

east of this line is not worth the expense of boring owing to the water-bearing beds being too close to the outcrop and consequently carrying only small supplies of good water or moderate supplies of bad water. On the eastern side of the line the volume of water circulating in the beds is insufficient to flush out any salt which was an original constituent of the sediments making up the Cretaceous Series.

An examination of the map will show that No. 10 Bore which yields a good supply of good water lies on the eastern side of the boundary line. The most likely explanation of the finding of good water in this bore is that it was sunk close to the bed of a fairly large creek which runs to the westward from the Cardabia Range and consequently the water-bearing horizon which has been tapped in No. 10 Bore has been well fed by soakage from the creek bed at its outcrop somewhere to the east.

No doubt a number of successful bores could be obtained on the eastern side of the line and close to it by choosing favourable sites for sinking a bore close to a creek bed which cuts throughout the water-bearing horizons at their outcrop to the eastward.

It would, however, be a very uncertain matter and it is not considered advisable to go to the expense of putting down bores on the eastern side of the line indicated.

The selected site for a bore at the Four Corners east of No. 5 Bore is also on the eastern side of the boundary line. There is, therefore, doubt as to whether suitable water would be met with at this site. In this case, I have considered that the sinking of a bore is justified because of the peculiar suitability of the site for watering four paddocks from the one point. It cannot be said that the site is particularly favourable but there is some chance of obtaining useful supplies. If the Four Corners site fails to obtain good water, the next best alternative is to sink a bore about 2½ miles north, close to the bed of C.Y. Creek, where water will probably be obtained owing to the water-bearing beds probably being well supplied at their outcrop in the upper reaches of the creek. The second alternative would be a bore put down about 2½ miles west of the Four Corners which lies westward of the line marking the boundary of good sub-artesian supplies.

Any site to the south of the Government bore should strike good supplies of water, and this remark applies equally to the whole of the coastal strip. It might be objected that shallow sub-artesian water was not reported in the log of the Government Artesian Bore, but it seems probable that the drillers who had as a definite objective the artesian horizon at the base of the Cretaceous Series, did not bother to mention any shallow water horizon lying within three or four hundred feet of the surface.

On the meagre evidence available it seems probable that the depth to the main sub-artesian horizons in the *Inoceramus* zone should be met with in bores throughout the coastal country on Cardabia Station at depths of probably less than 500 feet. (In all cases of exploratory boring the work should not be abandoned until it is certain that the blue shales underlying the *Inoceramus* zone have been penetrated, as until this occurs there is always a possibility of cutting a useful water-bearing bed.)

A study of the bores already put down indicates that the water horizons cut do not always lie in the same position in the *Inoceramus* zone. Sometimes

the water occurs near the top of this zone, sometimes near the bottom. A probable explanation of this fact is that the water-bearing beds are lenticular and do not extend uniformly over the whole area. For this reason no statement has been made as to the depth of water-bearing beds below the top of the *Inoceramus* zone. The safest rule to follow would appear to be to bore for the *Inoceramus* zone which is usually easily identified by the numerous shell fragments which are scattered throughout, and to continue boring until the main body of the underlying blue shales is penetrated before abandoning a bore-site as hopeless. Until the blue shales are penetrated, there is always a chance of cutting a useful water-bearing bed.

REPORT ON THE VULCAN TIN MINE, GREENBUSHES.

(By H. A. Ellis, B.Sc., A.O.S.M., Geologist.)

Introduction.

The Vulcan Tin Mine is situated in the north-eastern corner of Mineral Claim No. 4, known as the "New Caledonian" Lease, situated on a flatly undulating spur between Bunbury and Westralian Gullies on the south side of the main Greenbushes-Bridgetown road, some two miles south-east by south from Greenbushes Townsite.

The mine is operated by a Perth company known as Vulcan Tin Mines, Limited, mining operations being carried out by the hydraulic sluicing of a weathered, kaolinised tin-oxide and tourmaline-impregnated zone of granitised schist and associated pegmatite dykes. The maximum dimensions of the working cut are approximately 260 feet in length, 195 feet in width and 35 feet in depth. The disintegrated tin-bearing material is elevated from the bottom of the open-cut as a pulp by a gravel pump and passed through sluice boxes in which the tin-oxide concentrate is recovered by the normal sluice-box process.

