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THE
“INDICATOR,”
SERIES
On Gold Mining.

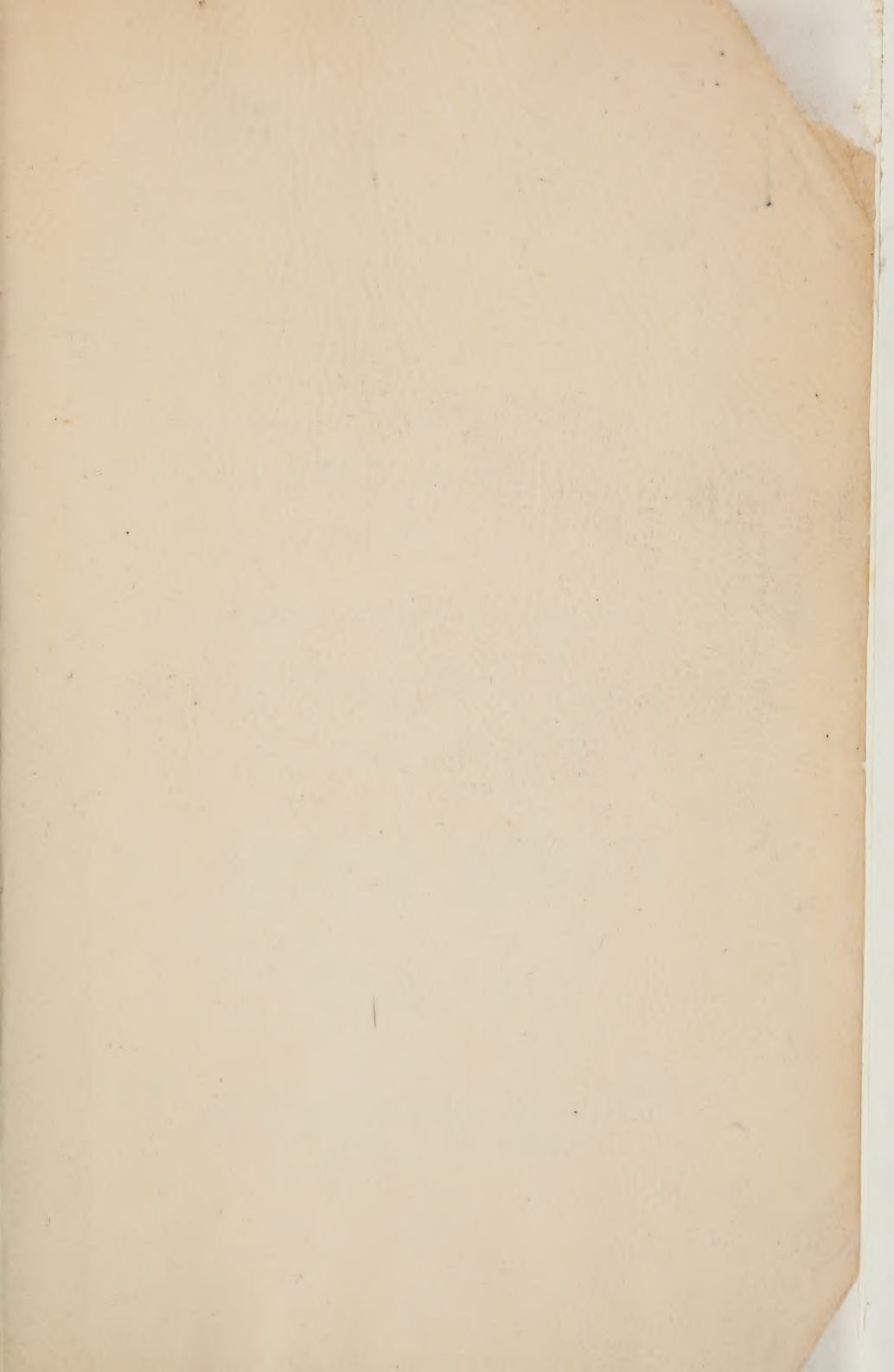
No. 1,
THE BALLARAT FIELD:
Its Minerals, Mines, and Machinery.

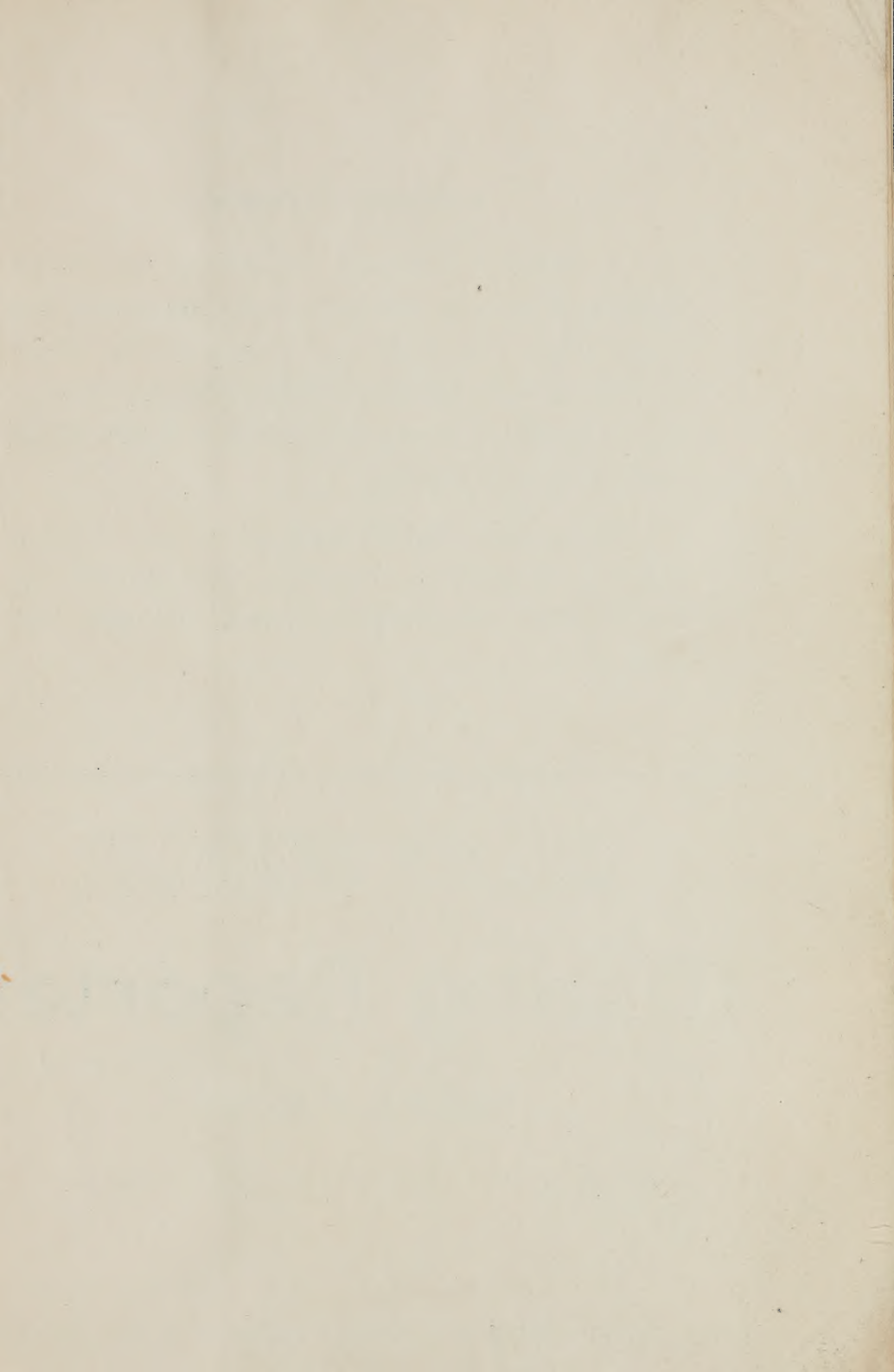
By
William Bradford,
Fields and Mines Reporter “Ballarat Courier.”

Director and Editor :
LIEUTENANT-COLONEL WILLIAMS.

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CORRECTIONS.

A mistake occurred in making the model representing the Steiglitz Lode Structure (see page 65). The lode lines north of the cross-course should have been placed to the west of those south of it, as described, and not to the east, as in the picture.

There are 25,000 shares in the United Albion Company, Steiglitz, not 36,000 as stated, and the company's area includes 130 acres.

WILLIAM BRADFORD,
Mining Reporter,

BALLARAT.

(Fields and Mines Reporter "The Ballarat Courier.")

**Descriptive Reports with Plans of Lode Sections
and Photos of Mines furnished.**

PRIVATE WORK UNDERTAKEN

P R E F A C E .



THE increasing importance of gold mining as an investment and an industry the world over makes all information bearing upon this subject of immense value to the general reader, and to the investing public in particular.

Some little time since it was suggested that an illustrated pamphlet should be issued, dealing with the lode features of our great goldfield, its mines and its mining.

On being approached, the managements of the leading companies offered co-operation; and Mr. Wm. Bradford ("Crush"), whose many years of experience as a field and mine reporter admirably qualified him for the undertaking, was commissioned to execute the work.

The following pages contain the results of his labors, in a form which, although necessarily condensed, conveys much valuable information in a style that will doubtless be found acceptable to all who take an interest in mining.

THE EDITOR.

BALLARAT, *December* 1895.





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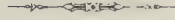
Lydiard Street, Ballarat.

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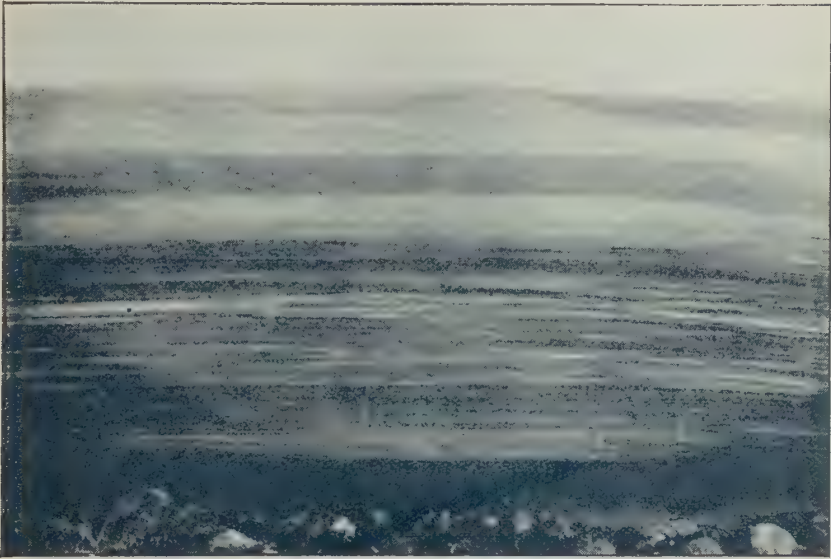
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MINING WORK A SPECIALITY.

Introduction.

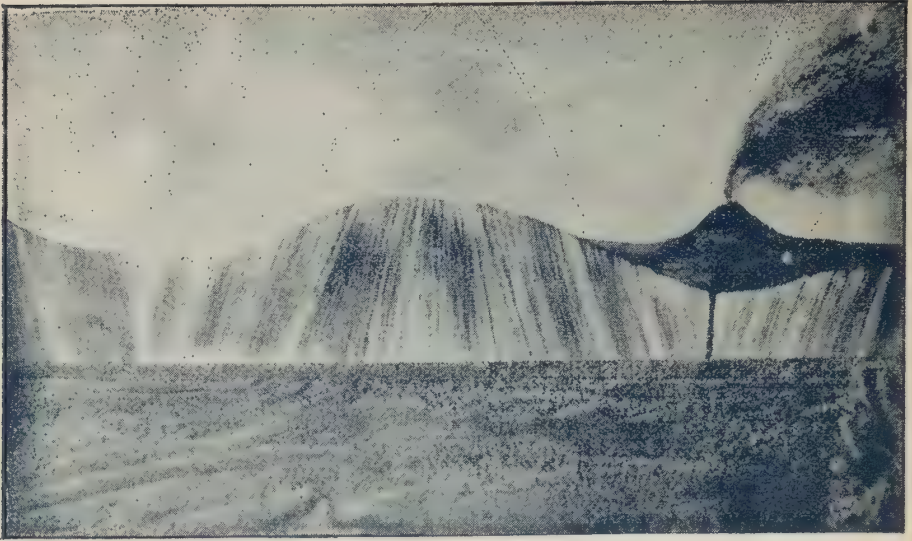


GEOLOGISTS have classed the rocks of which the crust of the earth is made into two divisions. In one are those which have been formed through the agency of water principally, and in the other those formed through the agency of heat principally. These divisions are known as the aqueous and the igneous: in other words, the sedimentary and the volcanic. Tides, rivers, ice, rain, and the weathering of all things, spread continents with their backbones of mountains, so to speak, in ocean beds, in the form of mud and sand, which became hardened as time rolled on into slates and sandstones. Geology relates that as the oceans



IDEAL SECTION.
Sediments Forming on Ocean Bottom.

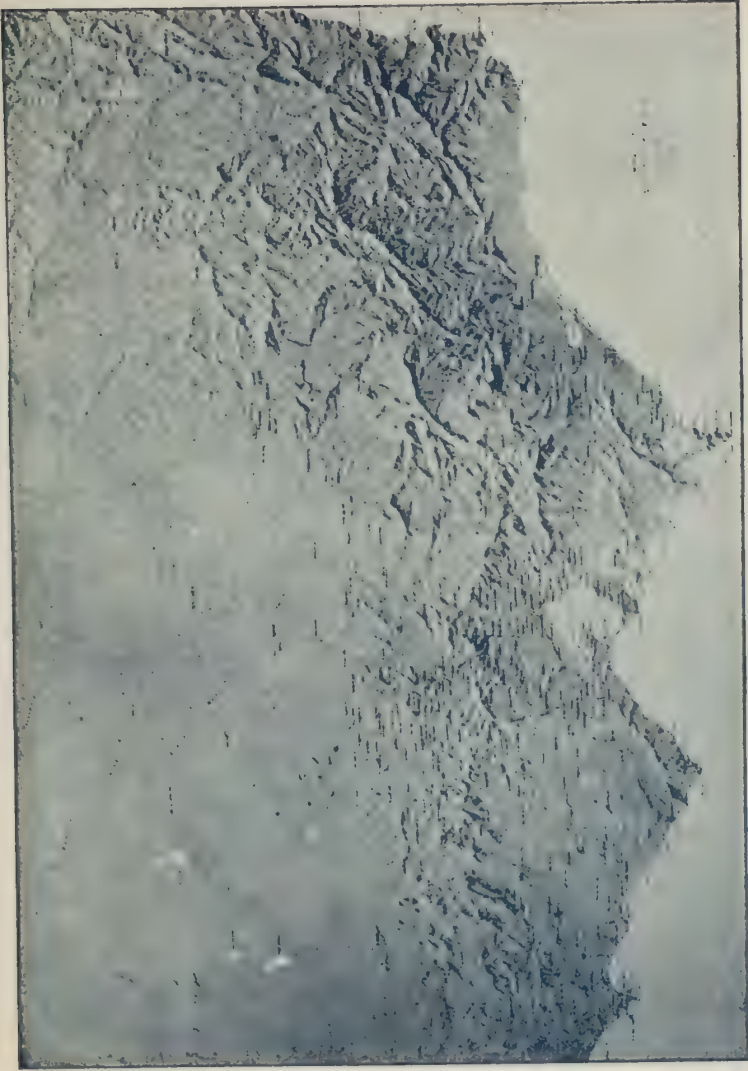
become shallower in this manner, the heat from towards the earth's centre ascends through the sedimentary masses, causing them to expand, and become "crumpled, corrugated, and contorted," forming mountain chains of new lands. In some instances the great weight of the sediments in very deep parts of the ocean is said to have caused a sinking of the mass into the regions below, where heat changes their natures, as fire turns sand into glass, or mud or clay into bricks. At intervals, during the slow raising or sinking of the sedimentary masses, the heat forces of the earth take advantage of any opportunity to break through the crust, and consequently, now and then, we have volcanic



IDEAL SECTION.

Sediments, after being raised and hardened and corrugated, in the form of Slates and Sandstones. The lines above represent the parts, since washed away. Of course the arching, etc., was of a more irregular nature than represented.

outbursts, which result in filling valleys and in turning rugged mountain ranges into broad and level plateaus. The water and the atmosphere never cease working. The levelling process is always in progress, and a new land, produced by the expansion of the sediments, or by volcanic action, is slowly but surely taken down to an ocean to be again stratified, and in course of time either sunk to the region of the heat rocks, or once more elevated. Thus cause and effect are said to have been following on during many millions of years, at a slow rate it is true when compared with the speed of our life-term, but at a very quick rate when compared with the endlessness of time. Competent authorities have stated that the Amazon and the Mississippi Rivers are removing the American Continent into the Atlantic Ocean at the rate of a foot of surface in 3000 years. Thus the time may arrive when new stratifications these rivers are forming may be elevated to form another land where there is ocean now. In the forcing up and washing down of the rocks of ages the crust of the earth is said to be suiting its form to that of its cooling, and consequently shrinking, centre; and the crust being inelastic and brittle, it becomes broken and shuffled, so to speak, as it adjusts itself to changes in the contiguous structures of the earth. In consequence of this, rocks classed as having been formed in the beginning of geological time (as we know it) are to be met with in places near the surface, and other comparatively recent formations have been found at great depths. A great number of rocks belonging to different ages have been altered by heat, as mentioned above, or by infiltrating waters depositing a glass-like material (silicates carried in a solved state) in them. Although rocks altered by the infiltrating process, principally, are not as a rule hard to sample, those altered by heat, principally, have their original identity destroyed. The changed rocks are in the main known as the metamorphic (altered).



Model of Victoria, showing General Crumple of the Rocks. Prepared by the Government Mining Department, and
 sent by R. M. Serjeant, Esq., Band and Albion Mine, Ballarat.

