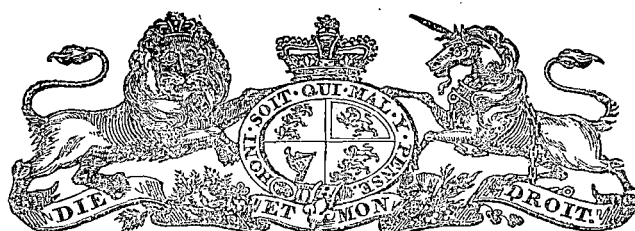


(No. 118.)



1882.

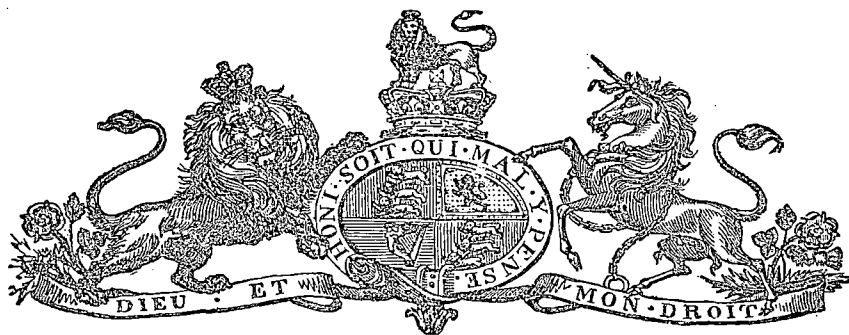
TASMANIA.

HOUSE OF ASSEMBLY.

LEFROY GOLD FIELD:

REPORT BY MR. THUREAU, F.G.S.

Laid upon the Table by the Minister of Lands, September 29, 1882, and ordered
by the House to be printed.



REPORT on the Mineral Resources and Permanency of the LEFROY GOLD FIELD, Tasmania.

THE principal rocks comprise at the surface soft light-coloured sandstones, with thin bands of slate alternating the beds. These change in depth into black dark-greyish sandstones and satiny slates heavily charged with iron pyrites. The district is formed of rounded hills, not rising above 320 feet above the principal watercourses draining the region, and which ultimately empty into the Nine-Mile Creek. Vein mining of auriferous quartz forms the principal feature of the district, though some alluvial deposits were formerly wrought with tolerable success. The country rocks are covered in places both with a detritus and a talus of considerable thickness, exclusively composed of angular and semi-angular quartz. Tertiary washes exist also in close proximity to flows of basalt, which overlay these deposits. The continuance of these "auriferous" pliocene gravels has been proved beneath the basalts at considerable depths, thus demonstrating the permanency of these hardly sufficiently tested deposits. There is an absence of any other eruptive or intrusive rocks in this neighbourhood, except, perhaps, a dyke of feldspathic granite on the road to and half-way from Lefroy to George Town.

The quartz reefs are found in very peculiarly foliated silurian schists, already described, and without very close observations the nature of the "wall-rocks" to the quartz lodes cannot be understood.

At first sight these schists appear to occur in very thinly laminated beds, exhibiting a wavy texture throughout, and almost horizontally deposited. They are traversed by subordinate, more or less vertical, joints closely resembling the carbonaceous forms of strata. After a more extensive survey all over the district, however, I found that these beds formed a portion of an anticlinal section of strata (nearly four miles across), the apex of which is moreover very much depressed and disjointed. And it is in that kind of country where, within certain zones, the Lefroy reefs occur, or, geologically speaking, in the "division of the country" so well known on the Garden Gully and other lines of reef, Bendigo. The Lefroy reefs, therefore, occupy clefts or fissures in the silurian beds; and as these lodes traverse the strata at nearly right angles, and more or less vertically, they are somewhat irregular in their course, owing to the character of the wall-rocks enclosing same.

(*Sketch A.*)—With regard to the tertiary gravels, it may be observed that a prominent eminence, immediately east of the New Native Youth line of reef, and close to where the East City of Launceston G.M. Co. used to carry on their operations from a now abandoned shaft, is capped by an older tertiary drift (pliocene), but so far no attempts seem to have been made to prospect same for gold, which may probably exist where, nearer the creek, this wash rests on the silurian bedrock.

(*Geological Plan B.*)—The principal valley, Sludge Creek with its northern course, near the quartz reefs, exhibits both the detritus and the pliocene gravels within a short distance only of the edges of a ferruginous band of mottled red to brown clay, which overlies those pliocene gravels, the former being in turn overlaid by a blue mottled clay, both beds being occasionally overlapped by the detritus (recent) referred to already. These characteristic beds of blue (dark) mottled clays resemble much those formed of volcanic ashes and "scoriae" so frequently occurring with deep diluvial gold deposits in other gold-producing countries, viz., Australia and California. A change of soil denotes here, the same as elsewhere, the presence of other strata; a rich, porous, though stony chocolate-coloured earth gives evidence of a decomposing highly-crystalline lava, i.e., basalt, existing hereabouts. It is of a deep green colour, owing to an admixture of this rock with "olivinite," besides enclosing in its vesicular cavities crystalline species of the Zeolite group of minerals.

At the sides of the valleys or creeks the ranges still exhibit the silurian schists with their covering of quartz detritus, the older tertiary drifts having been buried beneath the subsequent flows of basalt now covering or filling the original pre-historical, and much deeper valley. These basaltic flows,

passed, doubtless, in their igneous liquid state over the tertiaries, and became solidified, and there is consequently every probability of those pliocene gravels, as the result of abrasions and denudations of the Lefroy reefs, having become auriferous; on the road to the Back Creek, these tertiaries in fact, where deprived of their volcanic coverings, have been sluiced to a considerable extent at the edges of the deeper channels.

(C.)—On the plan of leases accompanying this report, it is shown that a shaft had been sunk to a depth exceeding 100 feet through hard basalt without reaching either the wash or the bed-rock, thereby indicating a considerable depth in the pre-historic valleys in that vicinity.

Of the quartz lodes, the New Chum "line of reef" may be cited as the more regular and continuous in this locality, though, of course, the behaviour of this lode is also subject to various changes as to width and metalliferous character, which are in accordance with the varying nature of its wall-rocks, but, on the whole, it may be stated that the reefs at Lefroy are, in my opinion, "true fissure lodes," and, therefore, more likely to prove permanent in depth and strike. This view is supported by the fact that no primary rocks (granites) occur in large quantities in the vicinity, which latter in Tasmania have already had the effect, singularly enough to record, of causing a gradual transmutation of auriferous quartz into an almost exclusively stanniferous and cupriferous veinstone.

The plans, sections, and diagrams furnished for elucidation of this report will exhibit the peculiar features observed: it is satisfactory to note also, that, although the petrifications could not be discerned for purposes of classification, the metalliferous properties of the lodes do not appear to afford evidence altogether unfavourable to their continuing to do so, similarly as they do now, at greater depths.

With greater depths, however, it is quite clear that the density and tenacity of the country rocks materially increase, consequently mining operations are not only greatly retarded but become much more expensive. On that account principally, and manual labour adding so much to the cost of raising and reducing the quartz, the deepest level at any Lefroy mine (600 feet) has been abandoned for a time. With the assistance of the modern percussive rock-boring machines worked by means of compressed air, fully 50 per cent. more work can be done in a given time, and at less expense, than manual labour, so that these levels, if driven at so much greater speed, if they once intersected gold-bearing stone which would not pay with manual labour, would leave a profit beyond expenses.

The veinstones, auriferous in character generally, richer where "shoots" of gold traverse the lodes, do not at Lefroy exhibit any material decrease in width or extent along their strike, certainly not more than at other quartz-mining centres; but at the same time it is to be deplored that a system of mining has to some extent obtained, which is detrimental to the future stability of this district, the same as it has been at other quartz mining districts. I refer to the exhaustion of the gold-bearing veinstone in some cases, in the stopes of their lowermost level, *before* another and deeper level is opened for stoping. The effect of this pernicious procedure may be stated as follows:—By the time that the yet remaining ore in the stopes approaches exhaustion, the yields gradually fall off, and the stocks recede in price or value: with greater depth, more powerful pumping and winding appliances for carrying on mining at still lower levels become a necessity, and as all previous profits have been divided amongst the owners, calls are requisite to cover that outlay, inducing thereby a feeling of insecurity that should not exist were a more judicious system adopted and observed. In other quartz-mining centres this "raking" out of the richer stone, with its unpleasant consequences, had to give way to the "continuous" sinking, cross-cutting, and generally developing of their mines, in the first instance, followed likewise by a judicious "blending" of the richer with the poorer class of quartz, thereby ensuring average and certainly much more satisfactory results. In making these remarks it may also be pointed out that this present system has another and even more serious result, because, on opening a deeper level, should it be found, as is very frequently the case, that the stone is much poorer than it was in the levels above, such an occurrence will induce a belief throughout the mining community and the colony at large contrary to the permanency of the gold continuing in our reefs to great depths, notwithstanding the experience, mostly to the reverse, of such in Victoria, California, and Nevada.