Since the commencement of production by the present company on February 4th, 1937, approximately 41 tons of tin concentrates, of an average metallic tin content of nearly 57 per cent. valued at £5,707 10s., have been won up to the end of January, 1938. The approximate volume of the ore treated for this return is 16,900 cubic yards, giving an average value of 5.39 lbs. of concentrates, containing 57 per cent. of metallic tin per cubic yard. Operations are at present (January, 1938) suspended owing to a shortage of water, and the necessity for additional equipment to enable sluicing to be carried out under a higher nozzle pressure than is at present in use.

The limits of the tin bearing formation at present being worked are known definitely at one point only, namely, in a tunnel driven through the eastern wall of the open cut in a north-easterly direction.

As a result of an inspection of the mine workings and leases made by the writer during the period January 18th-26th, 1938, it was found that the only practical means of determining the extent of the payable tin-bearing formation was by a series of boreholes sunk with a percussion drilling plant in which the shoe of the casing can be kept in advance of the face of the drilling bit.

Topography and Geology.

The area in which the company's holdings are situated is one of gentle slopes of general low relief, and

falls within the the 760 to 920 feet contours of the contoured geological map of Greenbushes contained in G.S.W.A. Bulletin 32. It forms part of the headwaters of a southerly trending drainage system of the Blackwood River. The narrow alluviated valleys of Bunbury and Westralian Gullies cross the leases in a general south-easterly and easterly direction respectively, and, with the exception of these valleys, the entire area is thickly timbered with jarrah and red-gum forest, and is covered with ferruginous laterite of varying thickness, which completely obscures the underlying rock.

There are no natural outcrops of bed-rock which can be definitely recognised, and a conception of the nature of this rock can only be gained from places such as the open cut of the main workings, and the dumps of shallow shafts.

In the dump of the old main shaft, situated in the south-western portion of Mineral Claim No. 3 near the main road, some pieces of fresh looking quartz-hornblende schist and tourmaline-bearing pegmatite may be seen, while further to the north-west along a line of old shallow surface workings extending in this direction, pieces of soft, weathered, purple phyllite and weathered mica-schist occur in the dumps.

The rock exposed in the open cut at the main mine workings on Mineral Claim No. 4 is a highly felspathic, decomposed, quartz mica schist showing marked schistosity, striking N. 30° W., and dipping W. 30° S., at an average dip of 35°. This rock grades imperceptibly, in parts of the open cut, into what appears to be a massive kaolin formation, with or without granular quartz. The whole rock mass is liberally impregnated with black tourmaline, ranging in size from irregular patches, some 6 inches across, down to specks so small as to be only just recognisable. It is in this combined schistose and massive kaolinised rock that black tin-oxide occurs in payable quantities, irregularly disseminated throughout the mass.

A tunnel driven in a north-easterly direction through the eastern wall of the tin-bearing formation passed through a red clayey formation devoid of quartz and mica. This material represents the weathered portion of a rock type, the nature of which cannot be determined on present available evidence.

On the old Cornwall leases, a short distance S.E. of Greenbushes Townsite, in pieces of diamond-drill bore-core lying near the old workings, fresh amphibolite schist similar to the greenstone schists of the eastern goldfields may be seen in contact with fresh albite-pegmatite dykes.

Several exposures in road cuttings and old dredge holes, within a radius of six miles of the area under discussion, consist of hornblende schist, biotite schist, fine grained biotite granite and migmatites.

The general line of the known tin-bearing lode formations passes through the workings on M.C. 4 in a general direction of N. 30° W. up Bunbury Gully, through the old Cornwall workings and on to the old "White Lode" area, south of the Greenbushes railway station. Along this line rich alluvial ground has been worked in the past, and it is also from this locality that most of the lode-tin has been mined. From information supplied by old miners on the field, most of the lode formations dipped to the west.

Considering all the available evidence outlined above, it would appear that the underlying rocks of the Greenbushes Tinfield consist of metamorphic crystalline rocks of both a basic and acid composition, comprising a belt of unknown width, with a general north-north-westerly trend and a westerly dip. This belt has been intruded by one or more granite magmas, and has undergone granitisation marginally, and in zones within itself, resulting in the formation of replacement gneisses and schists and migmatites.

