and Whyte River field there is the same association of probably Silurian sedimentary strata with serpentinous rocks that prevails in the Zeehan and Dundas fields. In the case of the latter the serpentinous rocks also vary from nearly pure serpentine to gabbro and dolerite, as in the former.

The sedimentary strata are much contorted, and generally dip at high angles. The strike is about north-west and south-east, and the line of contact with the dolerite follows this line pretty closely. As might be expected, however, the intrusive rock has not altogether closely followed the bedding planes of the older strata in bursting through them, which has resulted in a feature that has caused some perplexity to those interested in the district, namely, the apparently irregular occurrence of a band of limestone. This limestone is well seen in Bell's Reward Mine, again in the north end of the Godkin Extended tunnel and round the Godkin engine shaft, but not in the Godkin No. 5 tunnel, which extends right across the line connecting the two last occurrences. Just before reaching the lode, however, in this tunnel we find occasional bands of

siliceous limestone interstratified with quartzite, and as in the Godkin Extended tunnel these transition beds lie between the quartzite and the limestone, it is pretty clear that the latter once existed in very much the present position of the lode, and that the bulk of it has been destroyed by the dolerite intrusion. The patch near the engine shaft is another portion of the same band which has escaped destruction; no doubt the limestone was continuous right along prior to the igneous outburst.

It has been necessary to go somewhat fully into these geological particulars in order to explain some of the very puzzling features met with in the workings, which have been the cause of a great deal of work being done without much good resulting therefrom. It is also necessary for the future working of the mine that they should be borne in mind. With the aid of the map accompanying this Report I shall now attempt to explain what has been found, and to indicate the direction future workings should take.

No. 1 Tunnel.—This was put in immediately under a mass of gossan cropping out on surface, in which there was a vein of pyromorphite two or three inches wide, giving good assay returns. Several cuttings that have been made into this mass since mining work began have proved it to be superficial and flat-lying, the gossan not extending downwards more than a few feet. From the shape of the surface of the ground it seems probable that this lodestuff has been brought into its present position by a landslip, and that therefore we should look for the parent mass higher up the hill. Unfortunately for the development of the mine, the slipped gossan, instead of coming to rest upon solid country when its superficial character would have been at once apparent, came right upon some clayey matter which might well belong to a lode, but which subsequent work has shown to be one of the broken clayey masses formed at the contact of the sedimentary and igneous rocks. There appears to be a good deal of this clay in the vicinity of this contact, formed by mechanical disruption of the older rock at the time of the dolerite intrusion, together with chemical action subsequently: under favourable circumstances true lode-matter might be formed in such situations, and the clay is much stained with oxides of iron and manganese, and in places has much the character of a true gossan. It has therefore taken a great deal of work to show its real nature, and has prevented the recognition of what appears to be the fact, that the patch of gossan on surface is not in its original position. In the No. 1 tunnel the gossany matter is found for 50 feet in from the mouth: much of it is stained black with oxide of manganese, and good assay returns were said to have been obtained from this black portion. As it has not been mined out, however, the presumption is that in bulk it was not rich enough to pay for removal. From 50 to 80 feet from the entrance there is a layer of ferruginous stuff in the top of the drive, but under it appears to be broken and stained country rock. At 80 feet there shows in the floor a piece of weathered shaly matter, probably the cap of the limestone found below this tunnel at the next level, which often contains a good deal of slaty substance in bands through it. Between 80 and 140 feet the tunnel passes through much decomposed clayey dolerite, and then to 230 feet encounters brown clay with occasional curious wavy markings; this is similar to the clay lying under the gossan at the entrance to the tunnel and to the stuff passed through in the first 200 feet of the No. 4 adit. After passing through it the drive goes through 84 feet of clayey dolerite. In the face there is a good deal of sandstone mixed with clay and traversed by ferruginous veins: there is also a little quartz. This was taken to be the side of the sandstone country coming in, but from what has been seen in the west end of the No. 4 tunnel it is more probably the eastern side of the true contact lode, which is exactly similar to this at the lower level. Another twenty feet of driving would probably have found the lode, and gone through it into the true sandstone footwall.