From north to south there are at present seven principal lines of reef that have been proved gold-bearing (more or less),—

1. Hackett's.
2. New Chum.
3. Native Youth.
4. Golden Point.
5. Prince of Wales.
6. Star.
7. Caledonian.

Besides these, there are others, such as the Shanrock, Birthday, which have been abandoned for some considerable time.

The *Hackett's* line of reef is situate about $1\frac{1}{2}$ miles north of Lefroy township; it occurs in a soft white to reddish argillaceous slate and sandstone (upper silurian), which is besides traversed by numerous veins of white crystalline quartz. A considerable number of small shafts have been put down on its course to various depths, not exceeding, however, 64 feet. The reef so near the surface is narrow, and it underlays to the south. Judging from general indications, the auriferous quartz forms most probably a portion only of other and parallel veins not yet discovered. The gold appears to occur in that characteristically crystalline quartz, without much regularity, but very rich specimens have from time to time been found in this reef. Inducements are held out for prospecting the ground by means of crosseuts, and the sinking to greater depths, where in the harder strata those veins may consolidate into a more compact body of auriferous quartz.

THE NEW CHUM LINE OF REEF.

This lode presents all the features generally observed with regular gold-bearing veinstone. Not only has this lode been proved auriferous at or near the surface for a very considerable length along its strike, but it has every appearance of so continuing until overlaid either by the carbonaceous sandstones, or the basalt occurring nearer George Town. Gold-bearing stone, more than payable, has likewise been traced to a good depth, viz., the 270 feet level.

The quartz exhibits a highly mineralised and laminated character, and the gold is well distributed, though in several shoots of gold it is even more richly apparent. These shoots of gold in traversing the body of the lode dip at certain angles, thus leaving the spaces intervening between the shoots comparatively poorer, if not barren. The width of the payable stone varies on the average from less than a foot to 10 feet, and the bearing of strike ranges from E. 6° N. to as much as E. 15° N.

After examining the mines where on this line of reef actual mining operations were carried on connected with the winning of ore, I would observe that there were three complete winding and pumping plants of ample steam power at work, sufficient to reach eventually levels from 500 feet to over 800 feet in depth; of these three companies, one was crushing the quartz raised in their own batteries; two others were erecting their own crushing machinery, one of which was meanwhile crushing at the New Native Youth Company's batteries; and farther west still, two other proprietaries were engaged in the erection of winding and pumping plants, thus exhibiting a scene of great activity not often met with, and evincing at the same time the strong confidence those interested have in the New Chum reef. There were at the same time three or four large shafts going down at considerable distances in advance of those that had already proved the continuance of this gold-bearing reef in their respective leaseholds.

The East New Chum Company.—At their only level, 240 feet in depth from the surface, which is, however, 40 feet deeper than that of the adjoining New Chum Company west, the New Chum reef was intersected in a crosscut driven south from the shaft at a distance of 23 feet; the lode was narrow there, but has increased considerably in the western level, and exhibits payable gold. A winze was sunk below this level to a depth of 26 feet, in which a somewhat larger stone, also showing some gold, was followed.

The New Chum Company have opened their ground or mine from three different levels; viz., the No. 1, at 120ft. from the surface, at which depth the reef was intersected in a crosscut driven 60ft. south; the No. 2 at a depth of 180ft., also with a southern crosscut 68ft. 6in. in length to the reef; and the No. 3 at 240 ft. with a crosscut of 78ft. south. The difference in the surface level will account for the otherwise seemingly corresponding depth of levels in these mines, which, in reality, are widely separated, through the various levels differing from datum level.

The lode at the lower level in the "east" end was fully 5ft. in width in the back of the drive, and 2ft. 6in. in the bottom, increasing, however, to a width of 8ft. in the back of the first stope above. Judging from the general appearance of the New Chum reef in this mine, it may be observed that the quartz shows a very good character for gold. The reef consists of crystalline quartz, in which numberless angular fragments of the wall-rocks are embedded, and it is besides highly mineralised by both arsenical and iron pyrites, chalcoppyrites being less frequent. The average gold yield has been very satisfactory for the owners, to whom an amount of £57,250 sterling has been disbursed in the way of dividends. The company have erected a separate and powerful pumping plant, leaving their other engine to do the hauling exclusively. Tenders have likewise been accepted for the supply and erection of a 15-head battery, to be furnished with all the usual modern gold-saving appliances. This will enable this company in a short while to dispense with the contract entered into with the New Native Youth Company for crushing at their mills, where at present the quartz is delivered at a fixed price by means of a tramway about three-quarters of a mile in length.

The West New Chum Company, immediately west of the last, are carrying on their underground operations at a deeper level than any other on this line of reef, and their shaft is still in the hands of the "sinkers."

Their lowest level was opened at 270ft. from the surface, and the lode was intersected in their southern crosscut. at 95ft. from the main shaft. The surface appliances comprise, besides winding and pumping engines, also an effective crushing plant, all of which are in good repair, and kept in a good working condition.

The main shaft is divided into three compartments, one for pumping and footway, and the two others for winding, with trucks and cages. All the principal workings are secured with strong timber, whilst the exhausted stopes have been properly filled with loose rock, thus ensuring safety from collapse of the workings. In this, as well as the last mine, the managers have utilised old shafts and winzes for the purpose of securing, besides the ladders in their respective pump shafts, independent footways or ladder roads from their bottom levels to the surface. This is a valuable means for escape in cases of possible collapse in the workings, whilst at the same time the ventilation of the latter is considerably improved. As far as their portion of the New Chum lode is concerned, it partakes of the general character observed in the two mines just described, the only and peculiar feature worth while referring to in this connection being the gradual curving of the vein in the centre of the lease towards the south from the western and eastern boundaries (*D.*) Besides there occur no less than three distinct shoots of gold, which dip at angles varying from 40 to nearly 55 degrees in their declination to the west. Between these richer channels, so to speak, of stone an apparently almost barren quartz forms the intervening portion of the New Chum reef. In their lowest level (270ft.) preparations were being made for the erection and fixing of an underground "balance-bob" or "beam," which is intended to take the weight of the rods and pumping gear working above this station or plat. For this purpose a chamber was being excavated opposite the ordinary working plat in which the above balance-bob, having a beam 24ft. in length, could be securely fixed and bolted to its properly massive foundations. Above the next higher level but little really remunerative stone remained in the stopes, thus illustrating what has been observed above on the same subject, but below that level in a winze very good quartz has been followed downwards. The lode has since been intersected in the 270ft. level, or No. 4, and in that crosscut (95ft. in length) about midway a gold-bearing spur has been met with, whilst the lode itself has been parted into two distinct bodies ("legs"), the one nearest the shaft (north) being almost vertical, and the other (south) having an underlay in that direction of nearly 70 degrees.

As this feature has been observed in the eastern stopes, its regular occurrence at the point of intersection in the crosscut was necessarily anticipated. This company have also distributed £22,000 sterling in the shape of dividends.

The West New Chum Extended Company are preparing for the erection of a steam plant, and meanwhile mining operations were suspended at a depth of 189 feet in their shaft.

The South-West Chum Company were also idle; their shaft had reached a depth of 200 feet, and machinery would be requisite to overcome the influx of water.

The Great West Extended New Chum Company ("Boys") have sunk two shafts. Of these two their old shaft was 260 feet deep, and they had opened at the 250 feet level. Their new whim shaft had reached a total depth of 140 feet, but at that level they had so far failed to intersect the continuation of the gold-bearing stone which was found at the 100 feet level in the old shaft, though they had driven along the reef for a distance exceeding 100 feet in length. The gold-bearing stone measured from 6 feet to 8 feet in width.