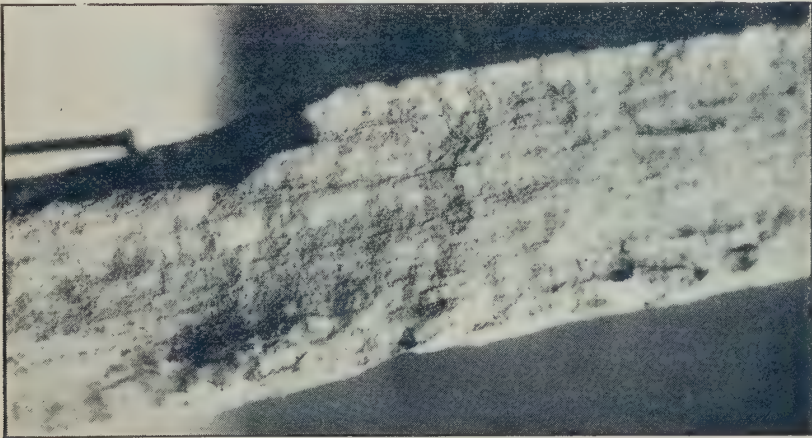
As concerns Victoria, nearly all mining is carried on in a sedimentary strata known as Lower Silurian (called after rocks found in the mountains of Wales where an ancient tribe called Silures dwelt), which is said to have been laid down in the morning of the geological day as we know it. According to R. A. F. Murray, F.G.S., the head of the Victorian Government Geological Department, this Silurian may be described as extending across the colony in a series of sharp alternate anticlinal and synclinal undulations* which form the minor folds of a

* Arches and troughs. W. B.

great, more or less synclinal trough, whose edges appear at either side of the country. Mr. A. R. C. Selwyn estimated the total thickness of the series, making allowance for the recurrence of the same bands, at not less than 35,000 feet. Great as this thickness appears to be, it is not more in proportion to the earth's bulk "than would be a sheet of stout paper if placed around a ball having a diameter of 16 inches." The elevation attained by the surface of the mass, in consequence of its expansion and corrugation, must have been considerably higher than present surfaces are, and it is said that at one time it formed an enormous plateau which extended away north as far as New Guinea, and south as far as Tasmania. The washing and general denuding agencies have been at work, however. The ocean has broken through in more than one place; great plains have been laid to the north and west with material removed from the higher parts; and, generally speaking, the plateau has been washed away, leaving the bare bones of silurian and granite rocks as a rugged ridge, in Victoria, which extends along the south and east coasts of the colony. This ridge of high ground is generally known as "the Divide," and our mining is confined to its alluvial and quartz formations.

Of the origin of any of the elements of which the earth is composed we know nothing; but we know that all are "on change." They are always on the move, from the ocean to the mountain and atmosphere, and *vice versa*. From mud brought up in deep sea soundings gold has been obtained, and enough has been seen in our mining to prove that mineralized slates, which were at one time mud, have had a deal to do in charging our quartz formations with gold. While the ocean beds were being raised above water level the filling of the extensive cracks which were being caused during the squeezing of the becoming rigid mass was being carried on. In conducting this work water was again employed, both as a solvent and a carrier. Water, as it hastens to get as low as it can, passes through all rocks, being filtered at a quick or slow rate according to the nature of the rock encountered. In its passage it becomes loaded with minerals, which it carries in *solution* (as salt and other like minerals are carried in water), or in *mechanical suspension* (as mud or muddy water is carried), or in both manners. Water is continually taking up or depositing material, as the rejective or receptive conditions it may be subject to for the time being demand. It travels to great depths, until the heat drives it up again; and we are told by scientific writers that a circulation after this manner is forever active all through the surface of the globe. To this active process we trace the origin of our lodes. As the result of experiments conducted by the writer on masses of stratified earth (impregnated with salt) which were subjected to the action of a screw-jack, fracture lines were created. Then, by allowing water to percolate from the top, and by placing a slow heat below, these crack lines became filled with salt by infiltration. According to the direction of the force, so the nature and direction of the cracks, and miniature lode structures similar to Ballarat, Sandhurst, Steiglitz, and Egerton were produced. As mentioned above, the waters are continually depositing some parts of their loadings or taking up other parts, according to the rejective or receiving qualities of the rocks through which they are passing. Thus

cracks having walls almost closed appear to have been widened in parts in consequence of the waters having taken up their wall matter, replacing it, in course of time, with quartz or other material or minerals. This action is known as replacement, and one writer (Kemp, "Ore Deposits, United States") says of it: "There is little in fact but a circulation or percolation of ore-bearing solutions which exchange their metallic contents, molecule for molecule, for the rock mass. We would not expect the ore body to be as sharply defined against the walls as when it filled a fissure (open crack), but rather to fade into barren material." The rule appears to be that in long, comparatively unimpeded passages the travelling waters deposit their loadings in regular and laminated (leaf-like) form. In this form gold is found in the solid quartz and in the layers of pyritic and other minerals between the layers of quartz. Where such conditions have governed the deposition of the lode matter, and the waters happened to be golden, a continuous line of golden stone (known as a "shoot") is soon formed. Where a crack has a bulge part produced by replacement action, or otherwise, the entry and exit channels are necessarily much narrower than is the bulge width. As a rule, the laminated feature is met with in such cases on the lower (footwall) side, and the greater mass of stone extending to the higher side (hanging wall) appears in irregular, storm-cloud shaped masses having deposits of fine pyrites (in some instances gold) as boundary lines between them (see page 11). In this form of quartz deposition the gold occurs in the lines as mentioned, and also in the solid stone in isolated patches, composed of (in some cases) cube-like pieces, weighing as much as a quarter of an ounce, and in other instances in stringy pieces and fine specks, associated with galena (lead ore) and black-jack (zinc blende).



Section of Quartz from No. 9 shaft, Band and Albion Mine, showing lamination (leaf-like).
Scale: One foot to one inch.

The next plate is a photo of a laminated formation (reduced slightly) which was taken from the overflow pipe connected with the pump cistern in the 720 feet level at the South Star mine, Ballarat. Here the overflow is continuous, and nearly twelve months' time passed as the travelling waters, which carried their loadings in solution principally, laid these laminations.



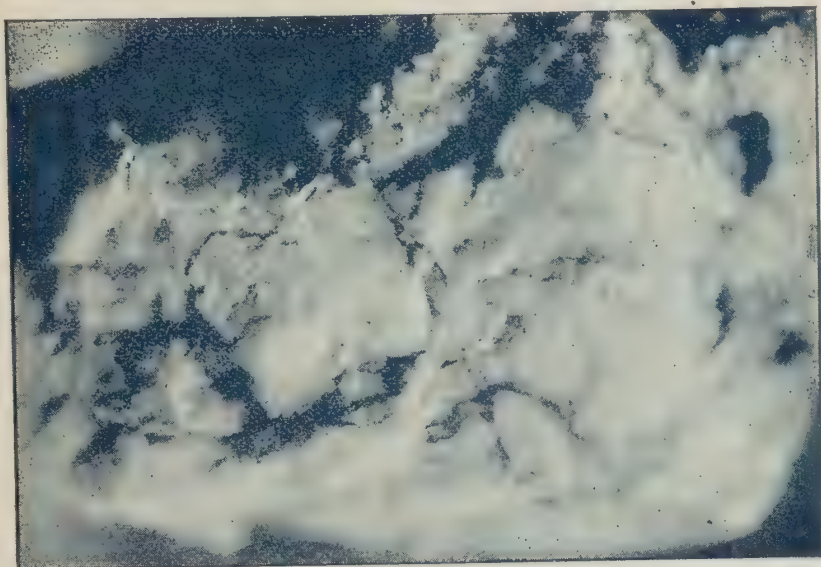
Section from inside of Overflow Pipe to Cistern at 749 feet level in South Star Mine. Principally dolomite carried in solution, with little other matter carried in mechanical suspension. Diameter, about 3 inches.

The next illustration of laminated structure is of a deposit taken from a pipe connecting the condensing engine with the exhaust tank on the surface at the same mine. Here an eight-inch pipe was reduced to about



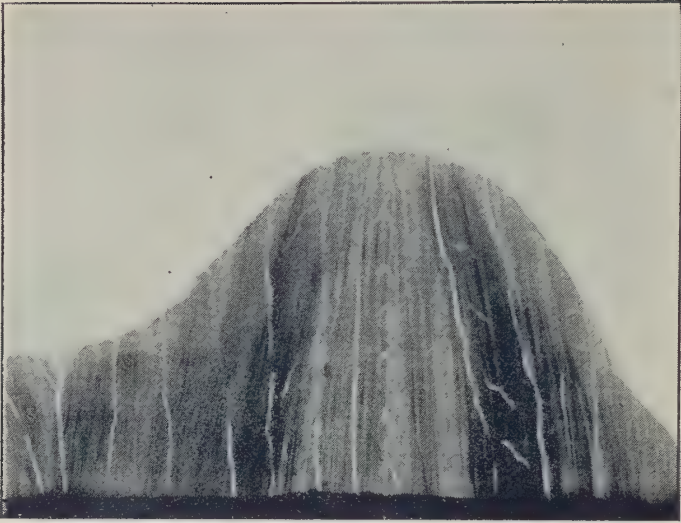
Section from inside of Pipe Connection between the Condenser and the Exhaust Tank. Principally earthy matter carried in mechanical suspension. Diameter, 8 inches.

an inch and a half in diameter in less than four months. This was under pressure, heat, and ceaseless action; and the tendency proved a source of trouble until it occurred to the engineer (Mr. George Pitches) that it would be as well to use the same water continuously to exhaust into, instead of replenishing from below as hitherto. The loadings can only be taken from one lot of water (kept separate) once, and accordingly since



Section of Quartz from No. 9 shaft, Band and Albion Mine, showing Cloud-like Structure.
scale: One foot to one inch.

this idea has been acted on there has been no further deposition. Here the waters carried the material in mechanical suspension, principally. According to these instances, laminated structure is due to the waters carrying two or more different materials in solution and in mechanical suspension, and to the tendency for like to be deposited with like. If there happens to be a greater quantity of one material than of others, a thicker layer of that material is formed. Thus where the waters carry a greater percentage of quartz ingredient (silicate) than of pyritic or other minerals, we find comparatively thick layers of quartz having thin divisional lines of minerals, and where the pyritic or other mineral ingredient is greatest it is *vice versa*. At Mount Lyle in Tasmania, and at Broken Hill in New South Wales, the waters contained enough sulphides to form pyrites lodes of great size, and recent developments tend to prove that the celebrated Mount Morgan mine in Queensland is a pyrites lode, the shallower parts of which had been greatly decomposed (oxidised) and enriched by the concentrates from parts since washed down. It appears, however, that moving waters are essential to the formation of laminated structure, and that the form of the passage or cavity through which they pass determines the arrangement of the deposit (as it determined the direction of the flowing waters) as to whether it is to be laid in



IDEAL SECTION.

A Cross-section (face of cutting from east to west) showing Crack Lines caused when Corrugation was going on, now filled by infiltration, etc., with quartz and minerals, and known to us as Lodes.

book-like form or in cloud-like masses. The vice-president of the School of Mines (Dr. Pimock), who takes great interest in mining matters, informed the writer that the law which governs the deposition and structural arrangement of materials, as mentioned above (lamination, etc.), shows similar effects in the deposition and structural arrangement of the materials which form stone in the bladder of human beings.

As mentioned above, in the bulges (wide parts of cracks) the gold is found in a more patchy form, bunched here and there through the mass of the quartz, and more plentiful towards the footwall side. This is when there happens to be a regular footwall: but even when there is not a smooth wall (with a layer of laminations) the gold appears more plentifully on the lower side. Thus gravity appears to have had a deal to do in determining the most favorable situations for its storage, whether when laid in the laminations, bunched in bulges, or gathered against an impediment in the course of the lode. No doubt, after deposition had taken place, the deposit was added to or reduced, according to the richness, or otherwise, or solving and affinitive natures of the waters which continued to flow its way.

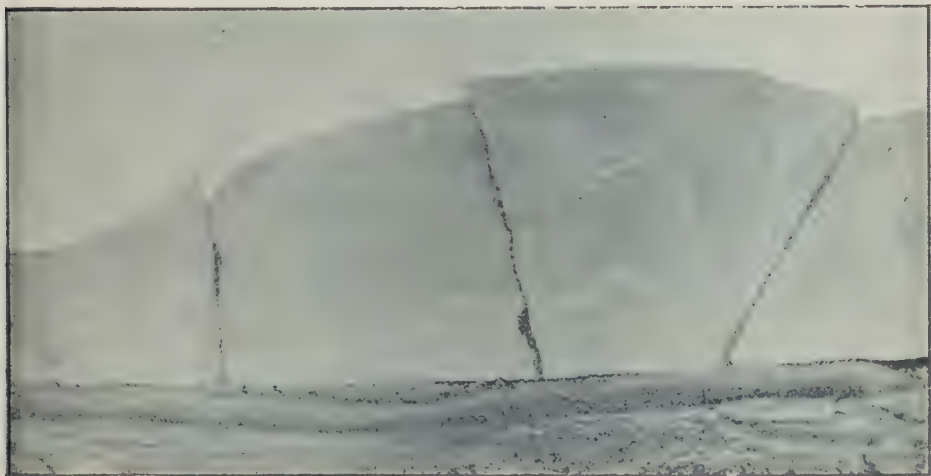
After the first series of cracks had become filled with lode matter (see plate, page 12), another class of cracks occurred, due to a strain on the mass of country in consequence of, perhaps, a push from the side brought about by volcanic action (top plate, page 13).

Another class of break (or crack) came later still. They are called "crosseourses," because their lines are more across the upturned edges of the strata than with them. As with slides, they are due to adjustments which follow altered conditions brought about by the ceaseless movements going on in the crust of the earth. There are other breaks known as dykes. These are cracks (filled with matter foreign to that in the make up



IDEAL SECTION.

Cross-section (cutting from east to west) showing Crack trending from north to south, with displacement, known to miners as a Slide.



IDEAL SECTION.

Longitudinal Section (face of cutting from north to south) showing Cross Cracks, known to miners as Crosscourses.

of the walls of the crack) connecting with the molten, or with the porridge-like and, perhaps, watery material of the granite order, which appears to be always seeking an opportunity to force its way to the surface. Some were formed long before the slides or crosscourses, some during their advent, and some since. According to the nature of the material found in them they are known as a basalt dyke, a granite dyke, an elvan dyke, etc. They are hardly as plentiful as are slides or crosscourses, but nevertheless

are associated with the golden zones of country all over the colony. All breaks (lode lines, slides, crossores, and dykes) evidently ease the strain on the earth's surface, and facilitate the adjustment necessary to the new order of things as the earth shrinks, or modifies its shape through other causes, and but for these adjustments the volcanic phase would be of a much more radical nature. It is said that all parts of the crust are continually on the move. Life is too short for humanity to notice much difference, but occasionally a big adjustment takes place (we call it an earthquake) which causes a noticeable impression both on the surface of the earth and on the mind of mankind in general.

Force all through matter is ranging—
 It mingles and alters, it sweeps;
 Form finds a place in the changing,
 While Time, as recorder, still keeps
 Notes to be seen in the histories
 Whose ledgers have balanced the past—
 Wonderful truth in the list there is
 Through page after page to the last.

The word Sulphides is used in this work to represent all those minerals which are associated with sulphur and arsenic in some form, known generally as pyrites (from the Greek *πυρ*, meaning fire). They include iron principally, galena (lead), zinc (Black Jack), manganese, &c.

The Field.

BALLARAT is situated on "the Divide," at an altitude of about 1,500 feet above sea level (see model, p. 7). Lower Silurian rocks, composed of fine grained sandstone and slate, form the base of the country round. Volcanic floes have covered a deal of it, and the granite is to be seen outcropping a mile or so to the east. The strata has been corrugated into troughs and arches—squeezed out of shape beyond identity almost,—which have their lengths (strike) lying in a nearly north and south direction. The lode lines follow the lines of the strata pretty well; slide action has been very general; crosscourses are much in evidence, and there are several dykes of the granitic (felsite) order. The extent of the displacement of the strata in connection with these breaks is well understood by miners, with the exception of the up and down movement on the crosscourses, and the north and south movement on the slides. The greatest displacement met with, so far, is in connection with an east and west movement on a crosscourse, and it does not exceed 650 feet, while in the majority of instances it seldom exceeds 50 feet. The field is gridironed with quartz occurrences. They have been formed on the slopes of the arches and troughs, and in the now almost vertical slate bands, on the sides of the latter, and are rarely found trending quite parallel to the strata lines.

The quartz mining to date has been confined to four lines, but a fifth has been opened to the west recently. These are known as the "Bonshaw" (from west going east), the "Guiding Star," and the "Consols," on what is known as the township; and half a mile to the east of the latter, the "Suliman Pasha" and the "Indicator" lines in Ballarat East (see plan).

The levelling powers of the weather and the waters of ages have been at work on the surfaces, which at one time were much higher than at present, breaking down mountains of quartz-laden rocks; sluicing their lighter particles away, and leaving the heavier (including the coarsest gold) as a layer of concentrates, known to miners as "washes." This is how humanity (I mean gold digging humanity) found it in the early fifties. Then attracted by the remarkable richness of the deposits, an army of diggers commenced the conquest of Victoria. They had not been long on the outcropping ridges of silurian in Ballarat East before they found that water-action had cut out gutters in the once-upon-a-time almost level carpet of

washes, and that these gutters made off to a common centre in a comparatively recently (geological time) washed-out valley. It was soon ascertained that the valley carried a main lead or gutter—afterwards known as the Golden Point gutter,—which represented the unity of the higher ones : and further explorations proved it to have a westerly and then a southerly trend, towards and under a plateau of volcanic rock (basalt), on which the city of Ballarat—or Ballarat and Sebastopol—now stands (see plan). After the diggers had worked out the shallow alluvial, attention was directed to the plateau, to the edge of which the main gutter had been traced and worked. It became known that the basalt covered the, at one time, lowest part of the Ballarat valley, and that the main gutter, having an irregular serpentine trend, passed under it, and southerly, after receiving numerous tributaries from the east, west, and north (see page 24). Finally, this main channel was traced and worked for a distance of about fifteen miles, to a place south of Ballarat called “the Durham,” with more or less profitable results. No doubt the time will arrive when it will be followed through the remaining thirty miles lying between “the Durham” and the ocean.