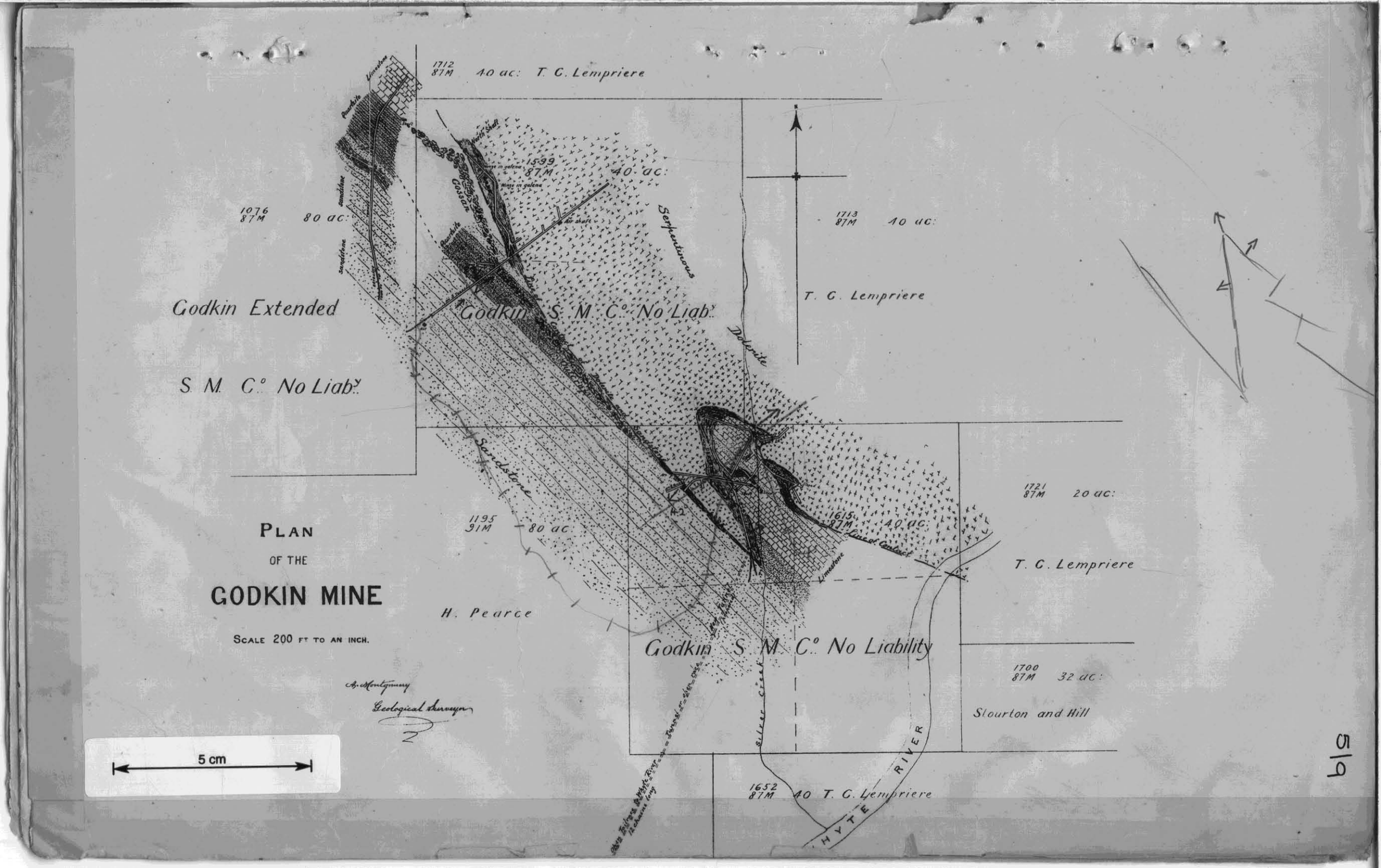
No. 3 Tunnel.—This is almost immediately above the end of the No. 4 tunnel. For about 12 feet in the mouth there is dolerite clay, and then the drive passes into hard sandstone. This tunnel seems to be altogether on the west side of the lode, and to have gone in just above it.