The United Chum Gold Mining Company intersected the lode in their whim shaft at a depth of 220 feet from the surface, where the reef presented a very promising appearance, being of a nice friable character, full of pyrites, and carries good profitable gold. They are sinking a new main shaft from beneath, 82 feet in depth, such shaft measuring 10 feet by 3 feet 6 inches in the clear of timber, and divided into three compartments. Pending the erection of winding, pumping, and crushing machinery (since completed), all underground operations are stopped, except the sinking of the main shaft, which is carried down by means of three shifts of experienced miners.

The plant in course of erection consists of a 16-inch cylinder crushing engine capable of working 15 heads of stampers, of which 10 heads will be started, with one 14-inch cylinder engine for winding and pumping purposes. An extensive dam has been built close to the mine, from which the batteries and steam boilers will be supplied with water by means of open cuttings and a tunnel 190 feet in length. The preparations for mining and for the reduction of the quartz are on a plan which cannot fail to give satisfaction, as the nature of the quartz admits of a larger quantity being crushed in the batteries than is usually the case.

The remaining quartz-mining companies located still farther to the west on this line of reef are exclusively engaged in sinking main shafts to considerable depths, with the intention of intersecting the New Chum lode by means of crosscuts. All of these, with one exception, which is using a whip for raising the *debris* mined to the surface, are employing horse-whims for that purpose, which entail, of course, a treble relay of horses and drivers. Considering that horsefeed is dear and fuel cheap,

and that the miners are able to break out the rock in such quantities that exceed the ability of the horses to raise in a given time, and finally, that in cases of bursts of water on intersecting the reef at low levels the miners are in danger, it becomes a very grave question for careful consideration by those who may have the control of these mines, whether it would not be safer, cheaper, and more judicious on their part to employ suitable steam winding engines instead of either horse whips or whims.

The Ryhope Gold Mining Company are sinking their shaft from below the 180 feet level. The dimensions are 8 feet by 3 feet in the clear, and it is divided into three compartments, including one ladder-road. They employ four miners, and raise their *debris* by means of a whip.

The Band of Hope Company are sinking by means of a horse-whim below the 150 feet level. Six miners are employed below, three on the surface, besides three drivers.

The United Chum Extended are also sinking, and had reached a depth of 118 feet from the surface. Their shaft measures, in the clear of timber, 9 feet by 3 feet 3 inches. It is divided into three divisions, and worked by means of a horse-whim.

The Consolidated New Chum Company are located farthest west on this line of reef, and they are sinking a finely timbered main shaft from beneath the 140 feet level. The dimensions of this shaft are as follow:—10 feet long by 3 feet 6 inches wide, which will enable them to cope with any quantity (however large) of quartz or *debris* to be raised by suitable steam machinery. At present they are doing this work by means of a well-built and strongly stayed horse-whim, which may suffice at the present; but eventually stronger and more rapid means will have to be adopted. The sinking has been through hard slate and sandstone, in which some quartz veins were discovered of a non-auriferous character however, because the auriferous channel of country is supposed to occur at a considerable depth beneath those spurs.

It will be seen from the above that, out of 11 mining companies, not less than five have proved the New Chum reef as gold-bearing and profitable to work, the remaining six companies being in a favourable position for soon proving the value of their respective leaseholds in a similar manner. This extension of auriferous quartz at so inconsiderable depths cannot, in my opinion, be held otherwise than as equally reassuring and satisfactory as the continuation of rich quartz down to the 270 feet level; and so far there appear to be no indications at that extreme depth (though moderate in comparison with lodes in other quartz mining centres), which could be taken as detrimental to the future prosperity of this lode.

Proceeding farther south, the Star line of reef is the next that occurs at Lefroy, but as there was very little work carried on at the time of my inspection, nothing very positive could be stated regarding the prospects, though profitable gold has been found, I understood, in several parts of this lode. Of the companies that were at one time at work, that of the East Morning Star were about to resume operations, their steam pumping and winding plant being overhauled for the purpose. Their shaft is 200 feet deep, and in a crosscut 30 feet to the south a reef nearly 4 feet wide was intersected. It was found that the richer run of quartz would yield over 1½ ounces of gold to the ton if kept separate, but by taking the whole reef on average 8 dwts. of gold had been obtained.

The Native Youth reef is about the oldest quartz lode that has ever been opened in Tasmania; it has been worked along its strike for a considerable distance, and the underground workings are of a very extensive character. Out of quite a number of leases as delineated on the geological plan, and also on the plan of leases of the goldfield of Lefroy, only one or two are really carrying on active mining operations, thereby restricting, it will be granted, the possibility of fresh discoveries. A number of these leaseholds have been amalgamated, not only on the Native Youth line of reef, but likewise the amalgamation includes a lease on the Golden Point line, which is quite a distinct lode from the former. I found that only one main shaft was at work, at which a steam pumping and winding engine was employed, thus concentrating the underground operations within a limited area in the close vicinity of the same, leaving the outside and considerably more so extensive portions of the leases for future development whenever this amalgamated proprietary may seem fit to extend their operations.

The New Native Youth Company employs, besides the above steam plant, a first-class crushing plant for reducing their quartz raised from the mines, or that of others in the vicinity. I was informed that this proprietary had carried on their mining operations with a very considerable amount of success, enabling them to pay its shareholders from £50,000 to £60,000 in dividends. It has been found judicious generally in cases of prosperity with mining concerns, to provide for a reserve fund, in order to aid the shareholders in the future development of their property in times less propitious, whilst maintaining likewise the value of their stock. If this had been done in some cases that need not be particularised here, there is no doubt but that such a course would have proved greatly to the advantage of those interested. This mine has been opened from the main shaft by means of the following levels, viz.—at 200 feet from the surface; at 260 feet ditto; at 320 feet ditto; at 450 feet ditto; and at 600 feet. As this mine, from all appearances, is located within

the centre of the division of the country described above, the lode is necessarily disturbed in its regular course to some extent. (Sketch *E*.) There are three principal faults or heaves in this mine, which interrupt or throw the Native Youth lode from north to south 20 feet, 16 feet, and 9 feet respectively; in fact, the strata near to the lode is considerably contorted and disjointed. The laminations of the strata nearer the shafts are nearly horizontal, but they assume a more and more westerly incline west, which at their dip is nearly 45° . As will be seen from Plan *AF*, the strata not only exhibits an anticlinal dip south-west and north-east, but the bodies of auriferous quartz at or near the 320 feet level occur similarly, though crossing the wall-rocks at nearly right angles. This is specially to be noted in the drive (at the 320 feet level), which followed the faulted-cross-course at a point 150 feet a little west of north of the main level. The run of gold-bearing quartz commences to dip north and also to the south, which feature is so frequently observed with the Bendigo quartz lodes, on a much larger scale however. It may also be observed that the lode maintains its course north to 12° east, and is made conspicuous by a peculiar soft deep black vein of "flucan" (*G*.) which encloses thin veins or blocks of quartz very rich at times. Besides these, two richer and wider shoots of auriferous stone occur, which diverge in their dip from their apex located above the 200 feet level (*H*.) Besides these so very characteristic "faults," "heaves," &c., there is another peculiarity which deserves attention on Plan *AF*. It is shown that at (*B*.) this fault, &c. is enriched by a seam of quartz for a considerable length along its north-western strike, and two small offshoots—which have a parallel strike to that of the main lode—were also observed, highly auriferous. Without the plans, sections, and sketches prepared for this report, it is scarcely possible to explain these matters very clearly, as they doubtless deserve every attention, because the indications are in the direction of undiscovered veins of quartz running parallel to those wrought up to the present time. At the same time it is also very apparent that the 450ft. level would, as it is now being extended through a very massive quartziferous and mineralised formation towards the Excelsior shaft, intersect the continuation of the auriferous stone dipping in that direction, as would also the 600 feet level if driven along the lode in the same direction.