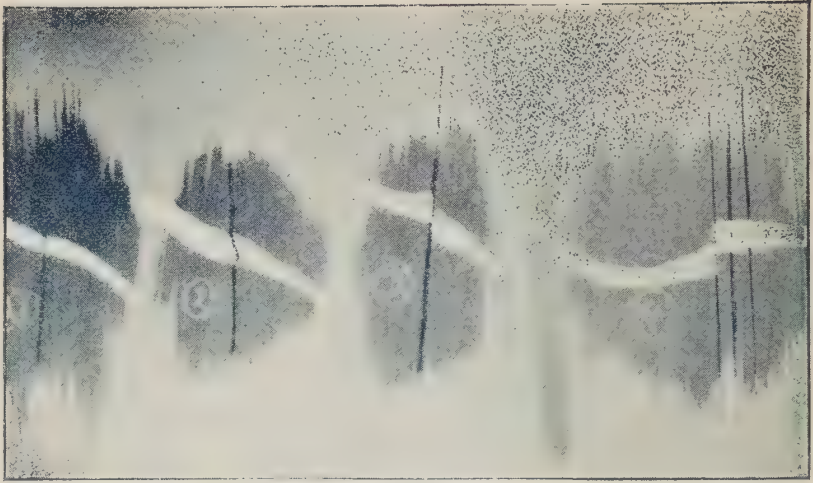
In the records of alluvial mining, all the world over, the Ballarat field can be classed as the richest. Gold the size of ordinary beans, in stringy, filigree pieces, in dust, and in lumps, the largest of which weighed more than 2200 oz., was obtained in the comparatively shallow ground of the slopes : and speaking generally almost fabulous wealth was met with not only along a belt of country on which, in a north and south line, the present quartz mines of Ballarat East are situated, but in the deeper ground under the plateau.

It was noticed by the early diggers that where the higher washes, or the sub-gutters, or the main gutter itself, followed or crossed certain lines of strata, more gold was found, and now and then, particularly on the higher ground, slab-like masses of quartz would be met with, in which the quartz appeared hinged together with stringy and tea-lead shaped pieces of gold. As the alluvial on the outcropping silurian became worked out, the quartz occurrences, in the strata below it, received attention, and now and again the striking of a “flat make” of a very golden nature would cause quite a stir in the local mining world. (Miners term all bulges or regular stretches of quartz formations on load lines “makes.” When the walls of a lode are found together, or nearly so, it is said “the make has cut out, and there is nothing but a track in the face.” In due course we hear that the stone is “making again,” and that “this make is bigger than the last,” etc.) The popular notion of the time was, however, in favor of “big main lodes,” and as no such thing of a payable nature had been found, and as the irregularly formed “flat makes” had not been proved to be permanent, or rich enough to suit the ideals of the time, quartz mining was not thought much of for many years. But it was never at a standstill, and when the miners who were working on the stringy-shaped occurrences had followed their series to a depth where the strata appeared less oxidised, the “makes” were found to be associated with a pyritic layer, varying in width from an eighth of an inch to about one inch, which had been formed in an almost parallel line with the line (strike) of the strata.

The occurrences which had been worked nearer the surface had also been associated with this seam of pyrites, but in consequence of it being more oxidised it was not so noticeable. As work proceeded it became evident that the pyritic deposit had had something to do in gathering the gold of the adjacent country (miners call all slates and sandstones "country") into a nuggety form, and that the point it had found most favorable for this action was where it crossed a "make" (see fig. 2, page 18).

In due course the country which contained these layers (there are many) became celebrated for its nuggety yields; and in the year 1871, or thereabouts, the layer, or seam, of pyrites which had received most attention was christened the "Indicator" by Mr. Morgan Llewellyn, whose party met with nuggets in association with one. Developments by crosscuts have brought to light numerous "indicators," all pretty well of the same pattern. They are known, going from east to west, as the "Eastern Indicator," the "Black Seam," the "Pencil Mark," the "Indicator," the "Telegraph," and the "Western Slates." These have received the most attention, but at one or two points where crosscuts have been put further east and west, numerous others have been met with, which are to receive attention as works are extended. As written by Mr. E. Lidgely, the geologist, who has been doing the field for the Mines Department, "these indicators are usually thin beds of dark-colored shales and slates, formed of a carbonaceous mud, containing a large percentage of iron sulphide." They are in most cases main fissures which have occurred in the line of a porous layer of strata. There has been usually a slight sliding movement between their walls, and there is no mistaking the fact that they have been and are main channels for the passage of mineralised waters, and that wherever replacement or other action has succeeded in getting the walls apart, quartz has been stored, as on other lode lines.

In the corrugating of the field, the forces appear to have been applied from a point which gave it a slight twist strain, and this resulted in forming innumerable small cracks (in addition to large main ones), which have evidently been enlarged by replacement action, as laminated stone is the exception throughout the field. It is in the association of the Indicator-sheets and the pancake-shaped quartz occurrences that conditions have been brought about favorable to gold-deposition in a nuggety form. As is to be seen in plate, page 19, there are masses of quartz to the east and the west of an irregular shape, varying in thickness from 50 feet to an inch or so. Some carry gold distributed through them in a bunchy form and payable, and others are almost barren. All have octopus-like arms of quartz going off at all sides, and it is in these, especially when they appear in anything but vertical form, that heavier gold is found, and where they happen to cross an indicator, the nuggety gold is met with. There is no such thing as a defined wall to any of the indicator "makes"—all appear to owe their origin to fractures in the strata, caused by a general twist in the whole field, which have been enlarged and filled by replacement-action. (There is no straight definition of wall—the stone and the wall merge into each other.) Where this association of the indicator and flat "make" (fig. 1, page 18) is met with the gold occurrence is not so rich as where the association is as in fig. 2.



Section showing Nature of Contact of Indicator Lines and "Flat Makes" of Quartz Occurrences.
Scale : About 4 feet to 1 inch.

The gold has been deposited on the higher side of the quartz in a sponge-like form ; and, in the pyritic track going through it, on its lower side solid, in a form which appears to have been governed by that of the receiving cavity. In general, where there is much pyritic mineral in the Indicator itself, the gold is sponge-like, and where such is not the case, it is solid. The sponge feature is evidently due to the association in the first place, of gold and pyrites, and the latter having been removed by decomposition. There are, as a rule, zinc blende, galena, and a little iron pyrites bedded near and with the gold : and it appears as if the most favorable situations for the deposition of the gold were the most favorable for the deposition of the quartz and sulphides (ordinary pyrites) : but the gold appears to have had a preference. It would seem as if all minerals take the slightest excuse, in the form of a ledge, pocket, or floor of any kind, to nest themselves. In one mine, where a small slide had displaced the Indicator west and down for a few feet, the line of the slide (between the displaced parts) was found to be covered with a thin and narrow slab of gold.

When an indicator passes through a "make," as in fig. 2, the nuggety phase is more marked. It appears that here there has been a retarding influence on the passage of loaded waters—a kind of block, as it were, and consequently a greater deposition has taken place, exactly as appears to have been the case where rich gold is met with in a lode just under or over a puggy mass, in a slide or crosscourse.

The Indicator has a smooth wall within three feet of it on either side, and a slide-move has taken place on the western one, as to be seen in fig. 4. All the gold in the wide expanse of indicator country—many hundreds of feet—has not been gathered into points of intersection of the flat makes and the pyritic sheet. The country is interlaced with quartz occurrences.

Often, when a "make" which crosses an indicator is found barren at the intersection, it may prove to be rich (especially on the part east of the pyritic vein) when appearing with a north-eastern underlie. On the western side of the vein also, in parts where the quartz occurrences belly, as in fig. 4, the riches found in the curve have been so pronounced that it has received the name of "the gutter."



IDEAL SECTION (looking north).

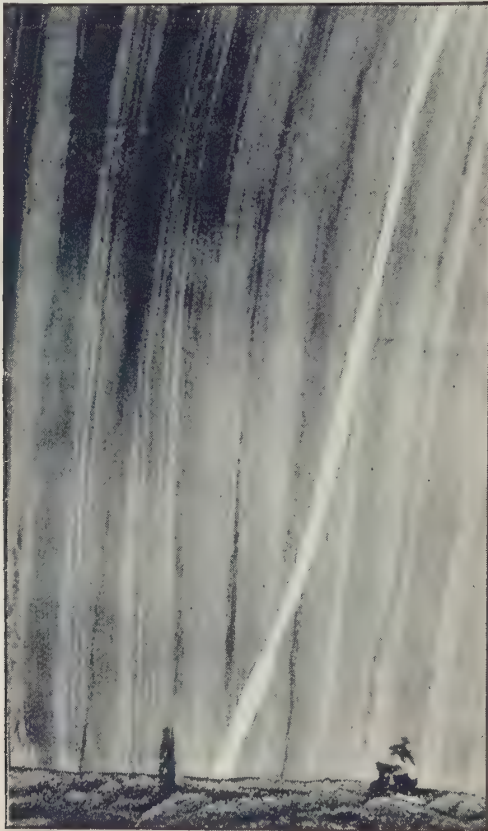
Section of Indicator Belt, showing the "Indicator," a Slide, and a Crosscourse. In some places the "makes" have greater regularity and thickness, in others less. Scale: Face about 50 feet to 1 inch. The horizontal plane (flat part) represents about 1,000 feet in distance. The displacements of the country on either side of the crosscourse, and above and below the slide, do not represent the actual extent of the moves here. As will be seen, the cross-course has resulted in shifting the lodes to the east (going north). * The Indicator.

Only one formation in Ballarat East has been opened which carries anything like smooth walls or laminated features. This is known as the "Suliman Pasha lode," and it has been formed on the west side of an arch in the corrugated strata. It carries its laminated stone on its foot-wall side, and has the usual spur-like veins running into its ill-defined hanging wall.

Other formations, on which nothing much has been done, known as "Roberts," the "Fire Brigade," the "Pug," the "Oregon," the "Yorkshire," the "Western," the "Temperance," the "Dinock's," "No. 1," "No. 2," "No. 3," the "Monte Christo," and others, exist in the space between the Suliman and the granite. They all bear the same relation to the network of comparatively flat quartz occurrences between them (with the exception of the Temperance) that the east and west "makes" in the belt of country known as the "Indicator line" do to the flat "makes" in connection with them. In fact, the country of Ballarat East and West is full of indicator features: and west from the Suliman, through that neglected space intervening between it and the Plateau the country is gridironed with formations of the Indicator and Suliman type, on the top of which the Golden Point gutter was phenomenally rich.

In Ballarat East all the lodes now being worked, and for that matter including those that have hardly received any attention, outcropped pretty well to the grass. In due course, however, the gutter was followed until a point was reached where it (on its silurian bottom) passed under the basalt plateau. The Yarrowee Creek marks the eastern boundary of the exposed silurian, and, of course, from this, going west, the basalt hides all the outcrops of the quartz reefs which had helped to enrich the gutter as it pursued its way to the ocean. As may be supposed, the operations in the deep alluvial uncovered the tops of several lodes, the first of which was the Consols formation, from which great quantities of gold have since been mined. This occurrence is noted for the laminated structure of its quartz, and for the regularity in its width and wealth. Trending almost north and south, it underlies to the west, not quite parallel with the strata.

Here, as might be expected in a continuous and regularly formed crack, there are smooth walls for long stretches, and laminated stone is the rule. The gold and pyrites have found favorable situations between the lamina, and they occur in the solid stone, in both cases more plentifully on the footwall side of the lode. That continuity and regularity peculiar to structure of this class of lode are to be seen also in their mineral occurrences.



IDEAL SECTION (looking north).
Section (face of cutting from east to west) showing Consols Formation.
Scale: About 40 feet to 1 inch.

The deposits of gold have been laid in continuous lines known as "shoots," and here the rule is these shoots pitch south at an angle of say 50 degrees. This pitch appears to have been regulated, in the first place by the conditions which governed the direction of the flow of the waters, and secondly, by the pitch of the section of its country, and these sections of country became pitched to the north or south according to the nature of the forces which caused the breaks known as crosscourses.



IDEAL SECTION (looking west).

Section (face of cutting from north to south) showing Influence of Crosscourses on "Makes" in Lodes Scale: 500 feet to 1 inch.

Of course, the above is only an ideal section: for, as mentioned above, we have no evidence yet regarding the extent of the up and down displacements. Following this, another outcrop was opened at a point situated at about 1,000 feet to the west of the Consols. It is known as the "Guiding Star lode," and it has features which are a cross, as it were, between the Consols class of lode and those known as "vertical" in Ballarat East (large "makes" between the indicators).

Here the laminations are on the footwall side only. Extensive bulges (having a width in one mine of about 70 feet) are frequently met with. Running up into the country of the hanging wall are numerous flat spurs, some of which extend for hundreds of feet. These as a rule are rich in gold. As in Ballarat East, they are well looked after. It would seem as if there has been a fairly uniform amount of gold spread in the strata of certain areas. Leaching (infiltration, etc.) processes have gathered it, with the silicates (quartz) into cracks. Big cracks afford greater facilities for the storage of other material than gold with the gold: little cracks offered less. Thus in small veins of quartz we get a greater percentage of gold in proportion to the quantity of quartz: in big lodes as a rule less.



FIG. 14. SECTION (see also text) showing Slide and Cross-course. Scale: About 100 feet to 1 inch. The hanging plane (on right) represents about 1,000 feet in distance. The display heights of the country on either side of the cross-course, and above and below the slide, do not represent the actual extent of the mine's zone. As will be seen, the cross-course has resulted in shifting the lodes to the east (going north). The formation on the west represents the "Guiding Star" lode, and that on the east the "Console."

Dolomite is to be seen associated with the quartz in most of the mines, and here on the Guiding Star formation, particularly on the hanging wall side. The "makes" have great length and comparatively short depth extension, the former bearing a relationship in extent to the latter say of 8 to 1. Several are to be met with trending parallel to each other in consecutive order, the whole forming a series under which is a series of track lines; below which again is to be found another series of "makes," and so on no doubt for many miles down. This is a general feature on the lode lines of Ballarat.

The extensions of the "makes" and of their series, and their relationship to the lengths, etc., of the series of barren country occupied by track lines, appear to have been governed greatly by the nature of the twist movements the whole field received while it was being corrugated. The deepest mines on the Plateau have worked through the series nearest the alluvial, and at the 1,800 feet level at the No. 9 shaft of the Band and Albion Consols mine apparently the top "make" of another series has just been opened. It is gold-bearing, and carries the pyritic element very plentifully (see page 51).

As will be seen, it has been formed between the arches of the corrugation, just as the majority of makes on the Plateau have been; and no doubt, as with the higher ones, the series will be found to be composed of make after make bearing the echelon relationship, as met with higher, that the bars of a venetian blind bear to each other.

Away to the west, and for a distance south of say half a mile, the Bonshaw line has been opened lately. The only difference noticeable in the occurrences here is that one has its smooth wall on the hanging wall side, with spurs going down into the country on the footwall side, and the other *vice versa*.



IDEAL SECTION (looking north).
Section (face of cutting from east to west) of Lode Occurrence in Bonshaw Mine, showing
Difference in Footwalls. Scale: About 100 feet to 1 inch.

There is a great similarity throughout the entire field in the class of country, its quartz and its mineral occurrences. This refers not only to the zone represented in Ballarat east and west, but to the parts extending for many miles to the north, south, east, and west. From some of the

formations immense riches have been obtained in the heart of a bulge, either in association with masses of pyrites (ordinary iron, zinc, and galena), or in a cavity (vug), which had been filled with the sulphides (pyrites), since decomposed. As stated above, some of the bulges carry gold dotted through their mass in cubes and in strings (usually in combination with zinc and galena); but the rule is, the lower or footwall side is richest, excepting where spur-like occurrences are found extending from the hanging or footwall side; and where such is the case, some spurs prove to be very rich, especially at the point of their junction with the main body. The strata throughout the whole district contains many pyritic sheets of the Indicator pattern, and it is those wing-like spurs, or massive makes, or regular formations of laminated quartz which have the closest association with them, that carry the most gold. The "heads," or planes (crack lines in the lode formation as marked on plate, page 21), in the quartz masses (found as a rule with their lines going at right-angles to the pitch of the make) appear to have had much to do in determining the point of the later deposition of gold, for in the Black Horse mine at Egerton more than one of these planes was found carrying a thin sheet of gold.

As regards the quantity of sulphides (pyrites) in the lodes it is hard to say anything definite. In several mines quartz "makes" have been met with carrying as much as 50 per cent., but the rule is a much lower per cent. from quartz treated. Taking an all round average for the district, I don't think it exceeds 3 per cent., which yields, say 2 oz. 10 dwts., and costs about £3 per ton for treatment (after it has been concentrated).



IDEAL SECTION (looking north).

Section (face of cutting from east to west) showing Lode Occurrences, the Golden Point Gutter, and the Volcanic and Other Layers of the Plateau or Township Line of Country. Scale: About 100 feet to 1 inch. From plans lent by R. M. Serjeant, Esq.

MINING MANAGERS



1915

BALLUAT

1915

1915

Mining Managers.

Hopkin Jenkins, late Grey Horse; R. Stevenson, No. 2 Shaft Star of the East; T. Hocking, No. 9 Band and Albion and Battery; R. Baker, Star of the West, Carngham; J. Campbell, late Long Gully; A. Pearce, Last Chance; A. Jenkin, Bonshaw; T. Tregurtha, New Speedwell; J. A. Williams, Suliman Pasha; J. Pearce, New Normanby; J. S. Trethowan, North Woah Hawp; H. Bath, Northern Star; G. Williams, Llanberris; W. Barton, late Band and Barton; H. Wadge, late New Koh-i-noor; W. Hicks, Star of the East; W. Longdon, New Victoria; R. Jeffreys, Sebastopol No. 1; T. Porter, Long Gully; W. Wooldridge, Garden Gully; R. Clinton, late New Mariners; J. Lithgo, North Prince Regent; J. James, South Star; J. Harvey, New Britannia; W. Gay, Dalzell cum-Prince Regent; J. Jensen, New North Bonshaw; J. Rees, Alliance, Steiglitz; A. Drummond, New Year, Steiglitz; W. Wright, United Albion, Steiglitz; B. Dingle Mitchell, Central Plateau; W. Chisholm, Prince Regent; M. Llewellyn, late Ironbark, Steiglitz; W. Thomas, Egerton Company; W. Josephs, Black Horse, Egerton; J. Black, late Waterloo, Steiglitz; A. K. Stewart, Eastern Star; A. Don, Tam o' Shanter, Steiglitz; A. Gawne, late South Plateau; R. M. Fisher, New Koh-i-noor; W. Edwards, late Egerton Company; H. Matthews, Lal Lal Lignite Company; H. Sutherland, Elaine; W. H. Hicks, Sir Henry Loch United; R. M. Serjeant, General Manager Band and Albion; J. Henderson, General Manager Black Hill Company.

MINING REPRESENTATIVES



BALLARAT 1895

Mining Representatives.



