

intrusions of granitic dykes; the quartz is white and glassy, and, as far as tested, very low in its gold contents; a large number of samples were 'dollied' by myself, and the best result obtained was only slightly better than a trace, most of them being blanks. There is, however, one fairly well-defined line of reef—or, rather, line of lenses—traceable on the surface in a north and south direction for a distance of about 10 chains, the largest continuous length of quartz being about 60 feet, and having a maximum width of about three feet; it is, however, broken in several places by granitic intrusions, and the lenses of stone are likely to behave just as irregularly vertically as they do longitudinally.

"The stone in this line is the typical white glassy quartz, and near the north end has a considerable quantity of carbonate of copper associated with it, as well as occasional small pockets of galena. This line was carefully sampled by myself, and a large number of samples dollied, the best prospect obtained being equal to about 1 to 2 dwts. per ton. A few of the samples gave traces of gold, but the majority of them were blanks.

"Almost every one of these reefs show signs of having been sampled several years back, and the area of possible auriferous country is so restricted that two or three men could thoroughly prospect it, from a reefing point of view, in a couple of weeks, and I am of opinion that this has already been done. The country rock is extremely hard right on the surface, and under existing conditions, *i.e.*, with the nearest battery 60 miles away, and over heavy sand at that, reefs would have to be exceptionally rich to be of any use to the prospectors, and I do not think there are any reefs of this description in the locality; and in my opinion, even if the reefs were of fair grade, there is nothing of sufficient size or regularity to warrant even the thought of erecting a battery on the spot.

"With regard to other possible finds in the vicinity, from personal observations, there is no auriferous country to the south until the Cosmo Newberry Ranges are reached: none south-easterly till Mt. Warren—and this is an exceedingly poor belt; and none westerly or south-easterly till the Duketon-Erlistoun belt. To the north and north-east, beyond Lake Wells, low granite ranges and sand plains extend as far as can be seen, and these are said to extend in this direction for practically an unlimited distance.

"As to the water supply of the locality, a well has been sunk on the eastern fall of the hills, about a mile and a-half from the lake, in which water was struck at about 30 feet. This water is, however, too salt to be of use even as stock water. If a well was put down on the other fall, I think the chances are that this would probably be salt too, as the lake runs round this side of the hills as well, though at a somewhat greater distance—about six miles. I do not think a permanent fresh water well is likely to be found in the locality. The present water supply is from a soak in a small creek eighteen direct miles from the 'find' along the Duketon road; water has to be carted from here to the 'find' over heavy sand, and the supply is only very limited and unless replenished by rain is not likely to last many more weeks. Between this and Duketon there is no water except at a rock hole six miles from the soak; this, however, is most probably dry by now as there were only a few gallons of water in it early in November.

"I don't think the 'find' is of sufficient promise to warrant the Government going to the expense of putting down wells along the road, but if these are put down, almost the only places where they could be put would be (1) on the cork tree flat, 16 miles from Duketon, and (2) on the creek, a little below the present soak, and I am not in great hopes of a supply being obtainable at either place, especially at (1)—that is in shallow wells.

"If these wells are put down—and this applies to all shallow wells in the out back country—I would very strongly advise that they should be put down in the summer season, for if a supply is met with then it can fairly safely be relied upon as permanent, whereas if they are put down in the winter—usually the wet season—a fairly heavy supply of soakage water is often met with which goes dry, or nearly so, before the dry season is over, and this is often a very serious matter in that part of the State. The Cosmo Newberry Government No. 2 Well is a case in point; this well is now only making a few gallons of water per day, and that only after it has been sunk another five or six feet by private parties."

Windanya Group of Leases, Broad Arrow Goldfield.—In the month of June Mr. Woodward prepared the following report upon the Windanya Leases, near Broad Arrow:—

SITUATION.—Windanya* is situated about four miles in a south-westerly direction from Bardoc, a town upon the eastern railway line 418 miles from Fremantle and 31 from Kalgoorlie.