The 600 feet level was submerged in water, and the information I obtained was to the effect that the New Native Youth lode had been driven on its course 360 feet east, and 85 feet west. The lode was a very strong formation of mineralised quartz 10 feet in width, but yielding only 2 dwts. of gold per ton. That increase in width at that deep level would be a favourable indication for greater regularity in depth, if only it were also traversed by shoots of richer stone, the same as on the New Chum line of reef. At this level* the prospects would be more reassuring had the adjacent country been prospected by means of crosscuts of good length. This would have enabled me to pronounce for or against the success of deep quartz-mining in this part of Tasmania. And as that question is of pre-eminent importance at Lefroy and other quartz-mining centres, it is quite certain that, as a preliminary step, the mining diamond-drill could be most advantageously employed to remove doubts that may exist in regard to this important problem. The steam winding and pumping machinery consists of one boiler, 27 feet long by 5 feet 6 inches diameter, and another boiler 18 feet long by 4 feet diameter, which work at 40lbs. pressure per square inch. The horizontal engine is 22 inches in diameter of cylinder, having a stroke of piston of 4 feet. This engine works both the pumps, and two spiders for flat Manila ropes; the lifts are $8\frac{1}{2}$ inches in diameter, and two plunger workings are fixed and geared at the 320 and 450 levels; the stroke being at present 3 feet only, as quite sufficient to keep the lower level free from water, though occasionally tanks are likewise used in the central division (3 feet x 3 feet 6 inches each), into three of which this shaft has been divided; the ropes have been in use for three years, and they are now adjusted to wind, if necessary, from the 1200 feet level.

The crushing machinery is worked by means of two Cornish boilers (a third is held in reserve), each of which measures 27 feet long by 5 feet 6 inches diameter, at an expense of from 30lbs. to 35lbs. per square inch steam pressure. Two coupled engines, each 18-inch cylinder, with a 3 feet 6 inch stroke, work the batteries of 40 heads, weighing 900 lbs. each head, and the drop, adopted in accordance with the average kind of quartz manipulated, ranges from 7 inches to 9 inches. The gratings have from 196 to 225 holes per square inch, and outside of the boxes the means for intercepting and aiding the amalgamation of gold consists of copper plates, mercury, ripples, blanket strakes, and tyes. It is calculated that the average amount of duty for every 5 heads stands at $3\frac{1}{2}$ tons of quartz crushed for every eight hours. The whole plant is very complete, compactly put together, well kept in order, and housed in. The so very requisite cleanliness in these "gold mills" is here much facilitated by the terraces along the tables and at the head of tyes, being constructed of cemented floors.

The Caledonian line of reef is situated south of that dividing range which rises to 320 feet in height above the local datum level, or about 578 feet above the sea level. This lode appears to be on the same bearing nearly, if the different altitudes of the others are considered, as those of the Birthday and Shamrock farther east. The strike of same, as ascertained in the Land o' Cakes Co.'s mine, is about east 18° north, for a width of stone from 3 feet to 12 feet. It is a well-defined gold-bearing formation, embedded in blue slate and grey sandstone, so favourable to permanent auriferous

* 600 feet from the surface, and nearly 350 feet below sea level.

reefs. There are several other leases held on this line, but only one other was at work,—viz., the Caledonian,—which has had a very good return from a small parcel of quartz crushed, and they are now endeavouring to trace same to a lower level. The Waverley Co., situated between the two former leaseholds, have intersected the reef at two different levels, but so far have met with little success, though at a greater depth their prospects may be said to be good.

Neither the leases nor other holdings on the Birthday or Shamrock lines of reef were in operation, and but little authentic information could be obtained for the purposes of this report.

In connection with the auriferous vein mining at Lefroy, the concentration and accumulation of auriferous pyrites and sands after crushing has been carried on to some extent, though not quite so extensively as this branch of gold production from those ingredients would seem to warrant, there being a considerable percentage of these metalliferous substances distributed both through the quartz lodes and the adjacent country rocks. Large quantities of coarsish pyritous tailings, rich in gold, the result of older and imperfect quartz-crushing appliances, have accumulated, and they are now manipulated for gold extraction in two different ways; viz.—

- I. By grinding to a pulp in Berdan basins with mercury; and
- II. By roasting in a reverberatory furnace, and subsequently grinding the ores with mercury in Chilian mills.

With regard to the former process, it was evidently sought through reducing, by means of the “mullers” in the Berdan basins, the size of grain of the pyritous sands, and by using a copious supply of mercury throughout to fix and obtain amalgamation of the thereby liberated particles of gold. Inasmuch, the basins and the “mullers” were both constructed of iron, the more these tailings were ground with mercury the more the latter became enveloped in iron films, and the greater would be the difficulty in recovering the quicksilver. In this case, where there was but a very imperfect mode for concentration, after grinding, the loss of quicksilver must be, of necessity, very large. The loss of quicksilver by this system is, however, a matter of great importance, not so much on account of the value of the mercury, but because it usually or always indicates a corresponding loss of gold. The greater part of the mercury passing away has been ground to a fine grey slime, and when placed under a microscope or other powerful lens, it is found to consist of extremely minute globules of mercury which will not unite (technically termed “floured”); and in most cases it is so heavily charged with gold as to deserve the name of “floured amalgam,” which swims on the top of water and passes away. The use of Berdan basins, with the view of reducing coarse pyritous tailings to fine pulps simply, would be most effective if the latter (pulps) were afterwards calcined in proper roasting furnaces previous to “chlorination,” but for the purposes of concentration and amalgamation only the result cannot be successful, inasmuch as both gold and mercury will escape in too excessive percentages as to render the processes remunerative enough to be adopted or to be persevered with.

The second method, of roasting in a reverberatory furnace, and grinding the thereby desulphurised residues in Chilian mills with mercury, is one yet greatly in vogue in some gold-mining countries, because it gives average results, and does not require scientific training or a knowledge of chemistry; but, if considered in connection with the chlorination processes, so universally adopted in California, Oregon, Nevada, Colorado, and by one proprietary at Sandhurst (Victoria), the great superiority of chlorination becomes at once apparent,—viz., that by its means upwards of 97 per cent. of the gold in these auriferous sands, as ascertained from very careful assays, are obtained as a final result.

LOWER GOLD DRIFTS.

(*Pliocene*.)

At Lefroy and vicinity these most important tertiaries comprise the auriferous drifts so extensively developed in Australia and on the Pacific slopes of America. Hitherto my investigations in Tasmania have resulted in the discovery at the West Coast of our quartz drifts (*pliocene*) at Long Plains and vicinity (*vide* West Coast Report), assimilating to the White Hills of Bendigo; and likewise the strong indications for sub-basaltic gold-drifts at the Back Creek goldfield (*vide* Report). In the first instance the drifts were largely and extensively developed; in the second case the formation overlaid by the basalts resembled the Ballarat, Daylesford, and Taradale “deep leads” of Victoria, and those of the “Alta lead,” Grass Valley City, California. At Lefroy the indications have also been realised in the Golden Era Co.’s workings (*I.*), where, at the 170 feet level, in prospecting for auriferous quartz in a north-easterly direction from the shaft, the black clay (diluvial) was broken into at a distance of 340 feet of said shaft. The clay referred to varies in colour from black to brown, in which flakes of grey slates and fragments of fossilised woods (lignites) are embedded. The company continued their main drive at nearly the same level in this wash for 60 feet farther, when they again met with the rising silurian bedrock. Several shafts were sunk below the level in this deep diluvial channel, by means of which it was ascertained that the bottom existed some 15 feet lower, or about 185 feet from the surface. The gravelly wash is yet irregular; very large rounded boulders, chiefly of quartz and sandstone, occur above and below the lignites, demonstrating very considerable fluvial action in pre-historic geological times. The pan prospects

obtained from the western sides of the channel were satisfactory, as they gave coarse heavy gold of a very high quality, the other residues being chiefly composed of iron pyrites, which are prevalent in the lower stratum of the wash. The workings were carried on under considerable difficulties, as the workings in the washdirt were beneath the main level, and therefore devoid of a good circulating ventilation; the water was also troublesome. Bearing to the north east the diluvium changed considerably to a light greyish clay deposit; higher up the "lignites" became larger; stumps were met with also; and all these fragments of trees, &c., singularly enough, exhibited on being broken up at the surface the original white to yellowish colour and fibres of wood; but they soon blackened, and eventually fell to pieces on being exposed to the atmosphere.

It would appear as if the main washdirt drive was approaching much deeper ground, and that so far only a bend of this diluvial channel had been crossed. However, enough evidence has been obtained for proving the auriferous character of the gravel met with at the higher ground of the channel, and such should be encouraging to the Company to test the ground at still deeper levels with the aid of steam machinery of sufficient power. It has already been stated that the basalt has been sunk into over 100 feet in depth, and that shaft is located only 16 chains east of the Golden Era Co.'s shaft, so that there are good indications for extensive sub-basaltic auriferous channels existing here, besides others that are shown on the geological plan of the Lefroy goldfield.