The above represents the Mining Exchange, J. D. Woolcott : the School of Mines, A. Anderson and Dr. Pinnock : the Miners' Association, J. Callinan : the Enginedrivers' Association, W. J. Williams : the pioneer diggers of 1851, J. Smith : the first battery party, W. F. Osbourne : the Mining Board, J. M. Bickett : the Mining Registrar, W. Christy : the Mining Surveyors, J. Lynch and R. Allan. The Members of Parliament for the district, including the Hon. R. T. Vale, chairman South Star Company ; Edward Murphy, M.L.A., chairman Sulieman Pasha Company ; Edward Morey, M.L.C. ; Thomas D. Wanliss, M.L.C. ; David Ham, M.L.C. ; Agar Wynne, M.L.C. ; J. W. Kirton, M.L.A. : Robert McGregor, M.L.A. ; J. Kerr, M.L.A. : W. Anderson, M.L.A. The Legal Managers are represented by R. M. Serjeant, Chalk and Cahir, James Henderson, Geo. Ruffle, W. Jackson, T. Williams, J. P. Roberts, R. A. Thompson, J. W. Dill, E. W. Spain, C. Barker, W. D. Thompson, C. Wilson, T. Curthoys, W. M. Acheson, E. Verey, and W. Parker : and we have J. Agnew, the Mining Inspector ; and the representatives of the Ballarat and Melbourne papers in J. Downie (*Echo*), G. Cockerell (*Herald*), T. F. Hart (*Star*), T. W. Cotton (*Courier*), J. T. Bourke (*Age*), and R. T. Powell (*Argus*), with F. D. Johnson (mines and fields reporter for the *Ballarat Star*) and the writer (mines and fields reporter for the *Ballarat Courier*).

The Mines.

WHAT a grand sound floats along from the mines on the eastern and western lines of reefs, especially at midnight when all else is quiet!

It resembles the roar from distant ocean-breakers, but it is the clamour from about 500 stampers, as they tell the tale of our prosperity, or otherwise, in very forcible language. Most of "the pay" comes through



The Ballarat Valley as seen from Bakery Hill in January, 1851. Looking west.

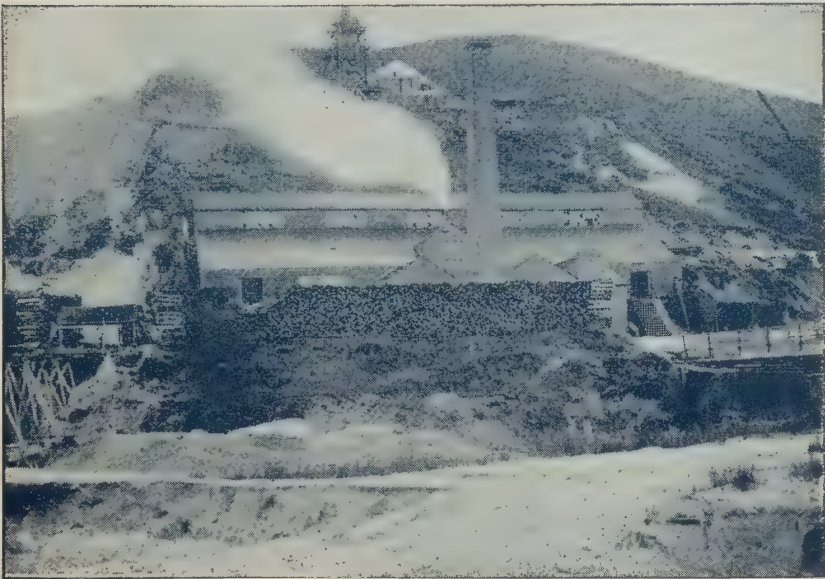
their boxes, and the rhythm of their beats therefore sounds musical to the thousands of dependents, viz., miners, tradesmen, and others, who have thrown their lot into mining.

Mining in general is beginning to show improvement all around, and there is reason to believe that the coming good time is to eclipse those good times of the past in the duration of its term and the value of its yields. Until recently our quartz mining has been characterised by spurts, due to the tendency we have had to treat all mines as if it was probable they would be worked out before the end of the month. Still the yields from the field have arrived every week, and time has proved that, although shareholders may come and go, the mine, if only treated as it should be, will go on for ever. And why is this? Simply because we are realising that our fields are treasures of wealth that can be made to yield their riches at a cost of less than 60 per cent. of the market value of such riches. We have been treating mining very badly. No business-undertaking could stand such gambling associations, such loose catch-as-catch-can treatment, such general wrecking, and live. The grand reality, as to our boundless resources, as to the cost of production in comparison to values, and as to the world's demand for more gold, has awakened our senses, and we are now going to work on a more lasting basis, that will tend to ensure a greater continuity and steadiness in the gold output.

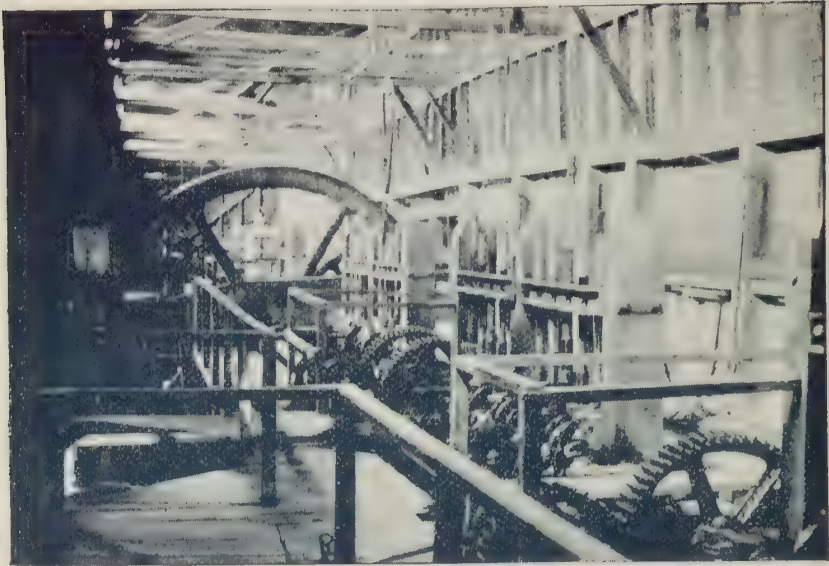
Away back in 1853-54 quartz crushing was commenced in Ballarat. This was on Black Hill (so called on account of the blackening it received from fires on "Black Thursday," February 6th, 1851). Being on the Indicator line of country, its surface contained a deal of nuggety gold, and it consequently received much attention from the diggers (there are people now alive in Ballarat who were here in 1851, and who state that the alluvial of Black Hill received attention from diggers a month before Golden Point did). In 1853-54, as stated, a party, which included a Dr. Otway (an American medico), W. F. Osbourne (a Londoner, late an officer in English Navy, who still resides on the hill), Captain Atrick (American merchant service), Patrick Usher (nephew of late Admiral Usher), and Lieut. White (of the 7th Light Dragoons), decided to commence operations on the quartz. They had made to their order at Langlands and Dow's foundry, in Melbourne, a four-head battery, and also a windmill, which was to do the driving. This was not a success. The stone was found to be poorer than anticipated, and the windmill was not a reliable motor. Another site was chosen, two additional stampers, a Chilian mill, and a small steam engine were obtained. The first site was at the top of Two Ton Gully, which is on the southern face of Black Hill; the second was at the bottom of it. The party used mercury and shaking tables, but no copper plates or blankets. Just as things were in order for work the Steiglitz rush set in, and the little party became disbanded. They had obtained several ounces of gold while operating on the top site, however, and the first amalgam was presented to Lady Hotham (who with her husband, then Governor of the colony, was on a visit to the goldfield). After the Otway party, other parties in turn went to work on the quartz of the hill, until finally the areas of the whole became united in the title of the present Black Hill Company. Altogether many tons of gold have been taken out from depths not averaging more than 400 feet, but, as the

income was spent as received, when it became necessary to call capital, collapse followed. Like cause, like effect, and the present Black Hill Company is suffering from general debility brought about by the same tactics. Nothing is being done on the area at present beyond what a few tribute fossickers are doing, although the large area held includes a width of country containing not only the Indicator belt, but numerous other lines of quartz formations. There is a splendid opportunity for the action of a strong company here. A main shaft would be necessary, to be sunk to a depth of 1,000 feet at least, although levels much shallower could be opened into payable stone. The present pumping and hauling machinery if placed on one spot would be ample for all requirements for many years to come.

The treatment followed here does not include copper plates. Sixty heads of stampers fall about 75 drops per minute, and the feeding is automatic. Mercury is used in the boxes, ripples, and in the barrels. Long stretches of blankets do catchment service. The amalgam yields from 30 to 60 per cent. of gold, according to the nature of the ore under treatment. The united mass of gold and mercury, which is called amalgam, has all mercury squeezed out of it, that can be squeezed, through strong calico or chamois leather. The remaining ball is dense amalgam. If the gold in it is very fine, only 15 to 20 per cent. of the weight of the mass will prove to be gold. The miners call this "poor amalgam." If fairly coarse, it will go 30 per cent., and if very coarse, 50, 60, or even 70 per cent. Thus we hear of amalgam going "half," or "more than half," but in Ballarat seldom lower than 30 per cent.



Black Hill Company's Crushing Battery of Sixty Heads. Employed crushing for the public.
(Looking north).⁷



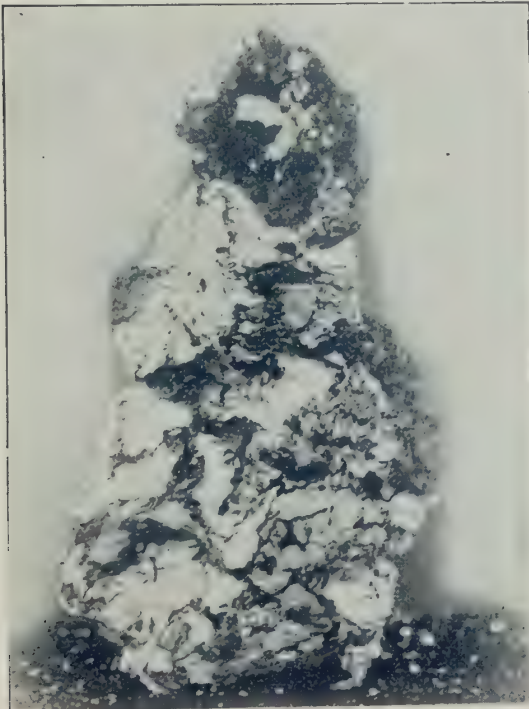
Interior View Black Hill Battery.

South of the Hill and on a spot which until recently belonged to the Black Hill Company, are the remains of one of its shafts, known as the "Queen No. 1."

It has been sunk 600 feet, but although in the heart of the Indicator country, nothing much has been done below by way of prospecting. From one of its crosscuts, one of the largest Indicator bunches of quartz and gold ever met with on the line was found. It turned the scales at more than 305 ounces, and after being cleaned was found to be worth more than £900. This was taken from the Eastern Indicator, which is east of the "Indicator." Experience tends to prove that deposits of gold have seldom occurred on two or more Indicators in any one part on the line. For instance, if a rich patch is met with on the "Indicator," the miners do not expect to find another patch on any of the others in the immediate vicinity. Thus, here the Eastern Indicator carried golden bunches, but the Indicator carried little or no gold. Of course, in depth this order of things may be reversed. Further south on the belt, it is generally so. The next mine south is the Victoria United Company's mine, a concern in 40,000 shares, half of which are held in England. The Indicator belt and other lines trend through the claim. A powerful winding and pumping plant graces the top, capable of dealing with depths to 3,000 feet or more. The ground was held formerly by several smaller concerns, which worked the shallow levels, and obtained heavy returns of gold, one crushing of about 30 tons yielding 1,400 ounces of gold. This stone came from the "Indicator makes." Other great yields were had from different parts of the area, but none of the mining efforts in those times were in accordance with requirements, that is,



WHAT MAY HAPPEN TO A MINE IN VICTORIA.
The remains of the Queen No. 1 on the Black Hill Flat.



INDICATOR GOLD from the above shaft. Weight, about 225 oz.
(The dark parts represent the gold).

as regards tactics essential to continued prosperity, and each venture collapsed on meeting with the first reverse. Acting on knowledge derived from experience, and holding an area which includes all previously held by three distinct companies, the Victoria United has commenced to give the place the attention it deserves. Not long since a diamond drill pierced "makes" at a depth from the surface of 901, 910, and 917 feet. The cores were golden. This was a little to the north of the present shaft.

Just south, the New Britannia is conducting operations. Here a first-class crushing mill of 40 heads is rattling along at about 85 strokes per minute. The gold is as described in previous remarks on Black Hill. Mercury is used in boxes, ripples, and in barrels. Copper plates and blankets with the usual sluice catchments for the pyrites complete the treatment. The main shaft is about 940 feet deep. There are 24,000 shares in the venture, and less than £8,000 in capital has been put into it by the shareholders. About £160,000 worth of gold has been raised, and although comparatively in its infancy, in addition to doing a lot of opening work, purchasing, and erecting additional machinery, it has returned £7,800 in dividends. One marked feature met with on the east side of the Indicator country here and in the Victoria United mine is a felsite dyke. It is known as the "Pug," on account of decomposition having rendered it soft in places. The quartz "makes" found in its vicinity are known as the "Pug makes," and where these are associated with the dyke, gold occurrence is said to be greater. There are other dykes of the same class in Ballarat East, and all trend pretty well north and south, and descend in a zig-zag course.



New Britannia Company's Plant, etc. (In Indicator belt of country).
(Looking north-east).

South of the Britannia, the Last Chance United mine is situated. This company is in 20,000 shares. It has received in capital £5,500, won more than £127,000 in gold, and has divided more than £20,000. Its main shaft is down about 800 feet, and sinking is now in progress. The quartz occurrences it is working are the "Pug makes," called in other mines further south the "Eastern makes" of the Indicator belt. The massive nature of the "Pug makes" here augurs well for the future. The dyke met with in the Britannia passes through. The whole country appears to be one mass of quartz, the value of which is to be seen in the total of the dividend account. What further crosscutting may bring to light here, and in all other mines, is hard to say; but enough is seen in tramping through the different levels to convince us that, although shaft-sinking should be



Last Chance United Company's Plant, etc. (Indicator belt of country).
(Looking east).

always proceeding, continuous crosscutting from all levels is of equal importance. The company has 40 heads of stampers, and the same treatment is followed as at the Britannia.

North-west from the latter mine is situated the No. 2 shaft of the Sulieman Pasha Company's mine.

The Sulieman lode varies in width from a few feet to 50 feet. It underlies to the west, pitches south, and its gold occurrence appears more in the shoot phase than as with the Indicator formations. Like the latter, however, it is found in junks of crystal form, in sponge-like pieces, and in strings, and also fine but rugged. The pyritic minerals are as common on this field. The main shaft is down 850 feet. At the northern end of the area not much is doing, but the action of the Victoria United,

in the Indicator country near by, is bound to stir things, and then shaft-sinking and crosscutting will ensue. Not far away, in a westerly direction, the largest nugget ever got in the Ballarat district was obtained. It was named the "Welcome," and it turned the balance at 2,217 ounces.



Sulieman Pasha Company's Plant, etc. On Sulieman Pasha line of lode, to the east of Indicator belt. (Looking south-east).

The Sulieman Company has raised more than £226,000 worth of gold. It has received nearly £12,000 in calls, and it has divided £22,000. Another felsite dyke, known as the "sediment," passes through the area, and bears the same relation to the lode as the more eastern dyke (Pug) does to the "makes" in its vicinity. South on the same line is the Llanberris mine. The company is in 2,000 shares, and got its birth in the year 1856. In working alluvial it uncovered a mass of quartz. This was the first of the Sulieman lode to receive attention. From that time the concern has been quartz mining, both on the Sulieman lode (a formation to the east of it known as Roberts') and on the Indicator belt, but its operations during about 35 years have not been extended much below 400 feet. The gold receipts total £136,526. The capital received is about £24,500, and £25,550 has been divided. The area is now worked by tribute companies. There are four separate steam winding plants and a 30-head battery on the ground. A tribute company, known as the "Llanberris No. 1," has one of these plants, and it has arranged to work the eastern or Indicator side of the area. Its shaft is now down 820 feet, and the management is exploring to the east and west and south, in a country loaded with galena and black jack.



IDEAL SECTION (looking north).

Section (face of cutting from east to west) of Formation in Sulieman Pasha Mine, showing Hanging Wall having fallen into and caused split in Lode. Scale : About 30 feet to 1 inch.

Going south we enter the area of the New Speedwell Company's mine. The main shaft is 700 feet deep (still sinking), and all the works to date have been confined to the "Indicator makes," and, as with all the mines on this remarkable belt, the Speedwell area has in a sense been sampled only in the shallow levels. From these more than £150,000 worth of gold had been taken previous to the present company acquiring possession about ten years ago. Since then, about £110,000 worth has been mined, about £9,000 of which has been paid in dividends. In developing works and machinery the new company has spent about £15,000. The main shaft has been deepened from about 400 to 600 feet. New machinery of the latest type has been added both to the winding and crushing plants, and a great amount of general exploring work has been carried out, and paid for by the gold. The crushing mill has 29 heads. No mercury is used until the amalgamating barrels are reached. The manager holds the opinion that where ores contain arsenical pyrites in a fine form, the latter divides a percentage of the mercury into globules, which form rafts on the water and assist the finer particles of gold out to the pyrites-catchments and the tailings-heap. He uses a wooden box, placed just outside the gratings, called a splash-box, with plenty of blankets following, and has found that

he thus catches a *greater* percentage of his gold *sooner* than when using mercury in the stamper-boxes and ripples. After the frictional matter and fine arsenical pyrites have been washed out with the tailings, the pyrites retained on the blankets is of too clean a nature to affect the mercury in the barrelling. The pyrites retained in the catchments beyond the blanketings in and outside the battery-house, yielded, when the mercury treatment was in use, between two and three ounces to the ton, and now they are hardly worth one ounce and a half. The system was not adopted before the results of experiments warranted it, and now the different tribute parties on the mine, and outside parties who bring ores occasionally to be treated, will have no other.



New Speedwell Company's Plant, etc. (Indicator belt of country).
(Looking south).

The New Normanby—the next mine—is one of the deepest of the eastern mines. The main shaft is down more than 900 feet. Explorations at that level have given evidences proving that the richness of or the number of “makes” in the Indicator country is not less at greater depth. All things appear to be about the same, excepting in this, the country is a little “tighter” in places. No doubt the causes which operated in forming cavities, and in storing quartz and minerals in them, have been general in their effects to depths comparatively shallow, when we consider the probable thickness of the crust of the earth, but very deep when measured from our standpoint. We shall keep moving down wherever it pays. Judging by the progress in deep mining in some parts of the world, where shafts are now below 4,000 feet (from the surface), Ballarat East has

a long distance to go yet ere it becomes abandoned, for has it not taken thirty years to root out a small portion of its golden "makes" from the surface to an average depth of, say, 400 feet? To date, the New Normanby Company is the pioneer in the move downward in the east, and withal, it is one of the youngest on the line. Its example is being followed by the New Victoria, the New Britannia, the Last Chance United, the Llanberris No. 1, the New Speedwell, and the North Woah Hawp Companies. It is in 24,000 shares, and has received £13,000 in capital. In return for this a good winding and crushing plant has been erected. Seven or eight levels have been opened, and works extended to the east, west, north, and south, from which more than £100,000 worth of gold has been taken. From this, money advanced by the Government has been returned, and £8,000 has been divided among the shareholders. It has a first-class 20-head battery, and the mercury and copper-plate system is in use.