No. 4 Tunnel.—This is also known as the 45-feet level, as it is connected with the main engine shaft. The workings at this level consist of two main crooked drives running more or less north-westerly, connected by a cross-cut: there are also several small branch drives from these. The mouth of the tunnel is under a superficial lump of gossan, and all round it there is a good deal of ironstone. For about 180 feet from the entrance the stuff passed through is yellowish clay, much stained in places with black oxide of manganese: it is not country rock, and it is not true vein stuff, but appears to be a contact mass at the junction of the intrusive and sedimentary formations: similar masses of clay are, however, sometimes found in lodes, especially large ones, and at the time the tunnel was driven it was natural to suppose that the lode was being penetrated. After passing through this limestone was encountered in broken blocks, often with clay between them, for some 42 feet. In this limestone the crosscut to the north east to connect with the eastern part of the 45-feet level begins. Leaving it till later, and continuing on the western branch, the clay is again met with about 12 feet past the crosscut and continues for 148 feet. The weathered dolerite then appears, and is seen also in a small crosscut to the south that has been made close to where it first comes in. This continues to within 14 feet of the face. On the last day of my visit there was about four feet in width of a mixture of oxide of iron, clay, quartz, and fragments of sandstone in the face, and then for about another 10 feet back along the drive the

country seemed broken, containing angular pieces of sandstone and weathered dolerite, and was a good deal stained with oxide of iron. Since then I have heard from Mr. Godkin, the acting mining manager, that the lodestuff proved to be about 20 feet wide, and after passing through it sandstone was cut on the western side. A good deal of water was also reported to be coming from the lode. Though the stuff contains a good deal of clay and country rock I have no doubt that this is the main lode, as it is lying on the contact of the dolerite and the sandstone. While I was at the mine a small drive was put in close to the mouth of No. 4 tunnel on the contact with the sandstone, and the material passed through was very similar to that found in the face, so that it would seem that this tunnel began just on the edge of the lode and went gradually away from it: the mouth of the adit seems, however, to be just at the point of a tongue of dolerite coming in from the northward, and the lode is small and would probably soon die out if followed into the sandstone country to the south east. No trace of it appears to have been found in this direction, and it seems most likely that in order to find lodestuff again we must go a little further east to the contact of the sandstone and dolerite once more.

Returning now to the crosscut connecting the two main drives of the 45-feet level, we find it to be all through limestone, broken at first, but more solid towards the north-east end for the whole distance, except for a band of sandstone in the middle close to the air-shaft. Along the western edge of this sandstone a short drive has been put in to the north-west along a seam of clay, which appears to break somewhat obliquely across the strata, and is probably a branch from the clayey contact mass lying between the dolerite and the limestone. The sandstone is only a small band some 8 or 10 feet thick, in the limestone. The air-shaft is one which was sunk early in the history of the mine: near the surface there was in it a vein of rich galena, which was lost lower down. The crosscut was driven to prospect for this vein, and was successful in finding galena and native silver about 70 feet north-east of the shaft. The eastern drive at this level was made for the purpose of following this ore, but has not been very successful. The best ore was found between the crosscut and the main shaft, and a large quantity was stoped out, from which some 30 tons of picked ore was shipped to the smelting works. This returned about £17 a ton gross value, the bulk assay giving about 150 ozs. of silver and 27 per cent. of lead. Mr. Godkin could not give me the exact figures, but these are pretty nearly correct. An examination of the heap of seconds showed them to consist of limestone with veins running through it of galena with a good deal of blende. Some very fine specimens of native silver were obtained during the progress of stoping. The galena when dressed clean assays very well, but the assay value of the whole heap of seconds I should judge to be very low, the percentage of galena in it being evidently very small. So far as I could learn no proper sample of the bulk has been taken, so the exact value is not known. This ore would be valuable in future for fluxing purposes on account of the large quantity of lime contained in it, and the silver in it would then help to pay expenses of smelting richer ore, but I am much mistaken if it could be profitably dealt with in any other way, even by concentration. The vein seen in the stopes from which the stuff at grass was taken does not appear to me to be a true lode at all; it is rather a part of the limestone that has been fractured and been impregnated with galena and silver in the cracks and joints; it has no regular walls, and the lodestuff does not differ sensibly from the enclosing country limestone except in being traversed by the strings and small veins of ore. I do not think that any reliance could be placed on its continuance either horizontally or vertically. The drives to north-west and south-east on its course, and following it as far as could be judged at the time, have not proved the rich ore to extend any considerable distance, and I do not think that this discovery will ever prove of much importance. It has even been detrimental to the mine, for it has diverted attention from the main lode. Its best point is that it proves that the country is favourable for the deposition of silver and galena, and therefore increases the probability that good ore will be obtained when the main lode is opened up.