The main workings on M.C. 4 are considered to be in a zone or belt of replacement gneiss and schist of unknown width, the economic importance of which is due to an accompanying introduction of tin-oxide into the schistose rock with associated tin-oxide and tourmaline-bearing pegmatite masses. As previously mentioned, this zone has a known length of some three miles in a general N.N.W. direction.

The evidence at present available tends to support the conception that the open-cut on M.C. 4 is situated near the southern end of this zone, and that the country to the south of Westralian Gully contains only narrow zones not yet shown to carry workable concentrations of tin-oxide.

The several shallow shafts on the old "Irone'ad" leases south of Westralian Gully are considerably to the west of the general strike of the main zone, and, although they show the presence of tin and tourmaline bearing pegmatites in the dumps, the small extent of the old workings suggests that deposits similar in nature to that at the open cut do not exist in this direction, or that, if they do, their presence has not yet been revealed by surface prospecting.

It would be possible for the strike of the main zone to swing round in the direction of these old workings; in fact, such a swing in strike would be in keeping with the shape of several small north-pitching dragfolds seen in exposures in localities some distance away from the present open cut, as these small folds indicated that some of the schistose rocks of the tinfield formed part of the western limb of a north-pitching anticline.

It would, however, be mere presumption on the meagre evidence available in the field to consider that the tin-bearing zone being worked in the open cut on M.C. 4 had a southerly continuation on the south side of Westralian Gully. The question of the northerly continuation of the formation and conditions associated with tin-oxide deposition can be taken as proved, since either tin-oxide or tantalite have been mined at intervals from M.C. 4 to just south of the Greenbushes railway station along the line of the formation. The manner of distribution of the tin-oxide throughout this belt is not accurately known, but present indications are that certain parts of it contain rich irregular concentrations as well as finely disseminated cassiterite scattered through a considerable bulk of rock. In all occurrences so far known, the matrix of the tin-bearing material consists either of albite pegmatite (the "Cornwall" leases) or a massive or schistose mixture of kaolin, mica, and quartz with abundant tourmaline.

The old workings on M.C. 3 (known as the "Lost and Found" lease) suggest that the bulk of the tin oxide was obtained in the past from alluvial deposits associated with the laterite, and from narrow decomposed pegmatite dykes, forming a stock-work in