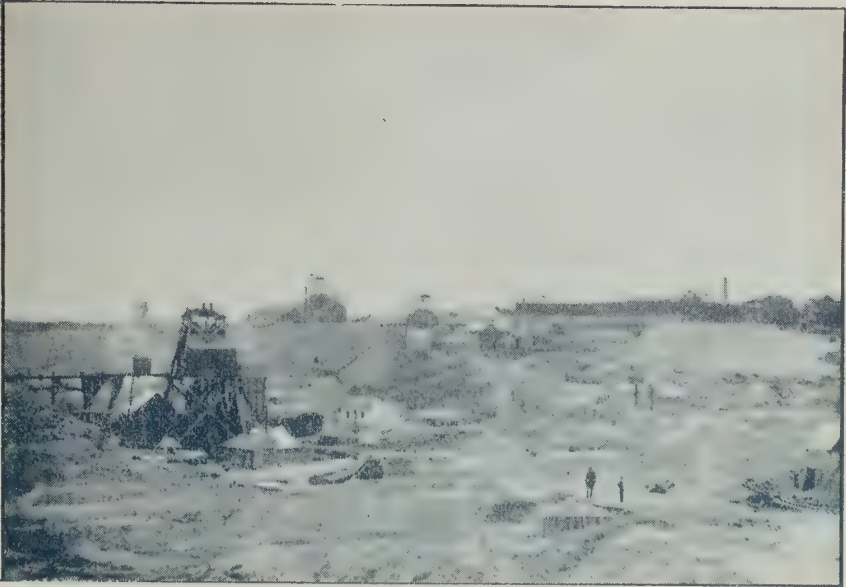


New Normanby Company's Plant, etc. Indicator belt of country (looking south). North Woah Hawp Company's plant and Prince Regent group of mines in the distance (Indicator belt of country).

South and adjoining it is the North Woah Hawp mine. The main shaft is down 860 feet. It has a good winding plant, and does its crushing at a public battery in the vicinity. There are 22,000 shares in the company, and the capital received does not exceed £3,600. Gold to the value of about £143,000 has been won, and more than £14,000 returned in dividends.

To the south there is a village of mines. The first is the Prince Regent Extended, a company which has secured about 50 chains in length on the Suliman Pasha line. It managed to get a title to this ground

and to erect a steam plant and do a little shaft-sinking before its strength failed it. The plant has been steamless for a long time, but the results of crosscutting to the west in the northern and southern mines will no doubt stir it into life again. South and a little east of this, the Woah Hawp Canton, a Chinese company, Tinworth's, a private concern, and the Prince Regent, a public company, have each their main shaft on the Indicator belt, within a north and south length of 1,500 feet. A little to the west of these the Dalzell-cum-Prince Regent and the North Prince Regent Companies have shafts down in the "western makes" of the Indicator belt. Not much can be learned concerning the yields from the Chinamen's and Tinworth's, but as they "keep on," and the owners appear joyful, no doubt these ventures are paying well. The Prince Regent, just south of them, is not doing so well. Its efforts are hardly in accordance with the extent of its area. A little south of the main shaft a crosscourse, bending as usual to the south-west, has displaced the country to the west (going south) for a distance of about 600 feet. The greater part of the company's area is south of it, but nothing has been done on its lode occurrences. Sooner or later this ground will receive attention. There are 20,000 shares in the Prince Regent Company: £12,000 has been received from capital, about £50,000 in gold, and £7,000 has been distributed in dividends. The main shaft is 870 feet deep. The Canton Woah Hawp, Tinworth's, and the Prince Regent have each crushing mills (stampers) of their own, in all of which mercury, copper plates, and blankets are used. The Dalzell-cum-Prince Regent Company's mine is in "Clark's Lease," which adjoins "the Prince's" area on its north-west end. Mr. Dalzell floated a company in 1,800 shares to work some stone known as the "western makes." The area includes a width (east and west) of about 750 feet, and a length of about 375 feet. A shaft has been sunk to about 750 feet, and from the "makes" worked to date more than £56,000 worth of gold has been won, and out of this more than £13,000 has been allotted in dividends. Not quite £3,000 was received in capital, and most of this is represented in the first-class double-cylinder winding plant on the claim. North and adjoining is the North Prince Regent mine. Here the area is also small, but like the Dalzell-cum-Prince, good. It includes about 450 feet on the line by a width of about 750 feet. There are 22,000 shares in the concern, and the capital received amounts to £4,125. A good main shaft is down to 685 feet, and from the different levels opened gold to the value of £46,161 has been taken. The dividends total more than £5,000. These "western makes" are of great size, and are just as much in evidence in the lower levels as nearer the surface. Irregularly shaped masses of quartz, varying in width from say a foot to 30 feet, having spur-like occurrences on both sides, are to be seen, and the country appears to be full of them. The country, as usual all down the line, is loaded with pyrites, the sandstone and slates (in addition to the bunches in the quartz) carrying it as currants are carried in a pudding. A good winding plant is at work, and the crushing for both the Dalzell-cum-Prince and this company is done at Clark's battery alongside, which is connected by tram.



Prince Regent Group of Mines (looking south). Chimney to the right is on Clark's Battery. The next mine is the North Prince Regent, then the Dalzell-cum-Prince Regent, and then Tinworth's with the Chinese mine nearest in the hollow. The Prince Regent shaft is in the hollow, south of Tinworth's. (Indicator belt of country).

Continuing south, we cross the areas of "the Indicator," the South Woah Hawp, the Golden Gate, the Dalzell and Buchanan, the Little's Defiance, the British Queen, the South Dalzell, and the Tower Hill Companies, all of which are on the Indicator belt. Further south we pass through a neglected part of the line, which, judging from the nature of its quartz occurrences and of the alluvial which has been worked in the different gullies leading off it, is just as worthy of attention as are the more northern parts. Passing on, we enter the Hiscocks region, celebrated as being the locality where gold was obtained prior to the first rush to Ballarat. Here the Indicator class of quartz formations is as much as ever in evidence, but the actual pyritic sheet has not been seen. A company known as the Hiscocks is at work on "makes" similar to those known as the western of the Indicator belt, but they may represent the southerly continuation of the Sulieman Pasha line. Quartz mining has been carried on here for more than thirty years; but, as with the majority of Ballarat East mines, the workings do not average more than 400 feet in depth. Not far south the Imperial Company is operating on quartz said to belong to the Sulieman line. This concern was inaugurated in the latter end of the fifties, and its workings are still above the 400 feet level. More than £150,000 worth of gold has been won, and, as in the companies of the past, each shareholder works his own share or puts a man on. A 12-head battery does the crushing, and copper, mercury,

and blankets are in use. The Indicator features are present for many miles further south (to the Durham), and in the alluvial taken from the gutters making off the higher ground nuggety gold has been the rule, not the exception. Different spurdy efforts have been made on the quartz, and the output of gold from it (including that from the Imperial Company) is said to have exceeded £400,000 in value.

Hard Hills, immediately south of the Imperial, was the scene of a great rush in the sixties, when the iron cements and the shallow washes which abound in the locality got sampled. Over the hill to the east is the township of Buninyong, and here great wealth was taken from a gutter which came from the south (on the east side), turned a half circle to the west and south, and went on to join the main stream from Ballarat as it passes to the Durham. A main line of quartz formations trends north and south in the "high reef" near the head of the gutter, and its mineralised quartz remains a glaring memento of unsustained efforts and marvellous apathy. These formations can be traced for many miles south, as they form a ridge from which numerous rich gutters made off to the main stream: and north the outcrops appear through the ranges, on past Ballarat East, through Little Bendigo, to Creswick. Nothing doing, however, for miles on the Buninyong end! The region cannot remain neglected much longer now that we are beginning to treat quartz mining seriously.

Between this line and the more western line which passes through the Hard Hills (the Ballarat East Indicator) extensive alluvial deposits have been worked. They trended south and east, under a volcanic layer, to the main gutter from Ballarat, and have been only partly worked, as the water became too troublesome after the mines ceased operations on the main stream. Before mining came to a standstill on the higher ground, however, more than £340,000 worth of gold had been won, and now that recent excursions into old workings in the main gutter have demonstrated that there is nothing to fear from the water (now drained) no doubt the three and a half miles of washes remaining in the tributary gutters will be put through the puddlers before long. A company called the Great Buninyong Estate has commenced operations, and what with the golden quartz formations and unworked alluvial of the area secured it has a good time in store if its efforts are to be conducted in a comprehensive manner.

Retracing our steps, we pass west to the lines of the Township reefs: and here it is as well to mention that although the Consols and the Guiding Star formations appear to be further apart from each other as we go south, the Township (viz., the Bonshaw, the Guiding Star, and the Consols) and the Indicator lines appear to be coming together. We have not far to tramp before we meet with the most southerly effort on the Consols line at a place called Long Gully. As usual, the spot carried rich alluvial in the early times, and ever since it has received spurdy attacks on its quartz occurrences. Recently a concern known as the Long Gully Company secured a lease with a view to giving the locality a thorough trial. The main shaft is down 700 feet, and in crosscutting

several lodes have been met with, some of which have "makes" that are very laminated, and carry a high percentage of pyritic ingredients and gold.

Due west at a distance of less than half a mile, we enter the area of the Prince of Wales and Bonshaw United Company. Beneath the basalt covering (which extends to the western edge of the Yarrowee River), and within this area, the main gutter from Ballarat winds its way (see plan), and from its bed, during the sixties, tons of gold were taken by companies (now defunct) known as the Prince of Wales and the Bonshaw. After the Prince of Wales Company had worked its alluvial it turned its attention to a large quartz reef which had been uncovered. Sixteen heads of stampers were erected, and some thousands of tons crushed for an average return of 15 dwt. to the ton. When the works on the lode were connected with the works in the alluvial the water became very troublesome, and as other alluvial mines in the vicinity ceased working it became more so. In consequence of this increase of water, which became too heavy for pumping appliances then in use, quartz mining was put a stop to, and no further effort was made until late in the eighties. Then the present company, consisting of 24,000 shares, under the name of the Prince of Wales and Bonshaw United, secured the ground of the two areas, and erected a pumping and winding plant equal to dealing with the water and general haulage from a depth of at least 3,000 feet. It



The Plant, etc., of the Bonshaw Company (looking south-west). (Bonshaw line of lode, west of Guiding Star line).

commenced sinking operations at a point about 2,000 feet south of the old workings, and ultimately reached a depth of 954 feet, from which level and others it did a lot of exploring on lode tracks. The first track intercepted proved to be a regular "stringer." Thousands of feet were driven, and four

years' time and thousands of pounds in cash had to be written off. As a last resource, it was decided to continue a crosscut commenced some time previous at a point about 1,100 feet north of the shaft. In due course a "make" on a line hitherto unknown was struck. It proved to be 20 feet in width from wall to wall, and it contained the usual pyritic blends in a very rich form and gold. Shares which previously could have been obtained for the call (sixpence) bounded away to pounds as crushing after crushing proved the find to be richer than anticipated. Further explorations made it apparent, however, that the "make" had been cut near its highest part, and that it pitched south at a sharp angle. A first-class crushing battery of forty heads was erected, and its action has resulted in panning out about £20,000 worth of gold to date. Two deeper levels have been opened (one at 1,050 feet and another at 1,150 feet), and opening works are in progress in both. The Bonshaw developments are due to crosscutting, and the question arises how many other lines of lode are there in the company's extensive area which crosscutting to the east and west might bring to light?

To the north and east of the Bonshaw we find the South Star Extended and the Prince of Wales Companies, both of which are carrying out exploring works, the former on the Guiding Star line and the latter on the Consols.

North again the Sebastopol Plateau No. 1 Company has an extensive area. A main shaft is down about 1,000 feet, and the crosscut has been through a formation supposed to be a continuation of the Guiding Star occurrence. All is quiet at present, but the recent developments on the Plateau in general render it probable that the plant will be under steam again shortly.



Central Plateau Company's Plant, etc. (Guiding Star line of formations).
(Looking north-east).

The next mine is the Central Plateau. Here all is activity, and the works are being pushed ahead in search of the southerly continuations of the golden "make" (said to belong to the Guiding Star line) recently met with in the adjoining mine—the South Star. Two main crosscuts are being extended to the west from a shaft 1,005 feet deep, one from the 860 feet level and the other at the 980 feet. There are 25,000 shares in the concern, and the plant includes substantial winding and pumping machinery.

Not far north of the Central mine is situated the shaft of the South Star Company. A depth of 2,030 feet has been reached, and exploration works are in progress at the 2,000 feet level on the "Consols" line. Crosscuts have also been extended westward towards the line of the "Guiding Star" formation from the 720 and 1,200 feet levels. Developments at more than 1,100 feet west of the shaft in the 720 feet level crosscut have of late proved very satisfactory, a golden "make" on the "Guiding Star" line having been cut. It averages in width say six feet, underlies at about 22 degrees to the west, and pitches south. The quartz is laminated on the footwall side, which latter is greatly frictionised, and pyrites appears between the laminations associated with gold. The latter mineral is to be seen also, imbedded in the solid stone. The hanging wall side bears the usual phase. So far the gold-bearing part of the "make" has proved to be about 500 feet long; but as the northern face continues to advance in a three feet width of gold-bearing stone it may yet be found to extend to the Star of the East Company's southern boundary, over 800 feet ahead. The southern face also continues to carry



South Star Company's Plant, etc. (Guiding Star and Consols lines of formations).
(Looking south-east).

golden stone. As remarked above, the "make" pitches south, and its being met with in such a strong and golden form, within say 500 feet of the Central's boundary, was enough to stir the latter company into activity. There is nothing like gold. It takes a lot of hard pulling to drag a few thousands in cash out of call payers, but only run a crosscut into a "make" containing a "glitter"—

When the stone finds all the pay,
Then the stamps begin to play
Sweetest music, night and day,
La-de-da! La-de-da!

The South Star Company had a long term of call-making, but the sinking and crosscutting tactics followed were bound to result in success, sooner or later; much sooner, perhaps, had not precaution to be taken in



CHANGING SHIFTS, SOUTH STAR MINE.

Just as many on the cage as they can stow,
When the driver puts the engine on the go—
Then they glide away from light
Into everlasting night,
Where they man the stopes and drives away below—
(It's not always beer and skittles ' down below ').

keeping well under the level of the main gutter. The "make," only just "broached" as it were, has to date yielded more than £24,000 worth of gold, and has averaged something like 12 dwt. to the ton. This has enabled the company to proceed with extensive developments in the lower levels without recourse to calls. The crosscut at 1,100 feet level (out west about 1,100 feet) is taking attention, and a "rise" is going through from it to the stoping works on gold in the 720 feet level. When connection is complete we may expect to hear soon of the South Star Company

entering the dividend list. The area held is large (see plan), and embraces the Consols and Guiding Star lines, in addition to many others which the crosscuts have yet to bring to light. The machinery equipment for pumping and winding, drills, and ventilation is ample for all requirements. There are 30,000 shares in the concern, and the calls have been responded to so well only £1 5s. 6d. has to be credited to sales of forfeited shares. At present the quartz from the South Star is crushed at the Star of the East Company's battery.

About a quarter of a mile to the north of the South Star mine the plant around No. 1 shaft of the Star of the East mine is situated. This



Star of the East Company's Crushing Battery.
(Looking south-west).

shaft is on the Consols line, and it is now down more than 2,000 feet. Some years ago the Band and Albion Consols Company worked a rich gold shoot in the Consols occurrence to its southern boundary, where a break was found to have displaced it. The Star of the East Company was formed to prospect the ground south, and after considerable plodding (many people said the lode would not be found south of the "Band's" area) a continuation of the stone carrying a golden shoot was found, and the company then commenced a career which has proved so far a continued success. Soon investigating works were conducted by crosscut to the westward at the 600 feet level that the formations on the Guiding Star line might be sampled, and in due course No. 2 shaft (situated about 1,000 feet to the west of No. 1) was sunk. The "makes" cut here were found to be of far greater magnitude than anticipated, having a width, in one of the levels, of 70 feet. At No. 2 shaft a new 70-inch Cornish beam engine, to be worked by 80 lb. boiler pressure, is now being erected, and early in 1896 it will be



Star of the East Company's Crushing Battery. Inside the eighty head building.
(Looking north from the engine-stand).

"on the job." In the engine house are the usual list of engines for winding, air compressing, ventilation, and sinking. The winding engine is of the double-cylinder pattern now coming into general use. The driver (to whom, as a notice states, you are not to speak) stands



Star of the East Company's No. 2 Plant, etc. (Guiding Star line).
(Looking north-east).

“monarch of all he surveys,” listening to the signal knockers. According to the readings, he directs the energies of the monster he rules and makes its power felt in the busy regions below. At No. 1 shaft, another machinery turn-out something similar to that at No. 2 shaft is at work. Alongside is the crushing mill, in which, all told, 100 head of stampers are at work. This is the largest battery in the Ballarat district, and the facilities it affords for getting through great quantities of stone have enabled the company to work some low grade ores at a profit. From the two lines it has taken more than £800,000 worth of gold, and to enable it to commence on this treasury less than £21,000 in capital was used. For this £21,000 the company has received £276,000 in dividends and about £30,000 has been paid to owners of the ground held. It has a plant valued at about £20,000, and an area, hardly touched yet, of unknown value. As soon as both shafts are connected at the 1,820 level sinking is to be resumed at No. 2 that the next series of “makes” may be worked, and crosscutting is to receive more attention.

Now we come to the famous Band and Albion Company's mine. Here things are emerging from a long work of discontent. Recent developments at No. 9 shaft on the Guiding Star line have brought golden faces to light, and in due course “the Band” is to support its efforts and reward its capital with the wealth from below again. As with the Star of the East, a time arrived when the company had to secure better facilities for dealing with the water, this shaft being down more than 1,900 feet. A beam engine 60 inches in diameter has been placed in position, and all being well, it will be lifting water before this year is out. In the meantime opening works are proceeding at the 1,800 feet level on a body



Plant at No. 9 Shaft of the Band and Albion Company. (Guiding Star line).
(Looking north-east).

of stone averaging not less than 12 feet in width and carrying gold in company with the usual pyrites. The rises are going up in a solid body of quartz, which pitches south and underlies to the west. This solid body of



IDEAL SECTION (looking north).