The crosscut has been driven from 20 to 30 feet past the drive on the supposed course of the lode. In the face serpentinous dolerite makes its appearance, indicating the edge of the main mass of this rock seen on surface extending eastward for a long distance. Between the main drive and this face has been all called the "The Native Silver Lode," but I could see no reason for regarding it as lode-matter at all, though there may be a few minute veins of ore through the limestone. The main drive, south-east from the crosscut, goes through limestone for about 75 feet and then strikes a formation of brown and grey clay, stained with oxides of iron and manganese, and containing some chloride of silver in parts. The clay shows wavy lines and markings similar to that in the mouth of No. 4 tunnel. Where the drive strikes the side of this a crosscut has been driven to the north-east through it a distance of about 30 feet. In the face we again meet with the weathered dolerite. From the mouth of this little crosscut the drive is continued on a more easterly course than at first and passes through the formation which is known as the "Chloride Lode" into weathered dolerite once more. Near the end another small crosscut has been driven south-west almost along the edge of the dolerite, but is not yet through the lode-matter, if it may be called such. Connection has here been made with the surface by means of what is called an underlay shaft, but which seems to me to be inclined in a direction opposite to the underlay of the lode. This shaft is through weathered stained dolerite, and I could not distinguish any lode on which it had been sunk: it is very straight and even, and appears to have been started as an inclined rise, and continued on at the same angle of slope without any reference to the lode.


1712
87M
40 ac: T. C. Lempriere
1076
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Godkin Extended
S. M. C° No Liab.
Godkin S. M. C°. No Liab.
Serpentinous
Dolerite
Sandstone
1195
91M
80 ac
1615
87M
40 ac:
1721
87M
20 ac:
T. C. Lempriere
Limestone
H. Pearce
Godkin S. M. C°. No Liability
1700
87M
32 ac:
Slourton and Hill
Silver Creek
HYTE RIVER
1652
87M
40 T. C. Lempriere
PLAN
OF THE
GODKIN MINE
SCALE 200 FT TO AN INCH.
A. Montgomery
Geological Surveyor
5 cm

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Between the two crosscuts the lode-matter is more ferruginous, and contains more manganese oxide and also some quartz, and thus has more the character of true lodestuff. As this is evidently another contact between the limestone and dolerite formations, it seems probable that here again a contact lode has formed, and it is probable that if followed to the south-east the lode-stuff would be found to continue along the junction.

The drive to the north-west from the engine shaft was partly blocked up in the end at the time of my visit, and I could not see all the north-west end of it. For about 140 feet from the shaft it passed through limestone, a good deal shattered, and with a lot of soft clayey matter (pug) between the blocks. From 140 to 200 feet was all black "pug," containing fragments and lumps of limestone. From 200 feet to 233 feet from the shaft, which was as far in as I could get, there was a great deal of gossan; where first met with this was lying rather flat, resting on whitish clay, and this again on the black "pug." The gossan is largely composed of oxides of iron and manganese, but also contains a good deal of clayey matter and some quartz; it is, on the whole, similar to the gossany lode-matter found in the main lode on the North section. I was unable to ascertain if the dolerite was met with after passing through the gossan, but, judging from the shattered condition of the limestone and the position of the dolerite on surface, it is extremely likely to be close at hand.