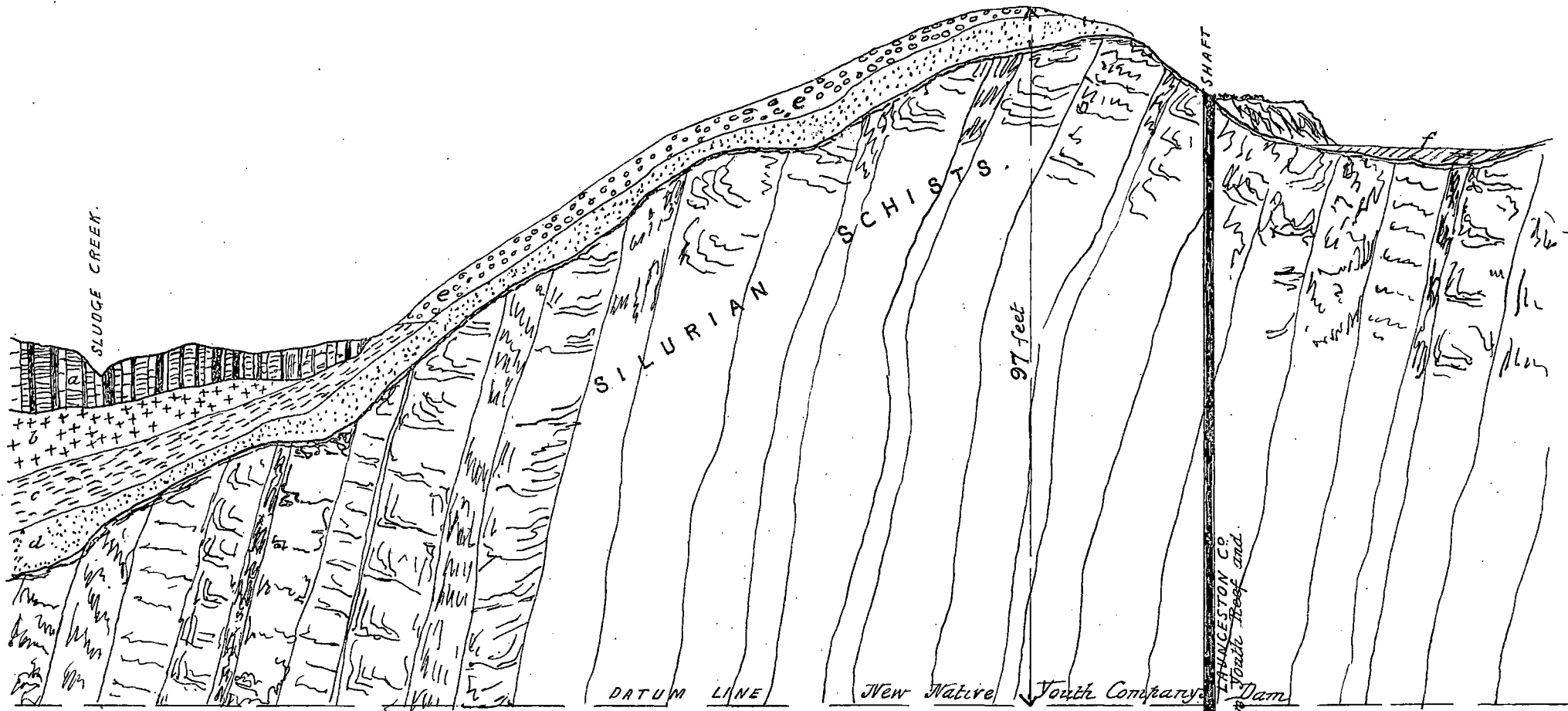
ALLUVIAL GOLD GRAVEL.

Between the Hackett's and the eastern extension of the New Chum lines of reef, a shallow deposit of alluvial (recent) gold washdirt is being wrought with satisfactory results. The sinking does not exceed 30 feet in depth, and the gravel is easily mined. It is probable that this deposit forms the upper end of a tributary to the much deeper ground south, and of its having been derived originally from either those two reefs or any other not yet discovered by the Pinafore Company, who have been prospecting for a lode in close vicinity to this deposit.

G. THUREAU, *F.G.S.*

LEFROY GOLD FIELD.

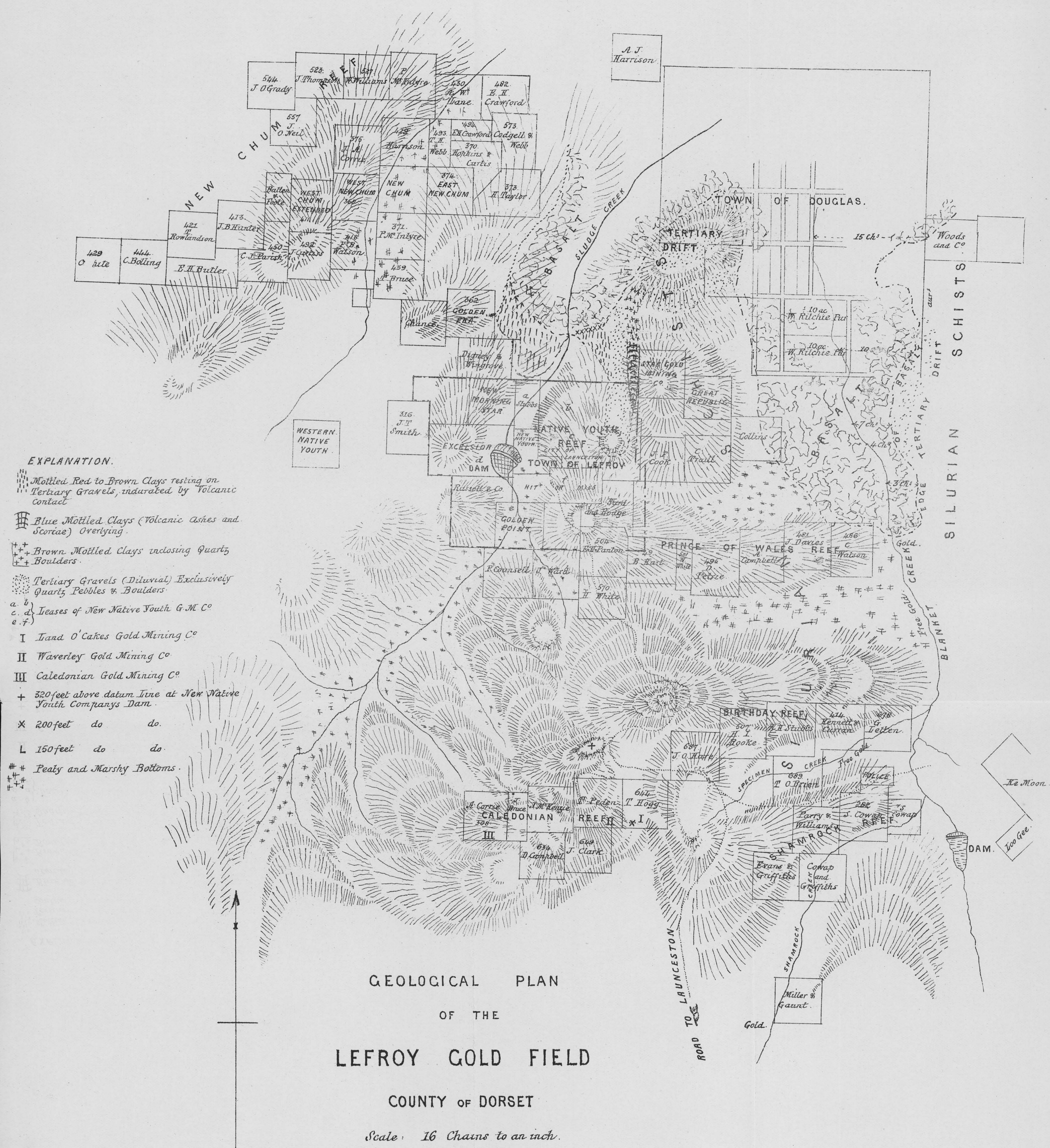
" CROSS SECTION."