Section (face of cutting from east to west) showing Nature of Lode Occurrence cut recently in the 1,800 feet Level, No. 9 Shaft, Band and Abson Mine. Scale: About 40 feet to 1 inch.

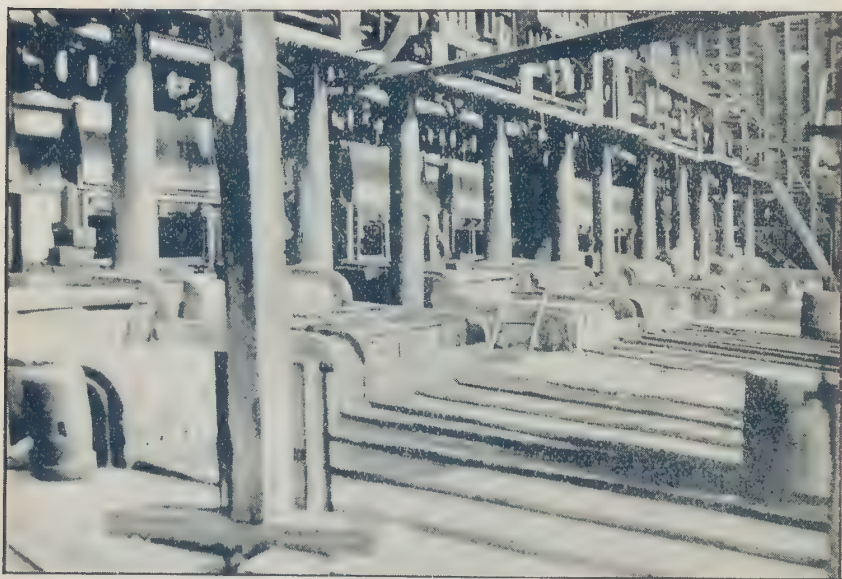
quartz has been formed in close association with a defined arch in a corrugation of the strata, and probably has a depth extension which not only means a lot for the Band, but for companies on the field in general. Theory has said that we can never reach a depth beyond the confines of quartz-laden gold-bearing country, and practice has verified its assumptions so far. At the 1,900 feet level a crosscut is going east for the Consols line, which in consequence of the angle of its underlay (to the west) is supposed to be nearer No. 9 shaft than No. 7, from which latter shaft parts above 1,700 feet level have been worked. The Consols lode has a wonderful record. The Band met with it in the workings near No. 6 shaft in the year 1879, and followed its gold shoots north and south to a depth of about 1,700 feet. As mentioned in connection with the Star of the East No. 1 shaft workings, that company took up the running, as the lode, carrying gold shoots, extended into its area from the Band's. The Star has worked it for thousands of feet southerly, and the South Star, the Prince

of Wales, and the Long Gully Companies are exploring on its line further south still. North the Sir Henry Loch United and New Kohinoor Companies are on it. Taking the total of the combined yields won from it to date, it cannot be less than £1,000,000, which has cost less than £600,000 to produce. The value of the machinery, plants, and areas are to be credited as assets. The formation differs from others on the field. It has less of the bulging "make" and less track phase, although a bulge with spurs has been met with having a width of fully 70 feet. (See plate, page 20). The walls have the smooth frictionised appearance. The average width of stone does not exceed four feet, and the laminated kind of structure is found frequently to extend from wall to wall. The Band has come down to us from the days of alluvial splendour. Its area represents a combination of areas, and includes ground once held by the Band of Hope, the Great Extended, and the Albion Companies. These concerns did not exist long in single form. The Band of Hope and the Extended joined hands, and in due course became united with the Albion under the name of the Band of Hope and Albion Consols. The gold won from the deep alluvial by each and all exceeded in total 519,551 ounces of the value of £2,078,325, of which more than £900,000 went out in dividends. Then the company took to quartz mining at the No. 6 shaft (as stated), and from the workings on the Consols line, and from those on the Guiding Star line (No. 9 shaft) it has raised more than £600,000 worth of gold, £250,000 of which found its way into the dividend account. Since then about £70,000 has been received in calls. In addition, as with all companies whose areas extend through the region of the Golden Point gutter and its tributaries, the Band intends to explore the higher ground of the ancient stream in search of washes, which though not considered payable



Band and Albion Company's Crushing Battery and No. 7 Winding and Pumping Plant.
(Looking west).

in the early times, may prove so now on account of the improvement in treating appliances and the lesser amount of water to be dealt with. It is thought that the tens of miles of old alluvial workings over the present quartz workings no longer contain the seas of water said to have accumulated in them since alluvial mining ceased. These connected workings formed a sort of adit more than twenty miles in length, extending to lower elevations, and notwithstanding that it may have become partially blocked in places, its presence facilitated the general drainage of the whole watershed. The winding engine at No. 9 is a splendid turnout of the double-cylinder type, equal to about 4,000 feet of haulage. There are air-compressors, ventilating and sinking engines, in addition to the new 60-inch beam engine for pumping purposes. Connected by tram is a 50-head battery, with mercury and all the gravity catchments for saving minerals, such as ripples, copper plates, Halley's tables, Frue vanners, etc. Close by the battery is No. 7 shaft, which is to be connected underground with No. 9 some day.



Band and Albion Company's Crushing Battery of Fifty Heads.
(Inside, looking north-west).

The next mine is the Northern Star. Here prospecting work is proceeding at different levels down to 1,300 feet on the Guiding Star and other lines to the westward. The crosscut at 1,200 feet level is in to the west more than 1,600 feet, and a large body of stone has been cut, supposed to belong to the Bonshaw line. This is the most western face on the field, and the discovery is of importance in verifying assumptions

as regards the existence of quartz formations out west. Dozens of lode tracks were passed through (including an elvan dyke 30 feet thick) in driving the crosscut, any of which might have a "make" face in the first 50 feet of driving along its course. These are to be explored in due time, but at present the western find is to receive all attention. The company has, in common with all companies on the plateau, a large area, and it is carrying on its general explorations in a systematic manner.

East of this, on the Consols line, is the Sir Henry Loch United mine. Here sinking operations have been continued to a depth of about 1,700 feet in following a rich shoot (or shoots), and although the length of stone worked does not exceed 200 feet and its width does not average more than 3 feet, £178,000 worth of gold has been mined, over £63,000 of which appears on the dividend account. As inferred, the shoot (or shoots) pitched nearly vertical, and the stone appeared laminated in places from wall to wall. It underlies to the west at an angle of about 22 degrees or less, and the bulge form is conspicuous by its absence. Recently the Loch's area has been increased by the addition of that recently held by the late Band and Barton Company. It now includes the ground once held by companies of the past known as Serjeant's Freehold, Fattorini's Lease, North Band Freehold, Young Band Freehold, Harvey and Bath's Freehold, and the Smith's United. The Consols line passes down the length of the area, and to the east of it a line of formations exists, carrying features similar to the Indicator line of the east as regards structure of quartz occurrences and class of gold, and also in the sheets of pyritic minerals which are associated with the "makes."

North of the Sir Henry Loch United is the New Koh-i-noor mine.



New Koh-i-noor Mine and Battery. (Looking south-east.)

The shaft is down about 1,300 feet, and crosscuts have been extended west from the Consols to the Guiding Star line. Both formations have been worked with varying results for long distances, but on the whole not much has been done to test the lower ground. The higher levels have been explored and worked a deal, especially on the Consols line, and gold to the value of £160,000 has been taken out. The "makes" on the Consols lode here appear more in the form of those on the Guiding Star line having bulges fully 50 feet wide, with spur occurrences running from their eastern sides. The spurs form a network similar to the Indicator occurrences. The whole country, for a width of about 140 feet, is more or less composed of bulge and strings of quartz having the lumpy sort of gold deposition. These features are more conspicuous in the vicinity of the shaft, but south, and near the Sir Henry Loch United mine, and generally in the levels below 900 feet, the country and lodes appear in a more regular form. Not much prospecting has been done to the east of the Consols line, although tons of gold were taken from its alluvial. Crosscutting is to be resorted to shortly from the lowest levels, and an effort is to be made to test the eastern, northern, and western parts of this immense area. It is all maiden ground as far as concerns quartz mining, and when we consider the richness of its alluvial, we feel assured that its quartz occurrences are to help a lot in the gold yields of the future. In the meantime the management has chanced meeting with water accumulations in the old workings overhead, and has put rises through to them. The "wash," so far, has proved payable. Instead of puddling it, it is put through the battery, and the treatment is found to be effective and economical. This development is another step in the direction of a return to that class of mining which all companies on the plateau are to take part in yet. The question arises, How many high mounds of washes remain untouched on different parts of the field similar to that known as the Hurdfield? From the latter (situated near by and to the east of the Consols line) was taken about a ton weight of gold. The owner of a residence area, measuring about 300 by 65 feet, sold the right to mine to a small company, and the developments which followed caused quite a boom in Ballarat in the latter part of the seventies.

The New Koh-i-noor Company has received more than £160,000 worth of gold from its quartz, about £63,000 of capital, and has divided about £35,000. It has a good winding, pumping, and crushing plant (the latter having 70 heads), and its general arrangement is compact.

North and west of the Koh-i-noor area there is nothing doing in mining, although in both directions there was great activity in alluvial times. The silurian outcrops through the basalt in places, but beyond the remains of a few weak and spurdy efforts on the quartz, the place is as maiden as ever—and this in the middle of a goldfield the richest the modern world has ever known.

Now, having reached the most northerly of the active ventures on the township line, we must go east again to the locality of the Grey Horse mine, Little Bendigo. (See plan.) The Grey Horse is a Glasgow company, and it has secured an area which has had intermittent attention at intervals



Grey Horse Company's Crushing Battery of Forty Heads.
(Looking north-west).

during the last 38 years. None of the efforts were conducted in accordance with requirements, and none survived. People are only now awakening to the fact that there are no lodes having a uniform gold richness in their lengths and breadths. All have rich and poor parts, and if the necessary system in mining is not adopted,—if the poor parts are not mined with the rich,—a mine suffers, and frequently becomes deserted. The cry of most shareholders is—“give us the gold in sight. Let others do the dead work,” and accordingly (under the No-Liability Act in particular) a mine experiences periods of activity and desolation, as one venture after another succeeds in tracing and working the gold shoots to deeper levels. Where the life of a mine is considered this state of affairs becomes minimised, and a regularity in the yield of gold follows, which, although perhaps admitting of a smaller dividend return per month, means that the capital involved is on a more sound and profitable base. If one part of our field has suffered more than another from the action of weak and ill-organised ventures it is the Little Bendigo part. As far back as 1856 crushing was commenced there, and since that time more than a dozen companies have got on their feet, to fall again on meeting with the first slight reverse. The place carries more than the average number of lodes, all of which trend north and south, and underlie to the west slightly. They are known as the Monte Christo, No. 1, No. 2, No. 3, Cook's, the Temperance, and the Welcome. The “washes” taken from over these outcrops in the early times are said to have yielded more than £800,000 worth

of gold, and since then considerably more than half a million's worth has been taken from the lodes. The latter bear all features (mineral and otherwise) to be seen in the Township and Indicator formations, one in particular (known as the Temperance) being very similar to the Consols. Instead of underlying at a slight angle off the line of strata, as do the Consols, the Temperance trends parallel to it, and has accordingly the same country in its hanging and foot walls through the distance which has been worked. These walls have been frictioned, and are very smooth. In the rest of the lodes the general features are more like the Guiding Star occurrences, and in places the "makes" are to be seen in a width of slates (say 90 feet) in echelon relationship. The Grey Horse Company has secured an area which includes most of the known quartz lines, and it has commenced to give the region a proper treatment. A 40-head crushing battery, to which is fitted all the latest appliances for breaking and crushing the quartz and saving the gold and pyrites, has been erected.



Grey Horse Company's Crushing Battery. (Inside, looking north-west.)

A shaft has been sunk 700 feet, and quartz occurrences after the pattern of fig., page 57 have been opened. The advent of the Grey Horse Company with such a strong machinery equipment means a lot for the district in general. It has come to carry out a comprehensive effort, and it does not expect bloated returns, but fair wages for the capital involved, with provision for repayment of same on (say) a five years' purchase base. In fact, it is going into mining (where reasonable assumption indicates payable gold exists) on a purely business base, which will allow of all stone above $2\frac{1}{2}$ dwt. to the ton being mined and treated at a profit. Since operations

have been commenced the country immediately around and for many miles to the north has been applied for and several companies, known as the Lothair, the North Grey Horse, the Grey Horse Extended, besides others, have commenced operations. This line (or zone of lodes) passes on the east of the Ballarat East Indicator belt, and between it and the granite its outcrops can be seen for a distance extending in a north and south line of more than 20 miles (through Buninyong on the south and Creswick on the north), throughout the length of which rich alluvial was obtained in the early times.



IDEAL SECTION looking north.

Section of Grey Horse Belt of Quartz Formations, showing Slide and Crosscourse. Scale: About 40 feet to 1 inch. The horizontal plane (dotted part) represents about 1,000 feet in distance. The displacements of the country on either side of the crosscourse and above and below the slide do not represent the actual extent of the moves here. As will be seen, the crosscourse has resulted in shifting the lodes to the east (going north).

We have now been through the field and its mines, and in closing our notice it must be stated that the ground covered embraces that only which is represented on the plan. To the north and to the south, and to the east and west, in fact, all round Ballarat, are townships, all of which are built on spots opened by the men of the fifties for alluvial, and which are now centres of quartz mining.

Perhaps the most famous of these is Mount Egerton, situated about 15 miles to the east of Ballarat. Here quartz mining has been carried on since the middle of the fifties. The lode formations are similar to those of the Guiding Star line, Ballarat, as regards their bulging "makes" and spur-like annexes. They have been formed principally on the sides of arches and troughs in the corrugation. The "makes" occur in lines, bearing echelon relationship in depth extension, and the principal



IDEAL SECTION (looking north).

Section of Mount Egerton Belt of Quartz Formations, showing Slide and Cross-course. Scale : About 40 feet to 1 inch. The horizontal plane (flat part) represents about 1,000 feet in distance. The displacements of the country on either side of the crosscourse, and above and below the slide, do not represent the actual extent of the moves here. As will be seen, the crosscourse has resulted in shifting the lodes to the east (going north).

mining to date appears to have been conducted on one series of them only. The crosscourses of the dyke class are composed of a kind of felsite, which gives one a notion of their depth extension. The gold occurs in a coarse and in a fine form. A lump, irregular and rugged in shape, weighing more than 2,000 oz., was found in a bulge, and



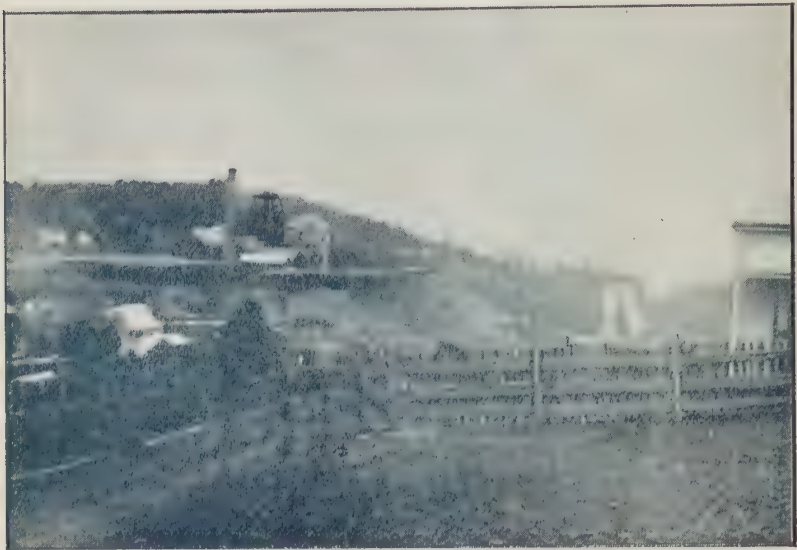
The Black Horse Company's Plant, Egerton. (Looking north-east).

samples as fine as ordinary pepper are met with frequently. The writer has seen gold permeating the quartz in a contorted "tea-lead" form, especially rich where associated with small and large cavities containing partly decomposed pyrites (principally iron) and clay. Several such "jewellers' shops" have been mined on Egerton, and in each case considerably more than £100,000 worth of gold was taken out in a very short time. Although this form of gold occurrence in bulge "makes" is common, stretches of laminated quartz comparatively narrow (having both walls frictioned), and carrying fine and coarse gold and pyrites in the stone, and in the laminations, occur at intervals. As in the Ballarat lodes, it would seem as if great lengths existed at one time, and that subsequent replacement-action had transformed the more crushed, or softer parts, on their lines into bulges, obliterating all evidences of friction on one or both walls. The lodes have been mined to comparatively shallow levels, along a distance, north and south, having a length of about 2000 feet. The companies at work are the Egerton (in 25,000 shares), and the Black Horse (in 20,000 shares), and the main shafts of both (situated within 400 yards of each other) are now down about 1,500 feet. The works are connected below, and both have been dividing the honors in working on one gold shoot, or a series of small shoots forming one large one.

The "Black" is the most northern, and its area includes not only the continuation of the famous line being worked, but of numerous others, all of which bear pyritic features of a very interesting character. From deposits worked to date more than £465,000 in value of gold has been won, and from this £178,000 has gone in dividends. This latter

is a good set off to the sum of £10,000 (about) received from capital. There is a first-class machinery turnout on the claim, including a 40-head battery, where mercury copper-plates are in use.

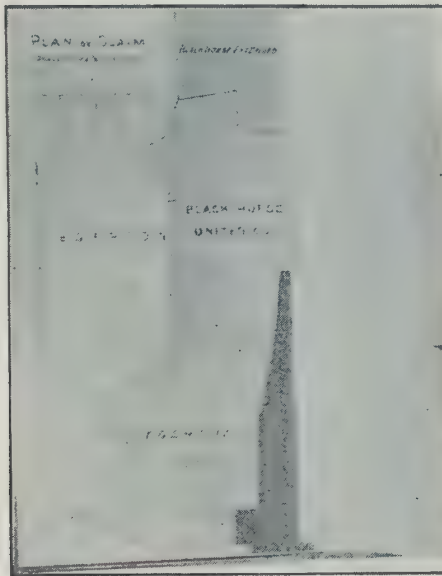
The Egerton Company has also a first class machinery plant. It



The Egerton Company's Mine. (Looking south-east.)

includes a Cornish beam engine for pumping and winding, and a 40-head battery. Its area extends away south. (See plan). At different points along this length operations have been carried on at intervals with very profitable results, and in mining occurrences, below those depths worked by previous holders, the company has taken out more than £775,000 worth of gold. The dividend account totals more than £310,000, and the capital receipts amount to less than £118,000. Altogether there has been won from the quartz of Mount Egerton, from the beginning to the present time, about £2,000,000 worth of gold, not less than £1,200,000 of which has found its way into the profit account. The whole mining movement on the Mount (as elsewhere) has nevertheless been of a spury nature. The intervals of glowing prosperity, alternating with those of bad times, mark the periods during which "make" after "make" in their echelon relationship, apparently, were met with and mined. Each proprietary for the time being appears to have had a bad opinion concerning the value of deeper ground, and yet the pick has proved it to be, so far, equally as rich as the higher. Of late years the "Black" panned out more than £100,000 in dividends from the vicinity of the 1,200 feet level, and the Egerton, from a patch a little south of this, gave more than £25,000 to its shareholders in the space of a few months. The lesson taught is that greater depths and more extensive crosscutting will yet result in proving that mining on Egerton, as elsewhere in the colony, is in its infancy.