90-*ft. Level.*—This was not examined by me, having been shut up by the new centering which was being put in the shaft. It passed through limestone, and then struck hard green serpentinous dolerite. Some lode-matter, 4 or 5 feet wide, taken to be the Native Silver lode, was cut at 130 feet from the shaft, but my informant could not tell me if it was at or near the contact of the limestone and dolerite or not.

110-*ft. Level.*—A crosscut has been driven to the south-west a distance of 189 feet from the centre of the engine shaft. For 116 feet it passes through hard solid limestone, then goes through fossiliferous sandstone for about 55 feet, and the remaining 18 feet was through soft sandy "pug." The end of the drive was filled up and could not be seen, but was said to have struck hard country again, either sandstone or limestone. A drive from the crosscut was put in to the north-west a distance of about 100 feet, following the soft "pug" formation; I could not get far into this, as the soft stuff had run very much into the drive and dammed the water back in it. A strong stream of water keeps flowing from this drive.

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It seems probable that the soft clayey formation met with in the 110-ft. level is identical with that passed through in the crosscut at the 45-ft., just before reaching the old main shaft, and that both are connected with the clayey contact mass seen in the first 180 feet of the No. 4 adit, and again past its junction with the crosscut; the gossan found in the north-west end of the eastern drive at the 45-feet level may also be connected with these.

The work that has been done, therefore, reveals that there is a tongue of sedimentary rock, mostly limestone, projecting out into the main mass of serpentinous dolerite, and that all round this, on its contact with the dolerite, there is matter of a more or less lode character; in parts it forms a true gossan, but generally it is very largely composed of clay, and only stained with oxides of iron and manganese. Though on the whole of a rather unfavourable appearance, still there is a certain amount of likelihood that ore will be found in parts of it, and to the south-east along the main contact of the two formations there seems every reason to expect that there will be a body of lodestuff similar to that found in the north section in the corresponding position. It may here be remarked that in the Godkin Amalgamated Company's sections on the south side of the Whyte River the tunnels that have been driven show the existence of wide ferruginous-stained masses of more or less lode nature at the contact of the dolerite and sandstone formations.

North Section, No. 5 Tunnel.—This is driven to the north-east across the line of the lode. For the first two hundred feet it passes through sandstone, the strata striking N. 40° W. and dipping as a rule to the north-east at pretty high angles. Between 152 and 162 feet from the entrance there is a band of broken iron-stained country where a good deal of water was struck when driving the adit. This has been taken to be the place where the Godkin Extended lode passes through the drive, but I hardly think it has anything to do with it: it is the axis of a small synclinal fold in the strata, for after passing through it we see them dipping to the south-west for some distance. At 145 feet there is another broken band of country much stained with oxides of iron and manganese, and which has evidently served as a channel for the passage of water through the rock. At 207 feet a distinct fault is met with; strike N. 40° W., dip 85° to N.E., showing slickensided surfaces. Immediately past this the strata stand vertical; so it may prove to be a fault of some magnitude, though I did not notice any sign of it in the adjacent Godkin Extended tunnel. Just past the fault the drive went through first three feet of sandstone, then struck beds of quartzite and flinty sandstone, dipping vertically. At 330 feet the beds begin to dip again a little to the N.E. and there is what may prove to be another fault, probably a small one. An occasional bed of hard siliceous limestone or calcareous quartzite is hereabouts met with, corresponding to the beds lying between the quartzite and the limestone in the Godkin Extended tunnel. At 338 feet there is a bed of clayey slate, and then sandstone

comes in again, similar to that passed through in the first part of the tunnel. At 348 feet this begins to be much broken and iron-stained, and at 355 feet it is so much impregnated with oxides of iron and manganese as closely to resemble lode-matter. At 396 feet the lode is reached and passed through at 424 feet: it consists of iron and manganese oxides, some clay, and a good deal of fragmentary wall rock. The lode appears here to be underlaying to the N.E. about 1 in 1. After going through the lode the tunnel has been continued for about 350 feet, in decomposed dolerite, which becomes harder and less altered as we proceed. A small iron-stained vein carrying a little silver was cut through, and followed a short distance to the north by a small drive, but was too small to be of any consequence.