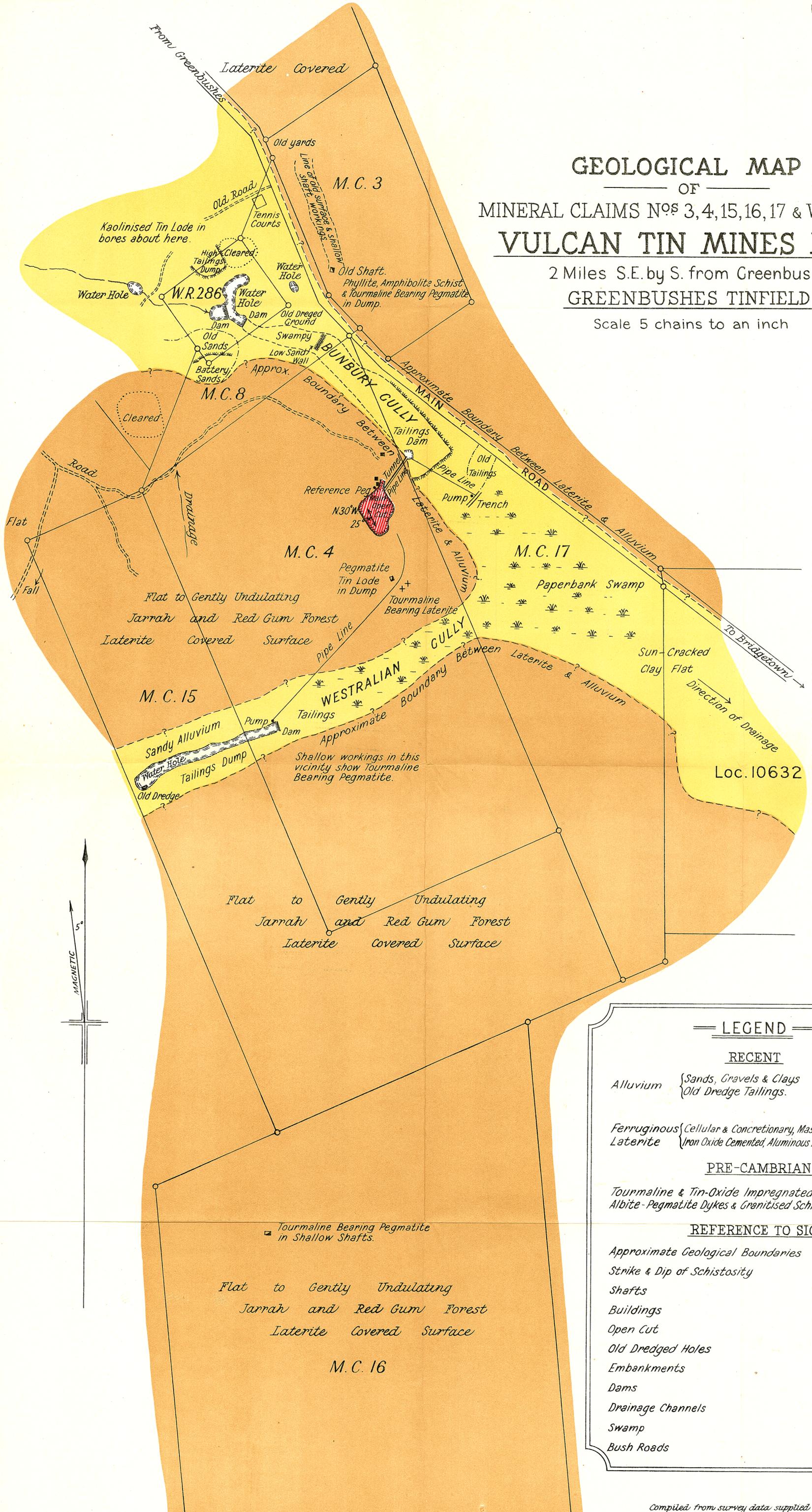
GEOLOGICAL MAP

OF

MINERAL CLAIMS Nos 3, 4, 15, 16, 17 & W.R. 286

VULCAN TIN MINES LTD.

2 Miles S.E. by S. from Greenbushes
GREENBUSHES TINFIELD
 Scale 5 chains to an inch



| LEGEND | |
|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| RECENT | |
| Alluvium | { Sands, Gravels & Clays Old Dredge Tailings. [Yellow Box] |
| Ferruginous Laterite | { Cellular & Concretionary, Massive Iron Oxide Cemented, Aluminous in places. [Orange Box] |
| PRE-CAMBRIAN | |
| Tourmaline & Tin-Oxide Impregnated Albite-Pegmatite Dykes & Granitised Schists. | [Red Hatched Box] |
| REFERENCE TO SIGNS | |
| Approximate Geological Boundaries | ---?---?--- |
| Strike & Dip of Schistosity | N30°W 25° ↘ |
| Shafts | ■ |
| Buildings | ■ |
| Open Cut | ⊖ |
| Old Dredged Holes | ⊖ |
| Embankments | ≡≡≡ |
| Dams | ≡≡≡ |
| Drainage Channels | ~ ~ ~ |
| Swamp | ≡≡≡ |
| Bush Roads | ⋯⋯⋯ |

Compiled from survey data supplied by Mines Dept. Geology, Plane Table & Open Sight Alidade Traverses by H.A. Ellis, Jan. 1938.

phyllites and amphibolite schist. There is no indication in these old workings of the existence of a wide mineralised and granitised zone similar to that exposed in the open cut on M.C. No. 4, and the deposits of M.C. No. 3 can be best regarded as forming a band of narrow pegmatite dykes parallel in strike to the main belt to the west.

The several shallow shafts on the other claims indicate the existence there of tin and tourmaline-bearing pegmatite dykes, but the amount of work done on them gives no clue as to the extent of these deposits. There is ample scope for surface prospecting in the vicinity of these old workings, and in the portions of the leases situated away from the known workings the presence of tourmaline in the ferruginous laterite can be considered a favourable indication of the possible presence of tin-oxide.

The Main Workings.

The main workings of Vulcan Tin Mines, Ltd., are situated in the north-eastern portion of M.C. No. 4 on a flatly undulating laterite and forest-covered spur between Bunbury and Westralian Gullies, on the south side of the Greenbushes-Bridgetown road, some two miles south-east by south from Greenbushes Townsite.