Three or four miles to the north of these famous mines the township of Gordon is situated. Here, about the year '58, quartz lodes were opened, and the riches obtained threatened to eclipse in value those of Egerton. Lode lines trending north and south (and evidently forming part of the belt passing through Egerton to the east) occur, on which, from the date of the first discovery to the present, operations of a very "in and out" kind have been conducted. Rich occurrences have been worked at shallow levels along a distance, north and south, of about three miles, but of late years only one company has been active, and that on a basis hardly in accordance with the requirements. The formation which has been worked mostly is known as the Parker's lode, and it averages, say, four feet in width, and underlies, with the strata, to the east slightly.



Plan showing the Areas of the Black Horse and Egerton Companies' Mines, Egerton.

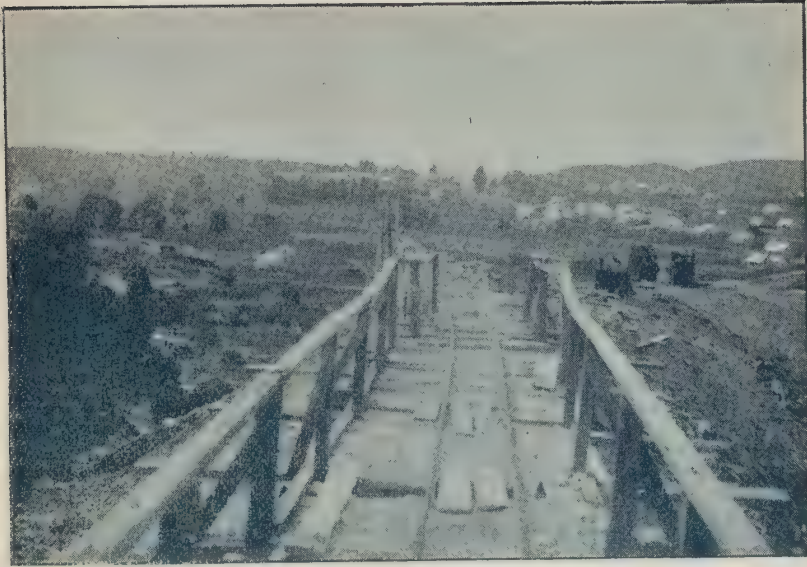
The Parker's lode trends north and south with the strata (see fig. 62). Its quartz is principally of the laminated kind, and the walls are for the most part smooth. The gold and pyrites occur between the laminations and in the stone. It is, though rugged, of a finer nature than that of Ballarat or Egerton, and contains a greater amount of silver alloy; value, about £4 per oz. The shoots of gold pitch almost vertically, and were met with first near the surface and mined to a depth of about 750 feet. Another gold-shoot was met with to the south at a depth of about 350 feet. This shoot, whether a continuation of the more northern one or not, was followed to a depth of about 850 feet, where the lode was found to be split

and poor. South again, another rich shoot was worked to a depth of about 450 feet, and since that time all efforts have been confined to rooting about in the levels opened. Most of the gold is found on the footwall side, and is richest where the wall carries a layer of quartzite (a kind of sandstone impregnated with silicate while in solution), and is hard. Where the wall is broken and soft not much gold is to be seen. These characteristics are general in the quartz formations through the whole of the State Forest which is to the north, and on to Daylesford. There has been a great waste of money on Gordon since the place paid dividends. The reason is, the great essential to profitable mining on this class of lode—shaft-sinking—was not attended to, with the result that about six times the total of the dividend account (about £20,000) has been squandered. A tenth of this sum spent in sinking would have shown very different results, for the gold-shoots of Gordon are of a very defined nature, and the simple fact that the lode became split at the 900 feet level is no argument that 50 feet deeper may not be found to carry it as broad, as defined, and as golden as ever. A splendid opportunity here awaits a company which shall mean business.



IDEAL SECTION (looking north).
Section (face of cutting from east to west) showing Nature of Gordons Lode Occurrences.
Scale : About 20 feet to 1 inch.

Between Egerton and Gordon an English company has secured an area, and south of Egerton prospectors are at work on the extension of this auriferous belt, which lies across the Moorabool River and on to Mount Doran. Around and on Mount Doran quartz formations outcrop



Gordons (as seen from the "brace" of the late New Parker's Mine, looking north-west).

in the ridges, from which crushings by small parties are being taken with varying results. The alluvial around is noted for its rich and patchy nature. Further west we reach Lal Lal, with its extensive deposits of lignite, its millions of tons of decomposed granite clays, and its broad expanses of terraced boulder washes on a granite bottom.

South from Mount Doran the Elaine Goldfield is situated. Here, as elsewhere, great riches from the surface down, great profits, and, until recently, great apathy. This part of our field has been corrugated into regular arches and troughs. These pitch north as a rule at an angle of about 45 degrees. The lodes occur well defined on the slopes of the squeezed-together arches—between the arches, over them, and, in more than one place, in the troughs. They have smooth walls, are laminated as a rule, and carry pyritic minerals in abundance. In one part of the field an "indicator" belt of almost flat occurrences is met with, through which a pyritic seam passes. Bunches of gold and pyrites are obtained at the intersection of the pyritic sheet with the flat "makes," just as in Ballarat. However, the lodes generally are very defined and regular, and exceedingly rich in parts. More than one has been followed from the grass without the assistance of calls, and in one instance—the Minerva mine—about £40,000 worth of gold was crushed from stone taken out to a depth of 350 feet, about £25,000 of which went to the dividend account. Other mines south, known as O'Farrell's, Yorkshire, Lindsey's, Victoria, Harp of Erin, Post Office, Royal Charlie, and Cleary's, have yielded well to the water level, especially the Royal Charlie, where an average of 15 oz. to the ton is said to have been obtained. The gold contains a silver alloy, as at

Gordon, and the pyrites is of the usual kind met with all over the Ballarat district, and with one slight exception, it contains a little antimony. Altogether the Elaine mines have yielded a total of about £130,000 worth of gold, at a cost all told not exceeding £70,000. In common with the rest of our fields, a revival has set in, and the Yorkshire, the Morning Star, and other ventures are now getting into harness. The field offers first-class facilities for crosscutting, and judging from the nature of the formations this kind of prospecting would suit admirably, in addition, of course, to sinking for the lower parts of the shoots already opened.

To the east of this is the township of Morrisons, where the basalt covers extensive deposits of clean boulder washes, in which tunnelling has been carried on for many years. This deposit is about 400 feet thick in places, and it is the result of numerous and distinct washings. The remains of an ancient river-bed is to be seen in one of the tunnels, in which are numerous trees fossilised through the action of mineralised (siliceous) water. On the level of this old river, some hundreds of feet above the original bottom, the gold-bearing wash is obtained. Various attempts to get to the bottom have been made, but the only company which succeeded did not find much.

About ten miles to the south-east of Morrisons, Steiglitz is situated. Here quartz mining was commenced as early as '54. The strata have been corrugated, as at Elaine, and the lodes occur in a similar form. They pitch north also, and carry the same class of gold. The part of the field that has received most attention comprises a length north and south of about eight miles by a width of say a mile. From end to end it is permeated with pyritic minerals, similar to Elaine, occurring in belts of strata that contain also the quartz formations richest in gold (see plate, page 65).

Both walls bear evidences of friction in places, but the bulge phase is met with (usually in the angles of the zig-zags) where the evidences of friction action are wanting. The gold is rugged, and some as coarse as ordinary oatmeal, although there is a deal of it fine, as instanced by the richness of the pyrites. It has silver alloy, as at Elaine, Gordon, etc., and in consequence its value ranges as low as £3 17s. 6d. The pyrites, in addition to the usual arsenic, iron, and other blends, contain antimony. Pyrites is associated with gold, principally on the footwall side; but here and there, especially in the bulges, it is to be seen throughout the whole "make" in bunches, spangles, and in strings. The stone is "milky" in appearance, with a slight blue shade. The stone towards the hanging wall, and usually through the mass of the bulges, bears the mottled phase. The quartz formations throughout the part of the field which has been worked vary in width from 6 inches to 12 feet, with a general average of say 18 inches.

The diggers of the fifties "dollied" and otherwise pounded out the gold, and at the succeeding rushes in the sixties and seventies the shoots were traced to greater depths with profitable results. Now, in the nineties,



IDEAL SECTION (looking north).

Section (face of cutting from east to west) Steiglitz Lode Formations, showing Slide and Crosscourse. Scale: About 40 feet to 1 inch. The horizontal plane (flat part) represents about 1,000 feet in distance. The displacements of the country on either side of the crosscourse, and above and below the slide, do not represent the actual extent of the moves here. As will be seen, the crosscourse has resulted in shifting the lodes to the west (going north), not as in other parts of the field, to the east. In all instances, however, the shift is in the direction of the widest angle.

another rush has set in : but although its equipments and mining modes, speaking generally, are on an improved basis, the success to date has been in nowise proportionate to the capital expended. In fact things have been overdone, or in other words the place has been overrun by numerous "boom-weed" companies, which sapped and wasted the capital that could have been used in "staying" the well-applied efforts of the larger concerns. However, splendid shafts (average size on field 11 feet by 4 feet) have been put down and good machinery erected on favored spots from the north to the south. Although there is a "lull in the hum of action," the most of the larger ventures will continue to work until a good deal more is known concerning the downward extensions of the gold-shoots. The Tam o' Shanter is the most northern company at work, and going south we get the Elsie,

the New Year, North Albion, Albion United, Alliance, Waterloo, Britannia, Weichart, North Birmingham, Ironbark, New Mariners, and Sailor's Reef mines, on all of which are steam plants, mostly of a powerful kind. This means a length of about eight miles, and includes only those mines following each other north and south in the middle of the field. There are about twenty others scattered on the flanks. From the shallow workings in the ventures named, and taken out from the grass down to an average, say, of 300 feet, £1,000,000 worth of gold has been obtained, at cost said not to have exceeded £600,000. The only two companies which have succeeded in returning a profit since the commencement of the '92 boom are the United Albions and the New Mariners.



The United Albion Company's Plant (as seen from the original Albion Company's shaft, looking a little to the east of north).

The United Albions Company is in 36,000 shares and its mine is situated about three miles to the north of Steiglitz township. Its area comprises about 90 acres. About £9,000 has been received in capital, more than £54,000 in gold, and £15,000 has been divided. The company has an extensive plant, consisting of a battery of 36 heads and winding, pumping, and ventilating engines. Its main shaft is down to 1050 feet. The stone bears all the features described as being peculiar to the field, and the lengths of "makes" between the angles of zig-zags are longer if not as wide as in some other parts. In a general way the quartz occurrences of the whole field are uniform, not only in the pitch and underlie, but in the zig-zag peculiarities and continuity of gold-shoots. The shoot being worked at the United Albion has been followed with very profitable results from a point to the south, where it outcropped in the grass.

At the New Mariners mine, formerly the shoots worked have been tapped again with unlooked for results. Here is another fine turn-out of machinery, and the battery equipment (44 heads) is of the best. The main shaft is down about 600 feet and sinking is being proceeded with. On this spot great riches were obtained in the early times, but the miners then did not do much crosscutting or the rich shoot of stone now being worked out would have been treated long since. The present company experienced hard times during the first 12 months of its career. It went to work in old workings and it suffered much from general debility, until one of the crosscuts went into a body of stone in which the gold appeared plentifully. A great change came o'er the scene.

Where were ever before us
Troops of birds, whose sweet chorus
Added charms to the spell
Of this blossomy dell,
Was heard the loved tones as the stampers descend,
For their chorus was this—"Dividend! Dividend!"

There is a felsite dyke trending through from the north of east to the south of west, in the vicinity, of which not much is known. The New Mariners is sinking for the next series of "makes," and although the yields at present are not as high as they have been, it appears to be simply a matter of time ere the company will be as flourishing as ever. To date there has been received in capital about £8,000, in gold about £109,000, and about £56,000 has been returned to shareholders as dividends. There are 15,000 shares in the company and its registered office is in Melbourne. The area consists of about 50 acres, and numerous lines of lode traverse it, which are to receive attention in due course.



The New Mariners Company's Plant, Steiglitz. The lower building is the old battery, the higher one the new. (Looking west).

To the east, at a distance of about half a mile, the Hanover Company is at work. The main shaft is down beside the dyke mentioned above, and the quartz occurrences being worked are in the dyke. As usual in such formations, they are irregular in form, being bunchy and stringy, though pyritic and golden. The gold occurs in very fine particles, though occasionally it is obtained as coarse as ordinary grains of sugar. It is found spread through the body of the dyke material, and in some "makes" of quartz it appears in a rich form. The pyritic ingredient is similar to that got on the field in general, though finer; so fine, indeed, it is necessary that great care be taken in the battery treatment. There are great possibilities in connection with working dyke occurrences. As a rule the gold in them is fine and patchy, but the patches have been found to be extensive and exceedingly rich. This patchiness is evidently due to the erratic form of the quartz occurrences. On a dyke such as this, having hundreds of gold bearing quartz lodes abutting on its walls, there is no telling what the pick may run against as its course is followed. It is said that south of this crosscoursing dyke no payable quartz has been met with, but this is due no doubt to want of prospecting, as the country for miles to the south contains many quartz formations that have not received attention. In fact, six to eight miles below this, where the Moorabool River has cut through the wash conglomerates, the basalt sheets and the marine lime beds, gold bearing washes and lodes have been met with, and the time will arrive when this Steiglitz belt of rocks will be traced, and its lodes mined, through the 20 miles between Steiglitz and the ocean.

Going west, we pass over a country covered with volcanic rocks, through which the slates and sandstone outcrop in places. On one of these outcrops, known as Woodburn, quartz mining is now being conducted. Gold bearing formations, which are probably a continuation of the Elaine occurrences, have been opened, but as yet no mining of a systematic nature has been attempted, and the place is accordingly on the "suspense list" with hundreds of other places in the colony which await the advent of some comprehensive system.

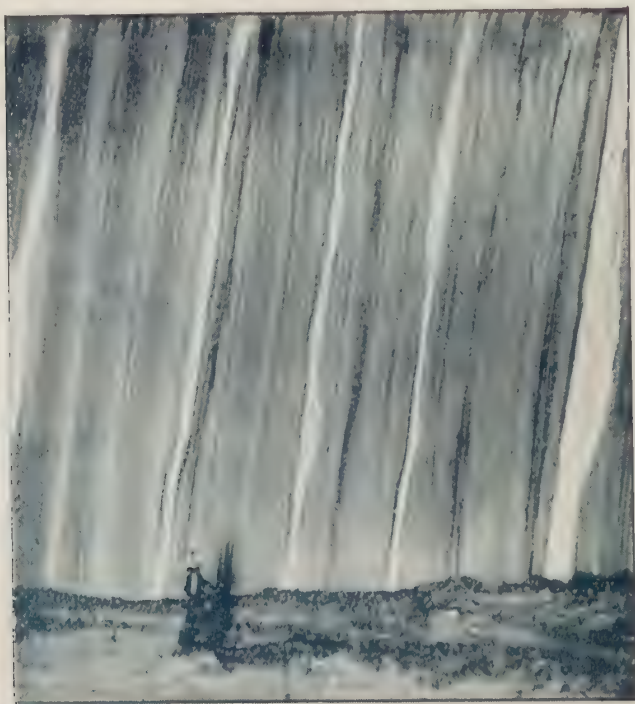
A few miles further west we cross the Leigh River (a continuation of the Yarrowee) and the Durham, where the ancient stream from Ballarat passes through. The country, a continuation of the Ballarat East and West zone, bears all the features noticed in the latter places, and although masses of gold were taken from the alluvial—main gutter, tributaries, and high terraces—and from outcropping quartz lodes, there is no mining going on in the district at present. The Ballarat Indicator belt of occurrences passes through, and the alluvial of its line is noted for its nuggets. The watershed further west still contains many unworked tributaries to the main gutter from Ballarat, and a concern known as the Napoleons Deep Leads Company has secured about 600 acres. Boring operations have demonstrated that great areas of gold bearing washes remain to be mined, and, apart from this, the country contains many gold bearing quartz formations of the Ballarat West type that have not received attention. In fact, here and to the east and west and north, to Ballarat, and through a distance southerly for 15 miles or more, the country is full of quartz lodes, representing the continuation of that belt, classed by R. A. F. Murray, the geologist, as being the most important in Victoria. Cement-covered rises and small

plateaus, gutters and protruding lode caps, are the general characteristics, and the more shallow parts have been turned topsy-turvy by windlass parties, past and present. And yet the lodes are neglected. Away at the southern end, where a more westerly main gutter comes south-east from Smythesdale and Linton and takes in the washings from part of this belt, a rush has set in, and so far the results have proved payable. This is at Rokewood, Corindhap, and Pitfield. The alluvial is scattered over a comparatively level and sun-cracked bottom. No doubt it will yet be traced into deep ground and followed eastward till it junctions with the main stream from Ballarat, when no doubt the combined stream will receive attention through its course to the sea. Going north-west from Rokewood brings us to the township of Linton, where the shallow workings are celebrated for their rich alluvial. This town is situated about 20 miles to the south-west of Ballarat, and the first rush for its gold took place in '54. A great number of lode formations passes through Linton. The country around is composed of the usual silurian rocks, which have been tilted into irregularly formed corrugations. These lodes trend, as usual, with the strike of the strata (nearly north and south) and, as at Steiglitz, underlie in places to the east and in others to the west—a little off the vertical. They vary in thickness from a few inches to say 10 feet. The footwall is generally frictionised and the hanging wall has uneven definition, with spurs leading off it in a flat and vertical form. The amount of pyritic ingredient is about equal to that of Elaine and Steiglitz, and its blends are similar. The gold is silvery also, and varies in value, some assays reading £4 and others as low as £3 17s 6d. It occurs in rugged shape, (coarse and fine) and in small shoots, which form, in series, larger ones. The quartz formations pitch south, though in places they pass nearly straight down.