From the tunnel a drive has been made along the lode to the north shaft: it is rather crooked, having been diverted from time to time from one course to another as the walls of the lode seemed to be at hand. In the first part of this drive, though there is much nice-looking gossan, there is also a great deal of clay and country rock, but towards the north-eastern end the appearance is much more favourable, the gossan being spongy and nearly all made up of iron and manganese oxides. Two winzes have been sunk, the first 34 feet deep, the second nearly 40 feet. In the first one a little galena and cerussite were obtained, and in the second ore came in at a depth of about 10 feet, continued to be got for about 8 feet, and then dipped to the north-east out of the winze, but was cut again by a small crosscut from the bottom of the winze. Just beside this winze a crosscut has been put in to the south-west, but not far enough to reach the footwall of the lode. Some very nice cellular gossan is seen in the mouth of this, probably corresponding to the ore vein cut in the winze. The north shaft is down 45 feet below the level, and would have been sunk deeper only that the water became too heavy for the horse-whim to deal with; it was raising from 1000 to 1200 gallons an hour, but could not cope with the flow. The chamber at the tunnel level is in very nice-looking gossan, and the shaft appears to be at the east edge of this; it is also at the east side of the huge outcrop of gossan on the surface, and this would indicate that the lode has very little underlay; however, 30 feet above the level a seam of galena was passed through underlaying to the north-east, and again sandstone has been found for ten feet in the bottom of the shaft, underlaying N.E. about 1 in 4, so that there seems to be really a certain amount of underlay to the north-east. As before remarked, from the nature of a contact lode it is likely that there will be sudden and considerable variations in the underlay. As the shaft below the level and the winzes had water in them at the time of my visit, I could not examine them to see the ore *in situ*. I, however, looked closely at the pile of it that was stacked at the mouth of the tunnel. It consists mostly of carbonate of iron, with veins and spots of galena and blende, very similar to the lode seen close to the creek at the mouth of Bell's Reward tunnel. A bulk assay is said to have yielded 12 per cent. of lead and 11½ ounces of silver per ton; and Mr. Godkin says that the average of his assays of picked pieces of the galena is 48 to 50 per cent. lead and about 37 ounces of silver to the ton. The stuff is too poor to be worth smelting as it stands, but would be worth concentrating; about 20 tons of it have been raised from the shaft and winzes. There is also a pile of from 15 to 20 tons of gossany stuff carrying galena and cerussite which has been saved, but which I should not consider to be of much value.

The workings from this adit are under the largest and best-looking outcrop of gossan on the property, and in the tunnel, too, the lodestuff is of a very promising character. The appearance of carbonate of iron and galena in the winzes indicates that the level is not much above the bottom of the oxidised capping of the lode, and gives hope that at a short distance down the gossan will disappear and be replaced by unaltered lode-matter carrying valuable minerals. It is clearly necessary to sink deeper, and the Company have now to consider the best way of opening up the lode at a greater depth; the most obvious way would be to sink the north shaft deeper and open the lode from it; this involves putting a pumping engine on the shaft and enlarging and re-timbering it before sinking could be resumed. It has been proposed to remove the Worthington pump from the main engine shaft on the south section to the north shaft, but I cannot see that this would be a really effective solution of the difficulty, for the experience now gained as to the quantity of water in the country renders it highly probable that the present plant will not be able to cope with it. If the Company were in a position to put an 18 or 20-inch lift on the north shaft or on a new shaft more to the south east of it, so as to be more in the centre of the body of ore to be worked, I should recommend them to do so, and eventually, if the mine comes up to the hopes entertained by its owners, it is likely that such a shaft will have to be sunk. I do not think it would be worth while moving the present engine, however, but would rather see the new shaft at once equipped with one able to deal with any water likely to be met with.