Black tin-oxide is being obtained from a soft, highly decomposed, schistose and massive kaolinised rock of granitic composition, mined in an open cut by hydraulic sluicing methods, the disintegrated rock being elevated from the open cut as a pulp by gravel pump and passed over sluice boxes in which the tin-oxide is recovered.

The site of the present open cut and the surface immediately surrounding it was the scene of alluvial and lode mining carried out spasmodically since about the year 1899. The alluvial mining consisted of the collection of tin-bearing alluvial material shed from the soft kaolinised lode material and covering laterite, and its subsequent treatment by washing. The lode mining consisted of small open cuts and shallow shafts sunk in rich concentrations of tin-oxide and the subsequent treatment of the puggy lode material in various classes of treatment plant, none of which appears to have been able to successfully treat the difficult lode material. A combination of Huntington mills, cone classifiers and Wilfley tables was noted in one old plant, and the equipment used by the owner of the lease who was operating it immediately prior to the present owners consisted of a 6-foot Chilean mill and sluice box.

The main treatment difficulty lies in the very high content of kaolin in suspension in the pulp, necessitating the use of large quantities of water in the sluice boxes to effect efficient saving of the fine tin-oxide.

The open cut has a maximum length of 260 feet, is 195 feet wide and 35 feet deep in its deepest part. The sides of the cut show a thickness of from two to four feet of ferruginous laterite capping a weathered kaolinitic formation, which shows both a massive and schistose structure in various parts. The general strike of the schistosity is N. 30° W. and the average dip 35° W. 30° S., with a tendency for the dip to steepen as the western side of the cut is approached. The weathered schistose exposures consist essentially of kaolin, quartz and muscovite mica, with a liberal impregnation of tourmaline frequently arranged parallel to the schistosity. They also carry

black tin-oxide scattered through them in a very fine state of division. In all probability this weathered schistose material represents a replacement schist formed by a process of granitisation of a pre-existing rock type whose original nature cannot be determined. Grading almost imperceptibly into the schistose material are masses of almost pure kaolin carrying more or less tin-oxide and tourmaline, either with or without small lenses or irregular patches of massive, jointed quartz or granular quartz. Muscovite mica in plates up to 2 inches square occurs unevenly through the whole formation, while occasional crystals of beryl, about 1 inch across, were seen.

The manner of occurrence of the patches of granular quartz in the more or less massive kaolin, and the presence of thin quartz veins cutting the planes of schistosity of the schistose rock, is very similar to that seen in granitised zones bordering greenstone belts in the Eastern Goldfields, and points to the occurrence of this process in the rocks exposed in the open-cut.

The eastern wall of the formation is met in a tunnel driven N.E. from the bottom of the open-cut, and consists of an iron-oxide stained clay without noticeable quartz, mica, tourmaline or tin-oxide. The other limits of the formation are not known, although definite evidence is available that it extends for at least 160 feet north, 160 feet west and 500 feet south of the present north, west and south limits of the open-cut, and that it is tin-bearing in these localities.

Dish samples taken and washed by the writer from a number of points in the walls and floor of the open-cut all showed traces of tin-oxide, together with ilmenite. The tin-oxide appears to be disseminated throughout the entire kaolinised formation in a fairly fine state of division, pieces as big as a wheat grain being occasionally seen. Much of the first grade concentrate consists of pieces of tin-oxide of smaller dimensions than this, while the second grade has some very fine tin-oxide, almost a powder, in it.

Crystals of cassiterite up to $\frac{3}{4}$ inch across are reported as having been found in the workings, but recognisable crystals are rare in the heavily tourmalinised kaolinitic formation which constitutes the lode.

Irregular masses of black tourmaline and some partially formed crystals of the same mineral up to six inches across occur, and the formation is liberally impregnated with irregularly shaped masses of tourmaline of smaller dimensions, the finest of which are in the nature of a fine powder.

Local concentrations of tin-oxide in the form of irregularly shaped shoots of comparatively small dimensions are reported to have been worked in the area now occupied by the open-cut by previous leaseholders. No doubt similar rich shoots have been encountered in the course of hydraulic sluicing operations by the present owners, and other shoots can be reasonably presumed to exist in the formation under the floor and behind the walls of the present workings.