Winding Engine, Black Horse Mine, Egerton.

There has never been anything done in a strong and systematic way to mine the lodes of Linton. The surface has hardly been scratched beyond what may be seen in the remains of spurs inaugurated when someone happened to accidentally meet with the top of a gold shoot in the grass. In such instances, elsewhere as here, it was soon gutted out to the water level or was lost in some strata displacement. There is nothing on Linton but the usual apathy in the midst of mineral features which if discovered in the midst of New Guinea, would cause Australia to "rush" it. It is estimated that £500,000 worth of gold has been taken from the alluvial and quartz at Linton at a cost of less than £300,000. The Linton United and the Bristol Hill and one or two smaller parties are the only companies at work on the field at present, and at both the general features would warrant more comprehensive treatment.



IDEAL SECTION (looking north).

Section (face of cutting from east to west) showing Formations in Britannia Mine, Carrgham.
Scale: About 10 feet to 1 inch.

The Linton lode formations continue north through Snake Valley and Carrgham. The alluvial on their line (especially the cements representing the earlier washes) was rich in gold; and along north for about ten miles the fossickers are still working it. At Snake Valley, six miles to the north of Linton, quartz mining in the ordinary "catch-as-catch-can" manner has been the order of the day for many years, and recently one English company got into harness and made a beginning

which promised well. It erected a first-class pumping, winding, and crushing plant, and put a main shaft down to about 700 feet. Main lodes known as the Britannia, the Baker, the Result, and Sinclair's have been opened. Altogether, in the past, about £160,000 worth of gold was obtained from the shallow levels near the shaft at a cost said not to have exceeded £80,000. The lodes are similar to those at Linton: in fact, as stated previously, they are continuations of the same lines. They carry the same class of pyrites and gold. They have been worked at a profit by small companies to an average depth of say 400 feet. The peculiarities of the crosscourses and slide-breaks and their displacements are known.



A Cage Full of Men from Below, at the Star of the West Mine, Carriaghan.

A few miles further west the granite outcrops, and east (towards Ballarat) we cross iron cemented washes, which cover many lines of quartz formations, on which nothing is being done. Further on, Scarsdale, Smythes Creek, and Haddon are met with; and in these places quartz mining is in abeyance, notwithstanding that yields obtained from shallow levels were highly satisfactory. The lode structures in these parts and through the intervening space to Ballarat, are somewhat similar to those of Ballarat West. The bulge and the track phases are a little more pronounced, but the class of quartz, return of gold, and pyritic occurrences are the same. From Scarsdale through the ranges east, back to the Durham, nothing but old workings in shallow alluvial, under which in the distance named there are hundreds of lodes in parallels, the eastern section of which belongs, as stated before, to the Ballarat proper belt. The riches obtained all through were about the same, and so were those

got to the south of Scarsdale and north through Smythes Creek to Haddon. The lodes have nowhere received more than scant attention. The remains of the usual "surface-roofing" tactics, and of an occasional half sustained effort where a rich occurrence has been followed for a hundred feet or so, are all that are to be seen; and this in a region of mineral wealth that the more business-like mining which has commenced to characterise our efforts is yet to render productive. North, through Smythes Creek to Haddon, the quartz has received a little attention. North and east from this we cross volcanic country, which covers the western outlet of those ancient streams that got their rise in and around the region immediately west of Ballarat. Drills have proved the existence of extensive gold bearing deposits, and the Western Leads Company has been formed to work them. North, the mines of the Midas group are working alluvial; and four miles due east from them we reach the Ballarat East Indicator belt, to the north of Ballarat East. We have, in this little work, been through Ballarat, and through the suburban goldfields which lie to the east, south, and west. The auriferous belts which lie to the north, north west, and north east, including Ballan, Blackwood, Daylesford, Creswick, Allendale, Kingston, and Clunes, will be comprehensively dealt with in our next publication, now in course of preparation.



Llanberris No. 1 Company's Plant, etc. (Indicator belt of country).
(Looking south).

The Indicator belt of country extends for many miles to the north of Ballarat, although in consequence of displacements occasioned by cross-course breaks, it has not been identified. The country on the extension of its line is noted for its nuggety gold, both in its alluvial and in its quartz occurrences. Three separate parties are now engaged in exploring the

region to the north of Black Hill (McCormell, Salmon, and Williams and Marshall), and as the works are being conducted in a systematic manner, at three different points, no doubt we shall know at no distant date more about the actual position of the belt.

EDWARDS' PYRITES WORKS.

With the exception of the works at the School of Mines and at Elaine, the Ballarat district has been until recently without an establishment where pyritic ores could be treated on a large scale. Recognising that there was ample room for a concern where ores could be treated on the most approved principles in small or large quantities, a gentleman from Bendigo (Mr. Edwards) who is possessed of considerable experience in such matters, secured an area on the ranges to the east of Sebastopol and erected a comprehensive establishment capable of dealing with 150 to 200 tons per week. Here facilities are offered for roasting the sulphur and arsenic out of the pyrites in a manner which admits of large quantities being treated very effectually in a comparatively short time. A long iron-lined furnace is fixed so that the plane of its floor can be graded to suit the class of ore which may be going through. At intervals along its length upright shafts revolve, to which are affixed blades similar to the blades on the screw of a steamboat. These blades sweep the slightly inclined floor, and they are arranged so that their circles lap each other through the length of their line. Thus wave after wave of the glowing pyrites follow each other from the entry vents at the higher end of the furnace to the exit slots at the lower end, all the while travelling against a fiery current which passes (in opposition to the wave movement)



Edwards' Pyrites Works and the Yarrowee, as seen from the Plateau immediately east of Sebastopol (looking south-east).

from the side of the lower to the upper end. The speed of the travelling mass can be regulated to a nicety, and the wave movement insures a uniform heat treatment to all particles of the ore. The furnace, which is a pronounced success, has been patented. At present more than 100 tons of pyrites are treated weekly, and the works have become a thriving centre of industry. In addition to the roasting and chlorination processes, the proprietor is about to erect other works for the treatment of less refractory ores by electrolysis and cyanide.



Ballarat Town and City as seen from Bakery Hill in 1895. Looking west, from St. Paul's tower.

Conclusion.

THE wage paid to miners in this district is £2 5s. per week of 48 hours, in six shifts of eight hours each. Enginedrivers receive 8s. 4d. per shift. Directors (usually five on a board) receive 5s. per sitting fortnightly. In a few instances £1 per sitting is paid. Legal and general managers receive as a rule £2 per week, but a few are paid as high as £5, and in one instance £8. Firewood is used for steaming purposes, and coal is used with it in several of the principal mines. In one or two instances water tube high pressure boilers do service, but the rule is Cornish flue, and there are a few Galloway tube boilers. Round wire ropes are the rule, and single cylinder engines are mostly employed, but these are gradually being replaced by the double cylinder type. Air-compressing engines



(Looking south).

Section showing Shaft, two Levels, and a Lode (as if we had all of one side of the crosscut removed). Scale: About 10 feet to 1 inch. Here we have two "plats" (near the shaft), two crosscut drives, and the northern ends of two main drives which have been driven on stone. Next plate shows a main drive on stone, with winze and stopes. (The drives in the model were hardly at right angles with the shaft.)

work the drills, and Root's blowers furnish ventilation. The increase of heat in the temperature as depth is reached is found to be at the rate of one degree Fahr. to every 50 feet. Nearly all the advertised blasting compounds are in use. Shaft-sinking—size about 12 x 4—at present levels costs about £1 per foot of depth; while crosscut drives—7 feet legs and 4 feet caps—and main drives on stone or otherwise cost about 30s. per foot; labor only, the company to find air-drills. Of course, there are parts in all mines which can be driven through for, well, as low as 5s. per foot, and in one mine—the Grey Horse—sinking and driving have not cost more than this sum per foot, for labor only, no drills, down to the present level, 700 feet. The mining methods followed are much the same as practised elsewhere, and the gold saving appliances and methods are those which experience suggests as being the most economical in dealing with our class of minerals. These appliances include stampers, punched gratings—150 to 200 holes to the inch,—water, mercury, copper plates, blankets, percussion tables, vanners (exceptional instances), with settling bins, blankets, and box race-catchments outside. The stampers weigh about 9 cwt. each, and fall about 8 inches between 70 and 90 times per minute. Each head crushes about 2 cwt. per hour. Much has



(Looking east).

Section showing Main Drive on a Lode Formation going at right angles to the Crosscut from the Shaft (just as if we had the western side of the drive away). The pass (or winze, as it is called) from a level above is connected with the the present level, and stoping has been commenced. When the miners connect one level with another from the lower level the opening is called a "rise," and when from the top to the lower it is called a "winze."

been written about the quantity of fine gold said to be going away in the slimes—not a glue-like slime, but simply dirty water. A series of experiments, however, conducted by the writer and others, on bulk samples of

tailings and water, collected from the exhaust races of the principal batteries of the district during a period which extended over twelve weeks, has demonstrated that, on the average, less than half a pennyweight of gold per ton of quartz is going to waste. This gold which did escape was found to be so fine as not to be susceptible to mercurial or blanket or other present catchments, and its association with pyrites (in a free state or otherwise) places it outside the scope of cyanide or chlorination treatment—that is in a paying sense; at present mercury and copper plates are used in most of the mills, but, as stated previously, in the treatment practised at the New Speedwell Company's mine, on the Indicator belt, the use of mercury and copper plates is dispensed with in favor of a splash-box placed just outside the stamper-box, and blankets. It is found here that a greater percentage of the finer particles of gold is secured before they reach the ends of the blanket stretchers or the percussion tables or other catchments. The pyritic concentrates, especially those caught outside the battery-house, return less gold than when mercury was in use, simply because a greater percentage of free gold is caught nearer the stamper-boxes.



The School of Mines, Ballarat (looking south-west).

I have not said anything about the average yield per ton of quartz on the field because a statement of a large or small average would not give the reader any idea as to the cost of the gold. It matters not what the average is if a profit is not the result. In other words, a low average yield is as good as a high average yield if the cost per ounce will allow of the same rate of profit. The Ballarat district on the whole returns a large profit on

its gold output, apart from the profit to the community at large which follows even when the metal has cost more than its market value. The average per ton is less than 8 dwt., but in considering the relation which the total of cash received from shareholders bears to the total returned to them from gold, by parties and companies past and present, it appears that the profit total more than doubles the call total. The reader must bear in mind that the aggregate total of capital called monthly is never received. Under the No-Liability Act people pay or forfeit. We find that we have had to date more than £8,500,000 worth of gold from quartz. To help in mining it less than £1,200,000 of capital was used, and the profit exceeded £1,000,000. This £1,200,000 was therefore the bucket of water in the dry pump which brought, capital included, more than £9,500,000 of wealth into circulation, from a treasury only fresh tapped, so to speak. When we add this total to the, in round numbers, £15,000,000 which was obtained from the alluvial, we get a notion of the reason why the Ballarat goldfield stands foremost on the list of the world's gold-producing centres. The monumental yields of the early days (huge returns from comparatively small efforts) have produced



Eighteen Hundred Feet Below.

THE TRUCKER-BOY'S TRAIN.

Through the darkness much blacker than ever was night
 Came the rays from a candle's dim, flickering light,
 As the "click" from the cage and the splash from the tank
 And the "rumble" of trucks on the move and their "clank"
 Helped the weirdness, and gave to one's mind a deep sense
 Of dejection, enhanced by the gloom so intense.
 Then the train of a trucker-boy came, and went by,
 And a smile on the trucker-boy's face caught my eye
 As he sang out, "Keep clear there! Look out! I can't stop!"
 And, "What time is it now? Is it raining on top?"

a baneful apathy, and a tendency to rush and spurt, which shows itself through the heart of the community, causing it to gamble, rather than to mine on the scale of magnitude we should. Miners who go from us to distant lands return more in love with their own field than ever; and there is more than one instance where parties have returned to prospect ground that the knowledge gained by comparison in distant parts has taught them to appreciate. There is ample scope for the profitable employment of hundreds of thousands of pounds—first determining the most favorable points—in carrying out comprehensive efforts in our neglected parts. More mining must be done in the mines and less in the market. The public, whose gambling tendency favors the production of uncertainty in the life of many a healthy mining venture, often bringing about its collapse and the consequent loss of capital,—which is charged to the cost of gold in the field, of course!—must interest itself very much more in the action of the pick, for the world bids high for gold, gold, more gold.



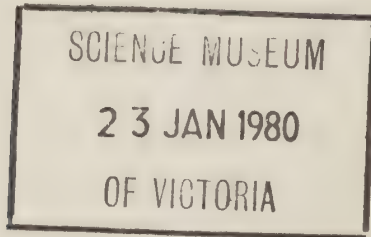
DRIVER AND WINDING ENGINE

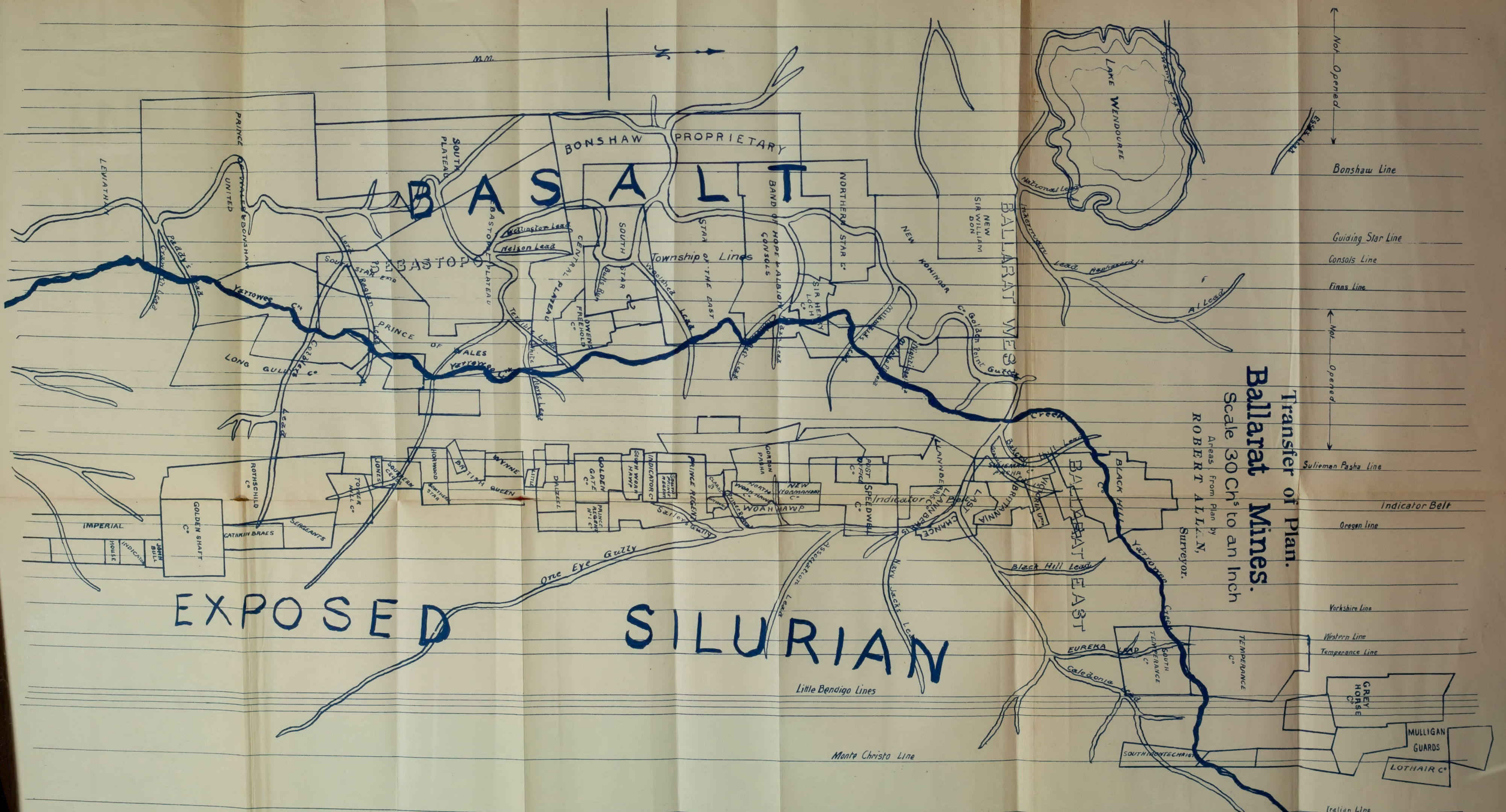
No. 2 STAR OF THE EAST SHAFT.

- All attention, in a railed-off stand,
 Silent and pensive, for he works a lever —
 A key to captured forces, 'tis a wand
 Which rules great issues in "life's fitful fever."
 He moves this rod, and shining cranks go round;
 One ponderous drum then sheds, one coils a rope,
 A "clanking" cage is sent deep "under ground,"
 Another comes with riches from a slope.
 Yes, now and then 'tis like life's ebb and flow;
 This master, god-like, rings the changes oft —
 He sends fresh mortals to the stage below,
 And brings the tired and weary souls aloft.

I have to take this opportunity to thank all the mining managers for the kind assistance they rendered me during my tramps below in their mines, and also to thank Mr. R. M. Serjeant of the Band and Albion Company, and Mr. J. Henderson of the Black Hill Company, Mr. R. Allan, and Mr. J. Lynch, mining surveyors, and the officers of the School at Mines, for their kindness in furnishing plans, etc., of the underground works, and other information concerning the yields of gold (from all sources) off the parts of our field under notice.

Most of the type matter herein has appeared in print, being in parts quotations from contributions furnished by the writer (as Special Mining Reporter) to the *Ballarat Courier*, the *Ballarat Star*, the Victorian Government Mines Department, the *Journal of the Australian Institute of Mining Engineers*, and the mining managers' paper, the *Australian Mining Standard*.





BASALT

EXPOSED SILURIAN

Transfer of Plan.
 Ballarat Mines.
 Scale 30 Chs to an Inch
 Areas from Plan by
 ROBERT ALLAN,
 Surveyor.

- Not Opened
- Bonshaw Line
- Guiding Star Line
- Consols Line
- Finns Line
- Not Opened
- Suliman Pasha Line
- Indicator Belt
- Oregon Line
- Yorkshire Line
- Western Line
- Temperance Line
- Monte Christo Line
- Italian Line

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SCIENCE

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