An alternative proposal has been made, which seems to me in the present state of the Company to be the most advisable to adopt, namely, to drive in to the lode in the south section from the Whyte River and then to drive along the lode to below the north shaft. Surveys have been made by the officers of the mine which show that an adit could be driven to cut the lode immediately under the mouth of No. 4 tunnel at a depth of 111 feet below the brace of the engine shaft, or almost at the present 110-feet level. The south-west corner of the southern section is very flat-lying ground, and an open tail-race is proposed to be brought in from the side of the Whyte River for a distance of 12 chains, at the end of which it will be 10 or 12 feet deep. For about 500 feet further

the depth will gradually increase to about 20 feet, and it will depend on the nature of the country whether an open cutting can be taken in or a tunnel driven. Finally from 360 to 400 feet of driving through sandstone country should reach the lode. From this point to the north shaft is a distance of about 2000 feet. The entire cost of the work would probably amount to about £2500 when completed; the benefit of it would, however, be perceived long before completion, for it is probable that soon after cutting the lode the latter would drain so as to enable the north shaft to be sunk to the level of the new tunnel and work carried on from the north end also, while a considerable amount of stoping of ore might also be anticipated to be done. The present engine shaft perceptibly drains the north section, so that it is reasonable to expect that the new adit would do so also. Besides this it is so low down that we may pretty confidently expect that even in the southern section it will strike the lode below the zone of oxidation, and therefore in driving along it there will be every probability of cutting through any shoots of ore contained in it. The entire length of the lode will be prospected from it at the lowest level at which natural drainage can be secured, and the pumping engine on the present main shaft will be dispensed with, effecting a saving of about £24 a week, or will be set free to enable the shaft to be sunk deeper and allow of further prospecting being carried on below the water level on the "chloride lode" and other parts of the eastern contact lode. Besides these there is another powerful argument for its construction: not only would it serve the present purpose of prospecting the mine and postponing the erection of an expensive pumping engine, but it would also be permanently useful as a drainage level, as it would never be necessary to pump the water any higher than to it. As it will be about 115 feet below the No. 5. tunnel this will mean that every gallon of water raised in future, even when the main new shaft is down, will have to be lifted 115 feet less than if it did not exist—a continual economy in pumping expenses that would soon repay its cost.

In calculating the expense of this work at £2500 I have taken the cost of the other work done on the mine as a basis and have allowed a margin for contingencies; but if it should prove that the lode is quite unoxidised along the tunnel level and is largely composed, as is likely, of hard carbonate of iron, the cost of driving will be greater, and the total expense would probably somewhat exceed £3000. Mr. Godkin has estimated that it would cost £1000 to remove the Worthington pump to the north shaft and to enlarge this and sink it to the tunnel level, and I do not think it could be done for less. The engine is, however, required in its present place for deeper prospecting of the eastern lode, and it would therefore be a pity to move it. Taking everything into consideration, I think that the long drainage tunnel would be the best work the Company could undertake under present circumstances. Though of permanent value for drainage purposes, it will not be of any use for haulage of ore unless a new machinery site can be got further down the Whyte River—a question on which I have no knowledge. The present engine shaft is not too high to supply the dressing-works with ore as it is, for it is important to have the material raised once for all so high that in going through the dressing-sheds it can fall downwards by gravitation from machine to machine without being handled or elevated. The main shaft is well situated for delivering the ore to the machinery site, and this supplies another reason for not removing the engines from it to the north shaft, as the former is the better situated for winding. To get the ore from the north shaft to the dressing-sheds an aërial tramway would probably be required, or else a long ground tramway too crooked to be worked automatically, so it would be better to truck it underground along the new tunnel to the present winding-shaft, raise it there to surface, and let it run from there to the dressing-sheds by a self-acting tramway. To do this the present 110-feet level would have to be extended to join the new tunnel along the line of the lode. If it is decided to make the drainage tunnel, work should be carried on from the 110-feet level simultaneously with the cutting of the tail-race, so that the crosscut might have reached the lode and a good deal of driving been done on it before the drainage tunnel reached it. Owing to the want of fall in the ground through which the tail-race passes it will not be possible to tip the stuff from the tunnel except at the Whyte River, unless an incline is constructed at the entrance. With such a long way to carry the stuff before tipping it the expense of driving will be much increased. It will therefore be best to raise as much as possible of the spoil from the tunnel through the main winding shaft and save trucking it such a long distance.