No information is available as to the depth to which the weathered kaolinised material extends below the bottom of the present workings, and, since the depth of the oxidised zone determines the limits of the present method of working the mine, this in-

formation is important and must be secured if any large scale mining operations are contemplated. With the information at present available a useful estimate of this depth cannot be made; it will be found more practicable to gain this information from bore holes.

Production.

Mines Department records show that between 1899 and 1934 some of the ground now held as M.C. 4 produced approximately 69 tons of tin-concentrates. It is impossible to determine whether or not this production came from an area now occupied by the open-cut, but it is almost certain that a large portion of it was actually produced from rich shoots of tin-oxide found in the formation now being worked by Vulcan Tin Mines, Ltd.

A more definite production figure is that of the recent owner, H. Paterson, who, according to Messrs. Lindsay and McKay, tin buyers of Greenbushes, produced about 9½ tons of concentrates, of about 60 per cent. metallic tin content, during the period July, 1935, to June, 1936, from ore taken from the open-cut now being worked.

In these production figures no yardage or tonnage is given, and the grade of the ore cannot, therefore, be ascertained. A complete record of the production by Vulcan Tin Mines, Ltd., was made available by the company, and the following is an analysis of the figures:—

| | |
|-----------------------------------------------------|-------------------------------|
| Date commenced production | 4th February, 1937. |
| (Production figures to end of January, 1938.) | |
| Total tonnage of First Grade Concentrate | 35 tons 13 cwt. 1 qr. 25 lbs. |
| Total tonnage of Second Grade Concentrate | 4 tons 19 cwt. 3 qr. 16 lbs. |
| Total Production | 40 tons 13 cwt. 1 qr. 13 lbs. |
| Average Assay Value of Total Concentrate Production | 57.04% metallic tin. |
| Average Assay Value of First Grade Concentrate | 59.65% metallic tin. |
| Average Assay Value of Second Grade Concentrate | 38.46% metallic tin. |
| Market Value of Production | £5,707 10s. |

In order to arrive at some approximate estimate of the quantity of material treated for this return, a quantity survey of the open-cut was made by the writer, whereby the total cubic content was obtained. This amounted to approximately 24,900 cubic yards. From a sketch plan and longitudinal section of the open-cut, as it was prior to the commencement of operations by Vulcan Tin Mines, Ltd., an approximate cubic content of 8,000 cubic yards was obtained from the very meagre information available on the plan. This estimate has had to be made on insufficient information, and must be regarded as roughly approximate only.

It would appear then that a volume of approximately 16,900 cubic yards of lode material has been treated by Vulcan Tin Mines, Ltd., for a return of 40 tons 13 cwt. 1 qr. 13 lbs. of tin-oxide concentrate, containing 57.04 per cent. of metallic tin. This is equivalent to a recovery of 5.39 lbs. of tin concentrate per cubic yard of material treated.

The difficulty of treatment brought about by the high suspended kaolin content in the pulp in the sluice boxes makes it almost certain that some appreciable quantity of concentrate has found its way into the tailings dumps. These have not been sampled, and consequently an estimate of the total weight of

tin concentrate per cubic yard and the percentage recovery figures of the treatment process cannot be determined.

Nevertheless, the value of 5.39 lbs. of recovered concentrates per cubic yard is a very satisfactory one, and prospects are favourable for the existence of large quantities of similar grade lode material beyond the present limits of the open-cut workings.

Future Development.

The manner of occurrence and the physical nature of the tin-bearing lode material makes possible the application of mining methods usually employed in working alluvial deposits, and from a practical point of view the deposit must be regarded as if it were an alluvial deposit.

In hydraulic sluicing or dredging processes it is necessary to be able to treat large volumes, and the treatment plant and water supply at present available is not capable of doing this. Before considering the enlargement of the plant and the provision of a better water supply it is essential to establish the existence of adequate ore reserves, and this can only be done in the present case by a thorough boring campaign.

The limits of the workable ground are determined by the depth of the material amenable to the present treatment processes and by the length and width of the mineralised zone. The occurrence of tin-oxide in lode or reef formation is notoriously irregular, and in the present case this fact will materially influence the setting out of bore sites.