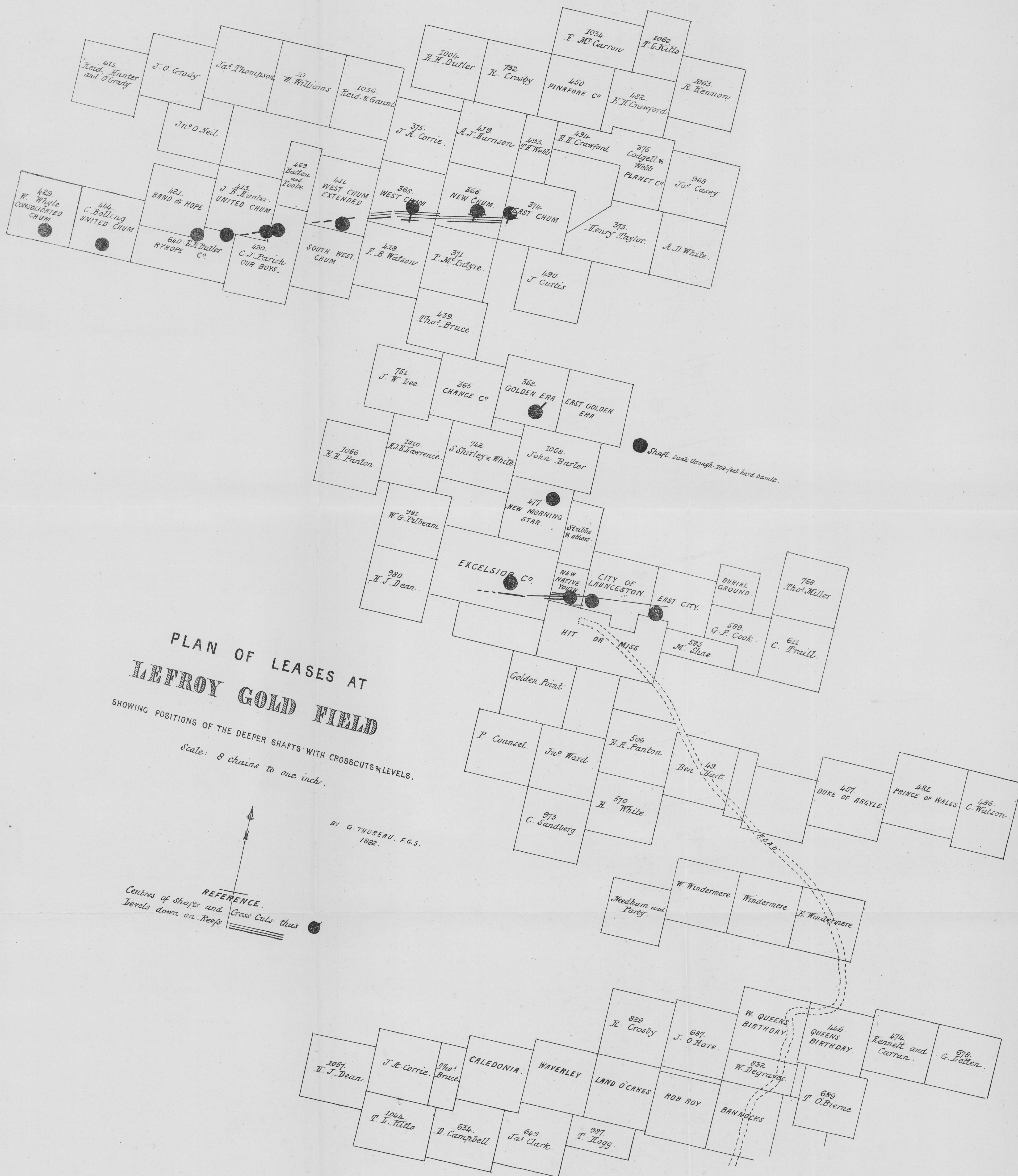


Reference. a. Basalt. - b. Blue Mottled Clay - c. Brown Mottled Clay - d. Tertiary Drift.

e. e. Angular Quartz Detritus - f. Alluvial (aur) gravels.

SHAFT, EAST CITY OF
LAWRENCE CO.
Dam
for the New Native
Youth Reef and
owned by Cross Drives





PLAN OF LEASES AT
LEFROY GOLD FIELD
SHOWING POSITIONS OF THE DEEPTON

GOLD FIELD

SHOWING POSITIONS OF THE DEEPER SHAFTS WITH CROSSCUTS & LEVELS.

Scale: 8 chains to one inch

Scale: 8 chains to one inch

BY G. THUREAU. F.G.S.
1882.

REFERENCE

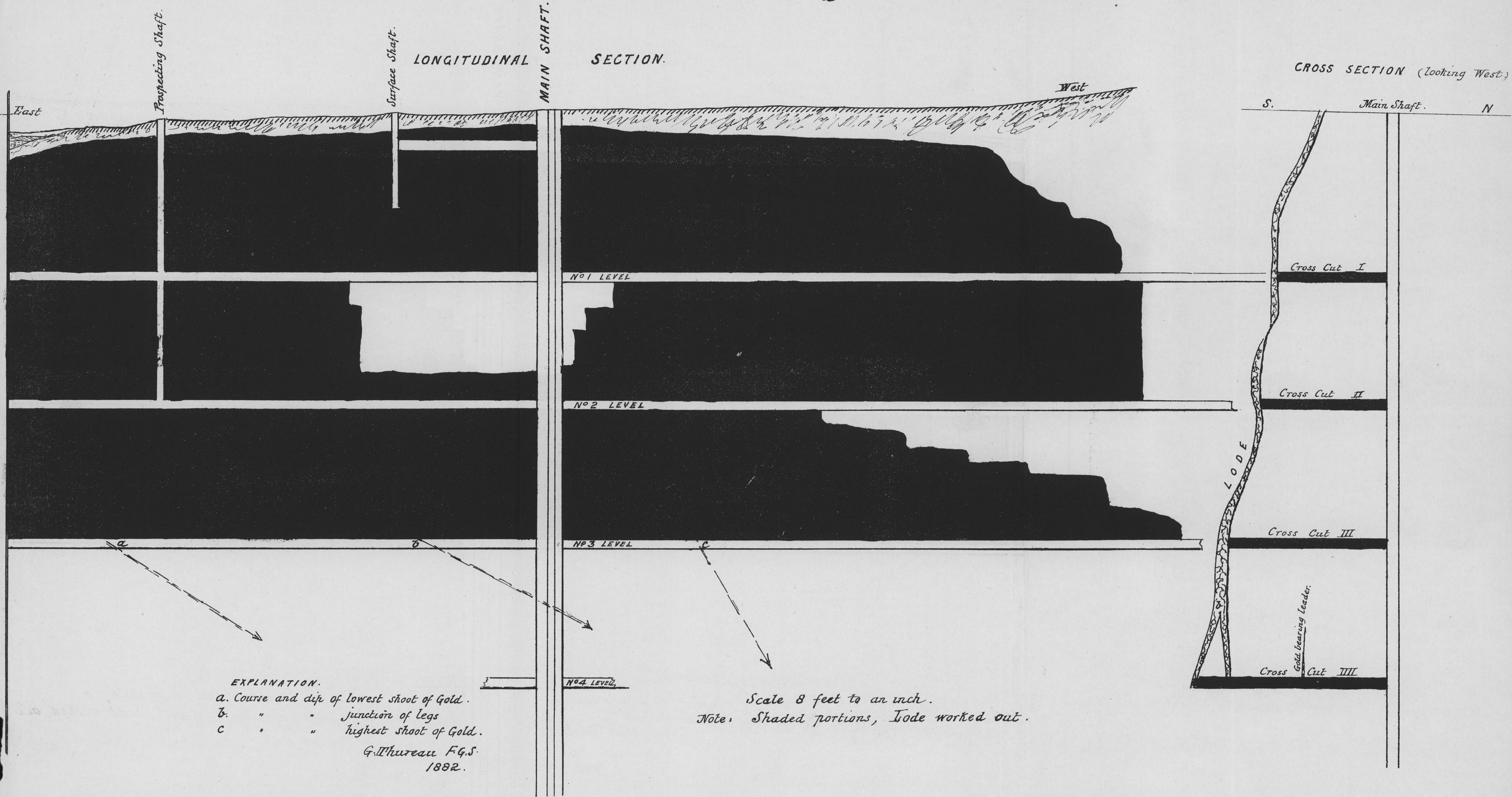
Centres of shafts and
Levels down on Reefs

REFERENCE.