I would therefore recommend that the construction of the new tunnel be begun simultaneously from the 110-ft. level of the engine shaft and from the Whyte River. It is possible that when the 110-ft. crosscut strikes the lode the water will be drained at once in the north section, and that sinking the north shaft with the present appliances can then be resumed, and ground opened up for stoping.

If the drainage tunnel is made I do not think that any steps should be taken towards sinking a new main shaft until the former work is completed, except making arrangements whereby there would be no delay in getting a good pumping plant, should such be required for deeper sinking. The tunnel will prospect the mine pretty thoroughly, and will allow a fair estimate to be made of the water likely to be met with lower down. Should the prospects of the mine then warrant deeper sinking a site for a main shaft to command the whole length of the lode will depend very much on the position of the ore-shoots found, and therefore cannot be chosen at present.

Another drainage tunnel has been proposed, from the side of the Whyte River above the machinery site. This, however, would be 21 feet higher than the one recommended, and would be as long or even longer than it, certainly much longer if it is found that the open approach to the latter can be taken right through the flat ground and up to the foot of the sandstone spur. The only advantage the second tunnel would have would be that it might be driven along the eastern contact of the dolerite and sandstone formation, and would therefore be likely to be in lodestuff. Seeing that the gossans found in the No. 4 tunnel, or 45-ft. level, prove that the zone of oxidation of the lode descends below it, and that it is imperative to get below this zone, I think that the scheme recommended should be preferred, as being more certain to reach the unaltered lode-matter.

Prospects of the Mine.—In spite of the large amount of work that has been done and the great expense which has been incurred, the future of the mine is still entirely a matter of speculation, depending altogether on the results of further prospecting work. No ore of payable value is yet in sight. Notwithstanding this the prospects must be regarded as fairly good. The gossan in the No. 5 tunnel is of a favourable appearance, and is now giving place to unoxidised ore carrying galena of good assay value, and there is reason to hope that valuable deposits will be found at no great depth below the present level. In the southern section native silver has been found accompanying the veins of galena, and a little silver exists in all the gossany matter ; the lode appears to be strong and permanent over a long distance. There is every inducement to go to the expense of further opening and testing the mine, and very reasonable hope of its turning out remunerative.

Much adverse criticism has been lavished on the way this mine has been worked, but I do not think that this has been fairly deserved. It is only now that a great deal of work has been done that the nature of the lode occurrence is evident, and so far as I can see there has always seemed to be good reason for all the work that has been undertaken at the time it was done. That so much of it has proved futile is unfortunate, but I do not think that any stronger term can be fairly applied. The discovery of the native silver naturally diverted all attention to the eastern lode, and postponed the attack upon the main lode. The great outcrop of gossan in the north section, however, ought not to have been neglected so long, and it is unfortunate that it was not opened up from the first instead of the southern section.

In my opinion a mistake was made in extending the tramway from the Whyte River to the Arthur River. From the mine to the Whyte River it was required, but from the latter the road would serve all present purposes. Should the mine become of importance the tramway to the Arthur would be very useful, but it has been erected needlessly soon, and money that would have been better spent in underground work is locked up in it.

I have the honor to be,
Sir,
Your obedient Servant,
A. MONTGOMERY, *M.A.*, *Geological Surveyor.*

The Secretary of Mines, Hobart.

WILLIAM GRAHAME, JUN.,
ACTING GOVERNMENT PRINTER, TASMANIA.