At present, the limits of the payable tin-bearing material being worked in the open-cut are known in one point only, and it is not possible to form even the remotest estimate of its extent. To secure this information it is suggested that a series of suitably located cased bore-holes be drilled with a percussion drilling plant capable of keeping the shoe of the casing in advance of the drilling bit, and also capable of withdrawing the case on the completion of the hole.

In view of the fact that the tin-oxide may occur in any portion of the hole and that the whole of the material must be treated to recover it, it may not be necessary to record the concentrate from less than 15 feet sections of the borings. It will be necessary to carry the bores down to the limit of the lode material which is sufficiently soft to enable it to be mined by the methods at present in use.

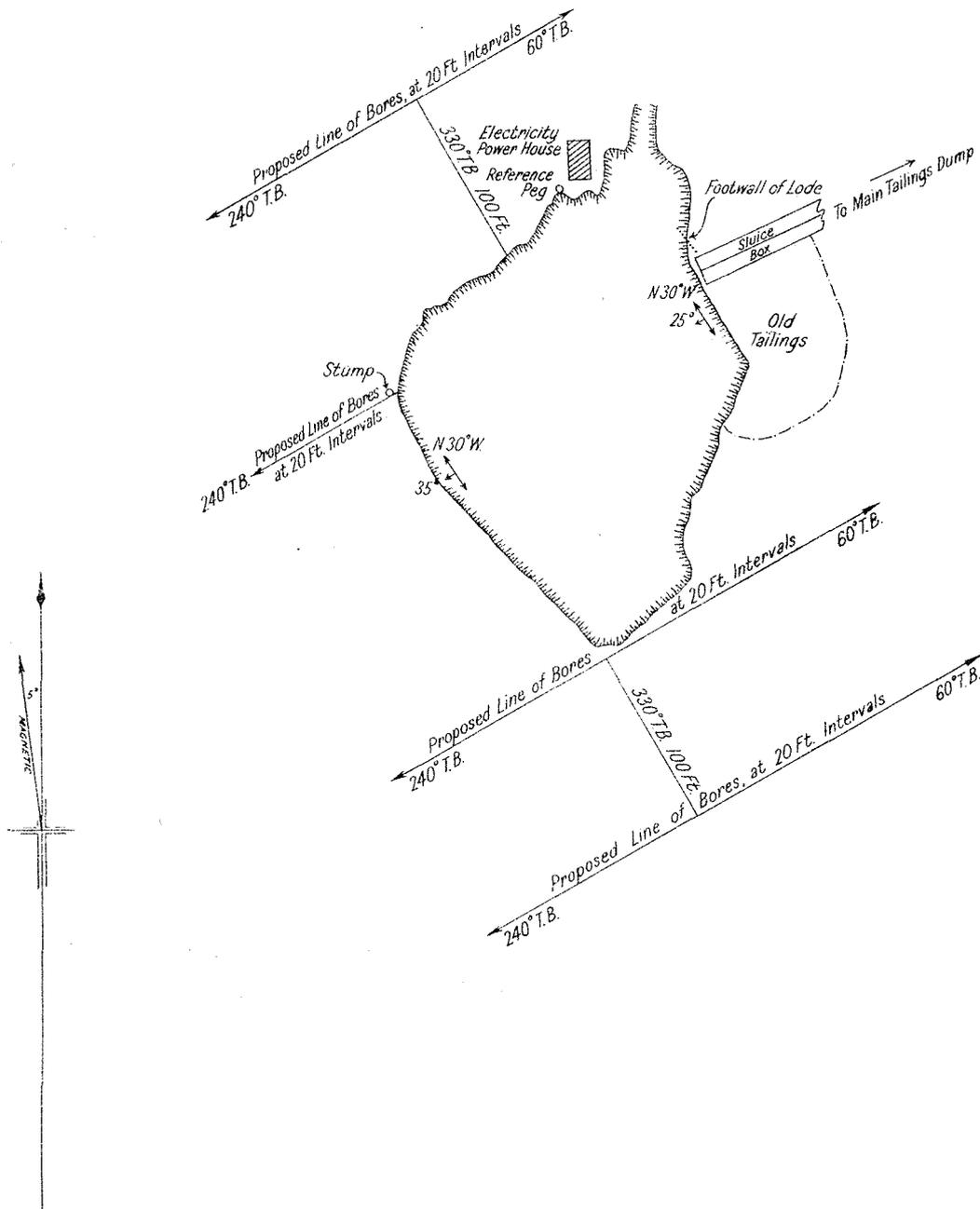
The concentrates from the 15-foot sections should be carefully saved and individually weighed, after which they could be bulked and submitted for assay for metallic tin. All computations should be made on a metallic tin content, because the concentrates cannot be obtained absolutely free from ilmenite or possibly tantalite and columbite. By this means a value in terms of metallic tin will be obtained for a section of the lode, the volume of which is represented by the product of the area of the cutting end of the casing-shoe (using the external diameter of the shoe if this has a bevelled edge) and the depth of the hole.