Grass Cuts thus

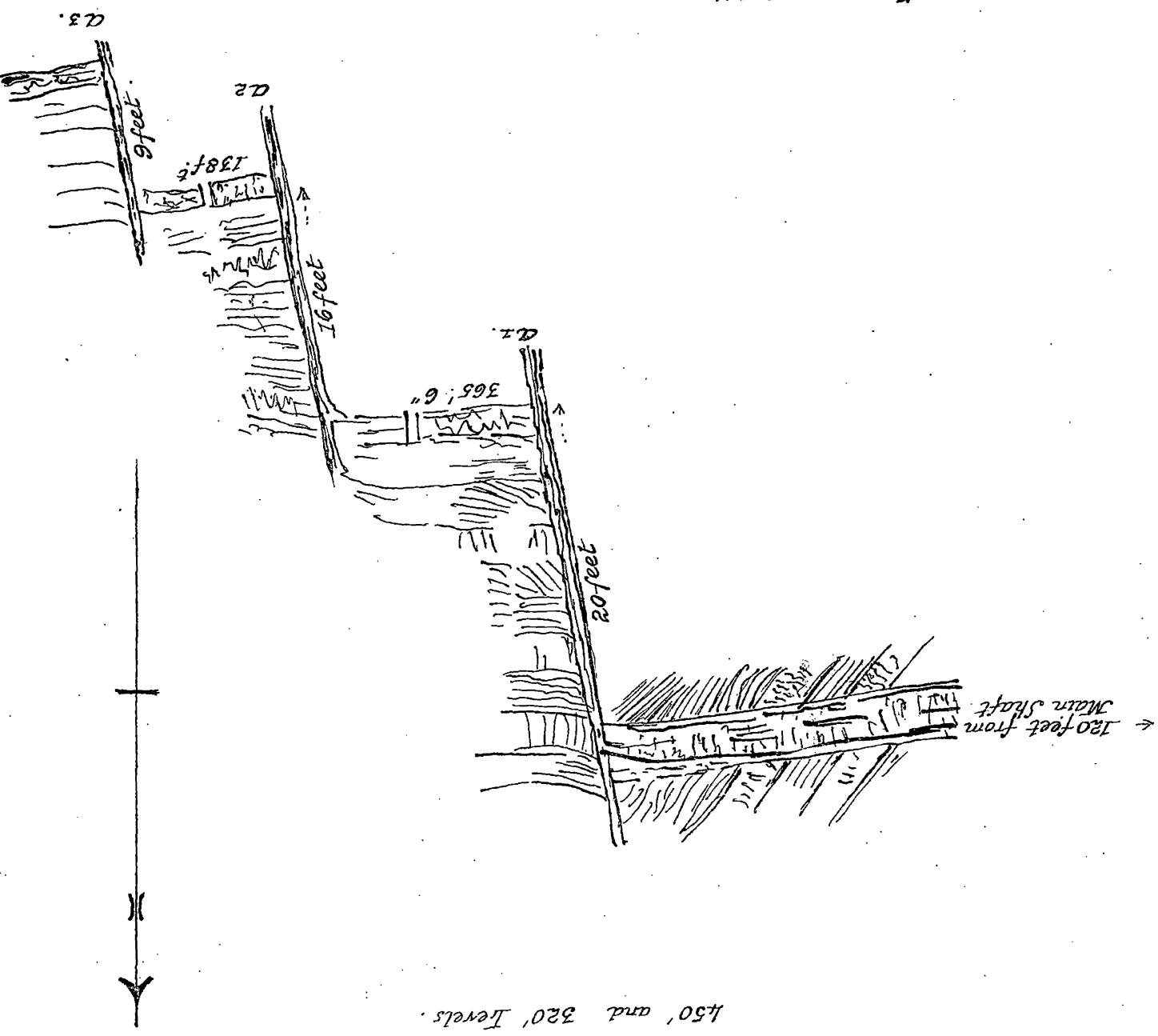
WEST NEW CHUM COMPANYS MINE.
LEFROY GOLD FIELD.

D



LEFROY GOLD FIELD. New Native Youth Co's Mine.

Shewing lode faulted, and contortions of strata.
450' and 320' levels.




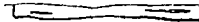

a1	First fault displacing or throwing lode 20 feet	do	do
a2	Second	do	do
a3	Third	do	do

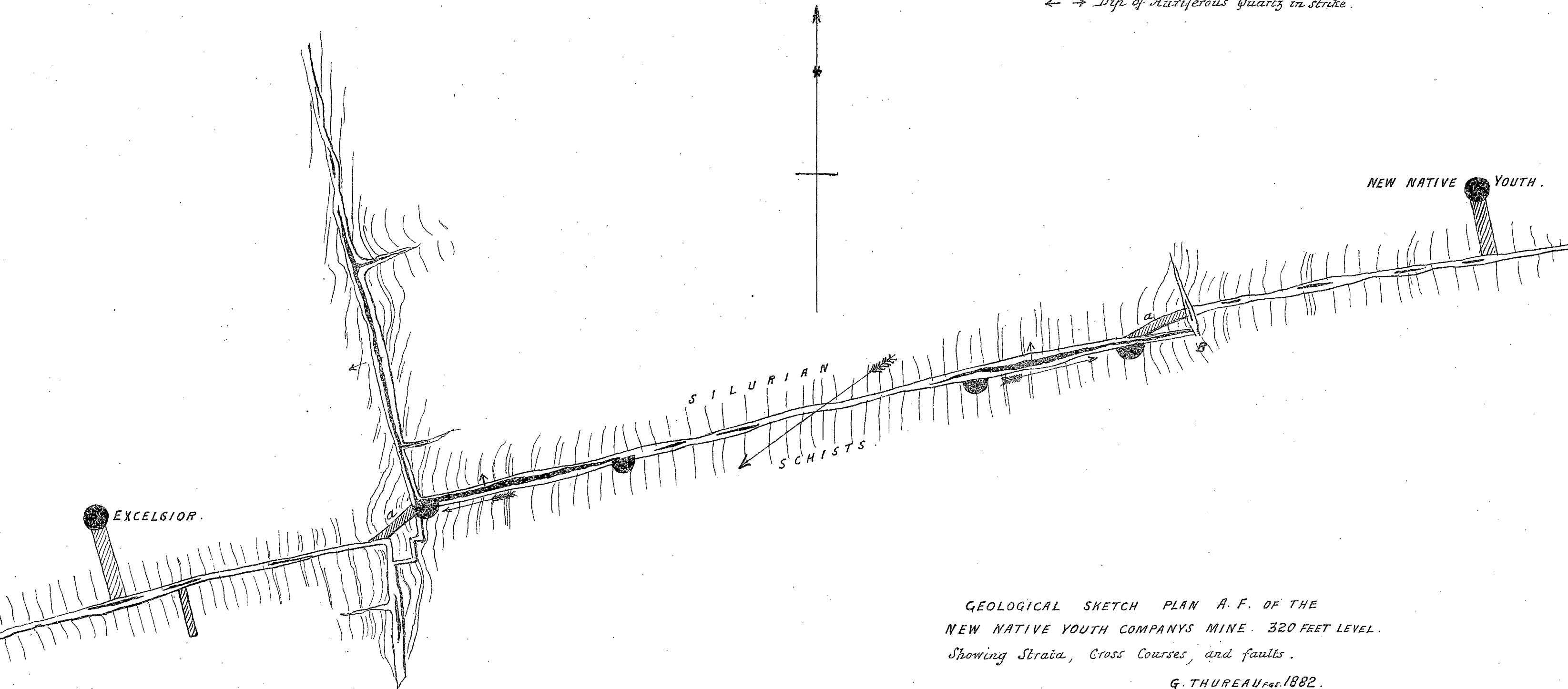
EXPLANATION

G. Thureau, F.G.S.
1882.

LEFROY GOLD FIELD

EXPLANATION.

Auriferous rich Quartz Reefs thus 
 Quartz Vein ----- thus 
 Shafts. ● Winses thus 
 a Levels B Cross courses.
 ← → Dip of Auriferous Quartz in strike.



GEOLOGICAL SKETCH PLAN A. F. OF THE
 NEW NATIVE YOUTH COMPANYS MINE. 320 FEET LEVEL.
 Showing Strata, Cross Courses, and faults.