GEOLOGY.—*Superficial Deposits.*—The area in which this group of leases is situated may be described as a valley running in a north-westerly and south-easterly direction of about four and a-half miles in length by half a mile in width, the surface of which is covered by a deposit of rich red loamy soil broken by two small patches of diorite boulders towards the southern extremity, the only indication of the presence of quartz reefs being lines of strewn fragments of quartz.

Laterite.—This valley is enclosed upon its eastern and western sides by lines of low ironstone-capped hills (laterite).

Schists.—The basic series are here represented by hornblende schists met with in sinking beneath the red loam of the flats, and are found to be much weathered above the water level (about 200 feet), and even below it in the immediate vicinity of the lodes.

Granite and Porphyry.—The acid series are represented by a granite intrusion, which outcrops in one of the patches of diorite towards the south end of the valley and by numerous small porphyritic dykes met with in the lodes.

Quartz Reefs.—The quartz reefs in the oxidised zone are much iron-stained and often contain vughs filled with gossan, which are generally rich in gold. Below the water level the quartz assumes a more banded appearance, and often contains pyrites in considerable quantities which in the vughs sometimes

* Vide Lithograph L 17, issued by the Department of Mines.

assumes a botryoidal form. The casing of these veins often consists of talcose rocks with veins of serpentine and fibrous talc. At the northern end of this area there are two main lines of lode fissure, the one upon which the Half Mile Reef mine is situated strikes north-west and south-east; whilst the other, upon which are the Struck Oil and Half Mile North, strikes north-north-west and south-south-east; both of these underlie to the eastward, and should junction if they continue a little south of the Half Mile workings. From this point to the southward, the country is considerably broken, the reefs being, although often rich, of short length, and have, for the most part, an easterly and westerly course, with a dip in a southerly direction.

THE MINES.—There are at the present time only two mines at work in this district, one, the Half Mile Reef, which is in the hands of a party of tributers, who are raising the small patches of stone which were unprofitable for the Company to handle; the other, the Half Mile North, which is a prospecting show worked by the owners.

THE AUSTRALASIA HALF MILE REEF, LTD.—Mr. T. Blatchford, B.A., formerly Assistant Government Geologist, in his report on this district, accompanied by a geological map, published in the Annual Progress Report of the Geological Survey for the year 1899, page 27, says of this mine:—"The reefs which are being worked on this lease do not appear at the surface in a defined outcrop, though they have been followed for a considerable distance in the underground workings. In the southern end of the lease, however, loose masses of quartz may be still seen at the surface, and these, no doubt, led to the discovery of the reefs lying but a few feet beneath the surface." Upon this property a considerable amount of work has been done, a main working shaft has been sunk to a depth of 565 feet, from which are the following levels:—120 feet level, 343 feet in length; 170 feet level, 580 feet in length; 250 feet level, 540 feet in length; 285 feet level, 120 feet in length; the 365 feet level being 440 feet; the 465 feet level being 310 feet; the 565 feet level, 250 feet; whilst from this level a winze has been sunk on the ore body for a further depth of about 40 feet. The ore body varied very considerably in size, but averaged about two feet in thickness in the portion removed, which was carried in an ore chute that dipped to the southward of about 150 feet in width. North and south of this chute the country was tested for a considerable distance, as will be seen from the length of the levels, but as the veins become too small and poor to be worth following or pinched out, work was abandoned; whilst in the bottom level the stone has become so small and of such low value that the work of sinking has been discontinued. The little water this mine makes comes from the upper levels, the lower being comparatively dry. This mine has now been regularly worked for a number of years, during which time it has yielded 22,962·00 tons of stone, from which 14,432·52ozs. of gold have been obtained, the average value of the ore crushed being 63oz. of gold to the ton. The question of the future of this mine is not one in which science can lend any assistance, since the ore body is still intact in the lower levels, but simply one of whether the stone from greater depths will pay to raise and crush or not.