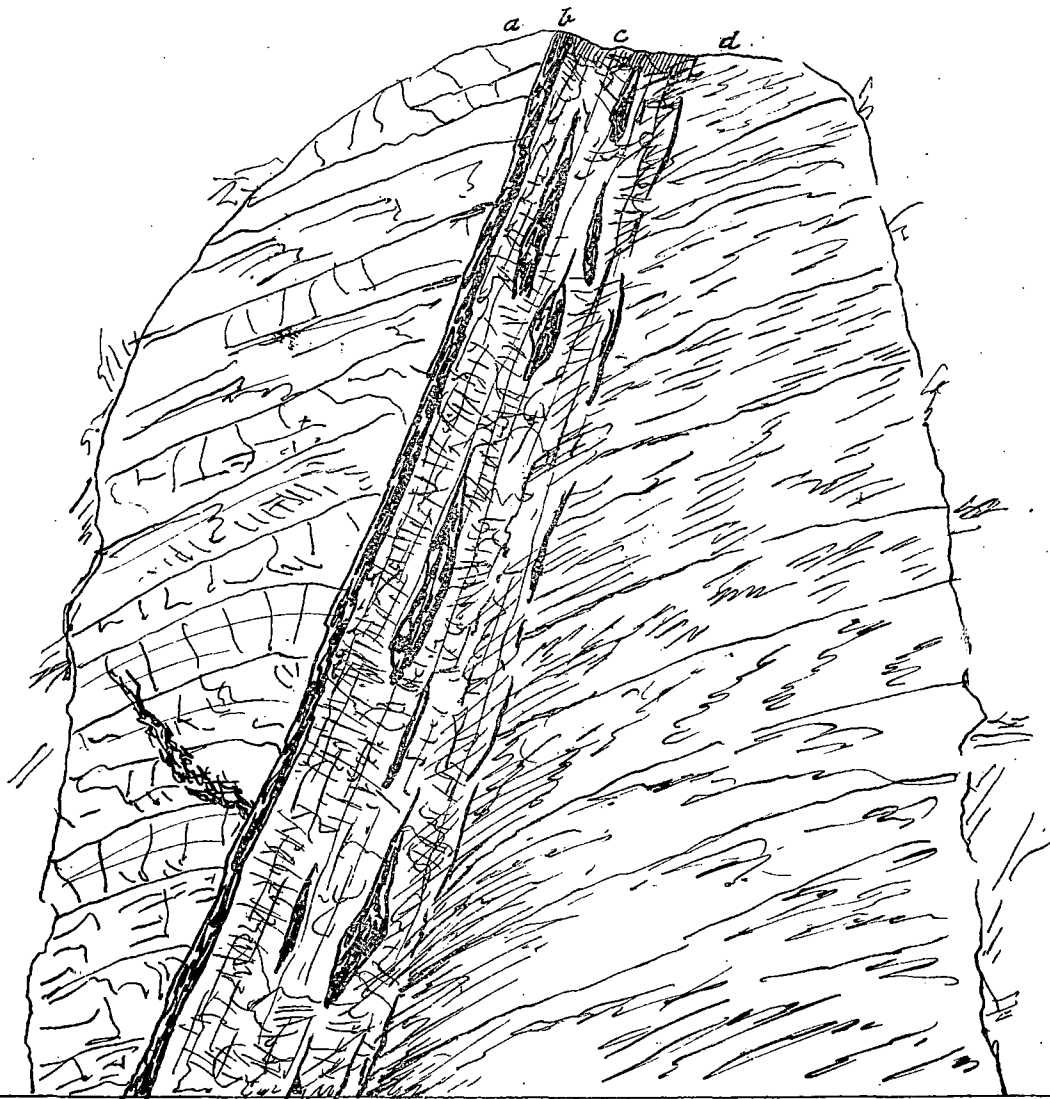
G. THUREAU FGS. 1882.

LEFROY GOLD FIELD.

New Native Youth Companys Mine.

PLAN G.

Sketch - CROSS SECTION at end of 200feet Level.



EXPLANATION.

a. Hanging Wall.

b. Selvage "Flucan" composed of black decomposed Slate interspersed with Iron Pyrites

c. Quartz Iode (aur) in which flakes of Slate and Sandstone occur.

d. Foot-wall

e. Fragmentary Flakes of Slate and Sandstone derived from Wall rocks.

Note. This Quartz gradually disappears in the foot-wall, d, which latter is indicated by no actual and visible division.

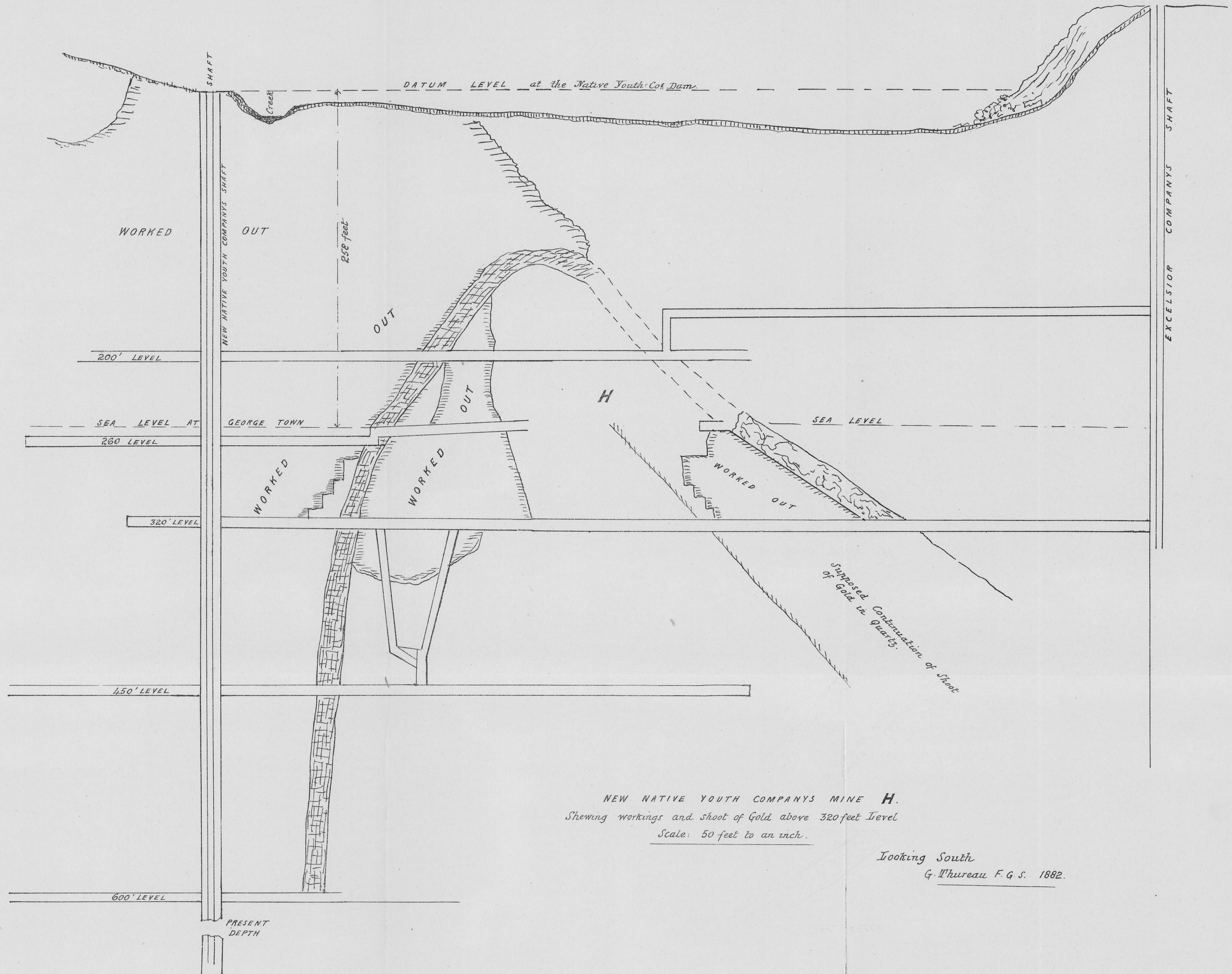
G. THUREAU F.G.S.

1882.

LEFROY GOLD FIELD

LONGITUDINAL SECTION B.

H



NEW NATIVE YOUTH COMPANYS MINE H.
 Shewing workings and shoot of Gold above 320 feet Level
 Scale: 50 feet to an inch.

Looking South
 G. Thureau F.G.S. 1882.