THE STRUCK OIL.—This property is situated a little to the north-east of the Half-Mile Reef, but belongs to the same Company, who use it as a water shaft for the supply of the battery. The shaft is about 300 feet deep, with a small crosscut from the bottom, in which a small vein of highly-mineralised stone heavily charged with water was cut. This latter was said to make at the rate of 45,000 gallons per diem, and thus stopped further prospecting at the time. There are several small shafts upon a small quartz reef, from which some years ago 139 tons of stone were raised and crushed, which yielded 105·05ozs. of gold, or an average per ton of 75oz.

WINDANYA HALF MILE NORTH.—This lease is apparently upon the same line as the Struck Oil, and about 400 yards to the north of it; there was no outcrop of reef through the alluvium, but it was discovered by fragments of quartz upon the surface. It has now been opened up by three shafts, one at the northern extremity of the lease, one near the south, and the other a little north of the latter. No. 1 shaft is situated near the southern boundary, and has been sunk to a depth of 60 feet, at which point it struck the reef. There is also a crosscut at 40 feet from the surface to the reef from which a quantity of stone was raised. The reef is here from five feet to six feet in width, but considerably broken. No. 2 or middle shaft is about two chains north of the first mentioned, and has also been sunk to a depth of 60 feet, passing through the reef near the surface where it was small. At the bottom of this shaft a crosscut has been driven 30 feet east to the reef, from which point it has been followed for a distance of 85 feet north and 35 feet south, the ore body being eight feet to nine feet in width. No. 3 or the northern shaft was sunk close to the northern boundary to a depth of 103 feet, passing through the lode at 40 feet from the surface. At this level it was followed both north and south for a distance of about 20 feet. At the bottom of the shaft, a crosscut was driven east 30 feet to the reef, which is here about 12 feet in width. The reef was followed south from this point for a distance of 40 feet, and a winze sunk 30 feet upon it. All the stone raised from these workings has been crushed, yielding 779·79ozs. of gold from 927·25 tons of ore, averaging 84oz. per ton. The country rock in the immediate vicinity of the lode is hornblende schist, the casing of the vein itself being often talcose. The lode consists of sections of quartz which are generally ferruginous, divided one from the other by intrusions of copper-stained porphyritic rock which lie between the lode walls intersecting the quartz, but in no instance so far penetrating the country.

OTHER LEASES.—To the southward of the Half Mile Reef there are a series of abandoned claims upon which shallow shafts have been sunk to win rich stone from cross reefs; but to judge from the amount of work done, they must have been small and of limited extent.

THE SURBITON.—At the south end of this valley is an abandoned mine called the Surbiton, upon which a considerable quantity of work has been done and plant erected, which latter has since been removed. This property was inspected by Mr. Blatchford, who in the Annual Progress Report for the year 1899, page 27, states that the reef strikes east and west dipping to the southward, and has been

opened by three shafts to a depth of 240 feet with a level at 80 feet from the surface, 206 feet in length, in which the lode is 132 feet in length and averages 10 inches wide, also a level at 160 feet driven east and west for a distance of 350 feet, the vein extending 255 feet, being about 15 inches wide upon the average. He further states that 10 tons of stone had been crushed, yielding 18ozs. of gold.

Wagin District.—Mr. Woodward visited the Wagin district for the purpose of reporting upon the possibilities of coal occurring and the reputed phosphatic deposits. From this report, which is given *in extenso* below, it appears that the occurrence of coal deposits is somewhat problematical, and that the reputed phosphatic deposits, which apparently cover a large area, do not contain sufficient quantities of phosphoric acid for fertiliser purposes:—

“Wagin* is situated upon the Great Southern Railway line, 193 miles from Perth and 147 miles from Albany, at an elevation of 840 feet above the sea level. It lies in one of the main valleys which drain the great tableland of the interior, the fall of which is so slight that in place of a well-defined water course a series of lakes have been formed which only during periods of great floods overflow one into another, by which means the water eventually finds its way into the Beaufort River.

“To the westward the ground rises rapidly for a distance of about four miles, attaining the greatest elevation in the district of Badgarnung Hill, which is a small ridge of granitic rocks about 300 feet above the level of the town.

“Should at any future time a water supply of greater magnitude than that at present in existence be required, there are several sites upon the eastern slope of this hill which would lend themselves admirably for reservoir construction from which 100 to 150 feet head of pressure could be obtained by a gravitation scheme, and a good water supply assured.

“A striking feature of this range is that it is clothed by a distinct vegetation from the surrounding country, the flora being identical with that met with in the coastal regions, whilst all around it nothing but the tableland vegetation is encountered.

“The main valley in which the town is situated runs in a north-east and south-west direction, from which the country rises gently to the north, whilst to the south and east it rises more abruptly on to sand plains, along the edge of which polished granite knobs outcrop here and there similar in every respect to those around the lake basins of the goldfields.

“Although this is one of the main drainage valleys from the salt interior, the holding capacity of the lakes is so great that without very exceptionally wet seasons occur inland little or no salt finds its way westward of the railway line, therefore the chain of lakes below it being filled locally are comparatively fresh, whilst those to the eastward, in some instances, contain salt in such large quantities as to render its removal after a long dry summer like the past a highly profitable undertaking.

“Upon the eastern side of this valley, running in a north-eastern direction from Lime Lake for a distance of about three miles, are some limestone deposits which in places consist largely of small shells, whilst the surface of the adjoining lake bed is covered by a deposit of earthy gypsum.

“**BONNAR'S LEASES** are situated upon the eastern side of Lime Lake, covering a portion of this lake bed, the low bank between it and the gypsum lake, part of which latter is also included.

“**LIME LAKE.**—This lake covers an area of about 200 acres with limestone outcrops upon its eastern and southern sides, whilst to the westward and northward, if these deposits do exist, they are covered with accumulations of blown sand. The bed of this lake is covered upon the south-eastern side by a deposit of black earth full of small shells, beneath which are shelly limestones, which give place further into the basin to an earthy limestone perforated by root holes that have mostly been filled with earth. Beneath these superficial deposits cream-coloured chalky limestones are exposed in an old excavation which was opened some years ago in order to obtain limestone which was burned and used for building purposes in the town and which, to judge by the mortar, yielded a most excellent lime. This hole has now fallen in, and, as no reliable information can be obtained as to its depth and whether or no the total thickness of the beds was tested, it is impossible to state anything definite under this head until more work has been done. The lower portion of this lake bed upon which water lies after heavy rains, and the adjoining belt upon which salt-loving plants grow, is covered with earthy gypsum, which deposit is being used in conjunction with the burnt limestone in the manufacture of a fertiliser.

“Upon the low ridge between this lake and the Gypsum Lake, which lies to the eastward, are some old kilns which are at present being used by the lessee in which he burns the root-pierced limestone from the lake bed, and some creamy limestones which outcrop upon this ridge.

“In a small hole sunk in the Gypsum Lake a white chalk gypsum deposit is exposed, but this so far has not apparently been much worked.

“**WILSON'S LEASES** are situated about two miles north of the Lime Lake deposits, upon a low ridge between lake branches. Little work has been done here as yet, but to judge from the appearance of the surface stone, and that exposed in the excavation for the kilns, it is apparently of very good quality and admirably suited for the purpose to which it is proposed to put it, viz., the manufacture of a fertiliser by the addition of phosphatic and other substances to the calcined limestone.

“The whole of this deposit, so far as examined in this district, is decidedly of lacustrine origin apparently resulting directly from the weathering of shelly deposits similar to those met with at the surface, the occurrence of the latter proving conclusively that, in comparatively recent geological times, this area must have been covered by a huge lake which, to judge from the type of the shells, was in all probability salt.

* The localities mentioned throughout will be found on Lithographs 408 and 409, issued by the Lands Department.