The boring campaign should be carried out under the supervision of a geologist, who would be in the position to locate bores additional to the lines set out below, using the information obtained from these bores.

PLAN OF
OPEN CUT-MINERAL CLAIM N^o 4
VULCAN TIN MINES LTD.

2 Miles S.E. by S. from Greenbushes
Showing Proposed Line of Bore Sites
GREENBUSHES TINFIELD

Scale 200 feet to an inch



Starting from the known tin-bearing deposit of the open-cut, and utilising the general direction of strike of the schistose lode material, the initial bores could be advantageously placed as follows:—

(a) The first line to be drilled at about 20-foot intervals in a direction of 240° true bearing from the most westerly part of the open-cut.

(b) The second line could be started in the same direction from a point situated about 100 feet on a bearing of 330° true bearing from the centre of the north-western bank of the open-cut. By drilling at 20 feet intervals in both directions (240° and 60° true bearing, respectively) the width of the tin-bearing formation will be established here.

According to the results obtained from these two lines of holes the distance between the lines of holes themselves can be adjusted to meet the circumstances when extending the campaign further to the north.

(c) Using the most southerly point of the open cut as a starting point two preliminary lines of holes at 20-foot intervals along lines 100 feet apart should be drilled across the southerly continuation of the formation in the same direction as for the northern lines.

In drilling these holes it will be best to determine the lateral limits of the formation by working outwards first to the east and then to the west from a centre line. The lines of these proposed bore sites are shown on the attached plan.

No boring difficulties are anticipated, and the footage drilled per shift should be high in this class of country. It will be essential for the boring contractor to keep an adequate supply of water on the bore site, and to provide a sluice box with sides sufficiently high to prevent the splashing over of the sludge as it is tipped from the sludge-pump into the box. This sludge will have a high content of suspended kaolin in it, and a reasonably large vessel should be provided at the end of the sluice box to take the outflow from the box and provide an opportunity for fine tin-oxide to settle below the lip of the overflow.

It is obvious that with no knowledge of the probable limits of the tin-bearing formation, a useful estimate of the number of holes required to prove a large volume of material cannot be made. The prospects of the present workings certainly warrant the provision of at least £1,000 for boring purposes, but until several lines of holes are drilled, no estimate of the probable amount of ground this expenditure would prove can be made.

Water Supply.

The present water supply drawn from old dredged channels, now forming water holes in Bunbury and Westralian Gullies, and from a trench in Bunbury Gully below the tailings dam, is inadequate for the present treatment plant in the summer months. During the winter months ample water is available from these sources.

An immediate improvement in these supplies could be made by ring-barking the jarrah and red-gum forest on the catchments of these two gullies, and additional supplies could be obtained from a group

of wells sunk at the junction of Westralian and Bunbury Gullies.

If the deposit is shown by boring to be extensive, then a water supply adequate for the requirements of a larger plant is necessary, and this could probably be best obtained by constructing a dam across Westralian Gully.

CONCLUSIONS.

(1) Mining operations carried out in the open cut on M.C. 4 show that tin-bearing lode material of a minimum average value of 5.39 lbs. of tin concentrate per cubic yard has been won from approximately 17,000 cubic yards of material treated by Vulcan Tin Mines, Limited, between February, 1937 and January, 1938.

(2) Records of production from an area which can be reasonably presumed to have included the present site of the open cut indicate that approximately 78 tons of tin concentrate was obtained from the formation prior to the commencement of operations by Vulcan Tin Mines, Limited.

(3) The sides and bottom of the present workings carry tin-oxide finely disseminated through the lode material, and hand bores reveal the presence of the tin-bearing formation at distances of up to 140 feet north, west and south of the present limits of the workings. There is no information at present available as to the limits of the tin-bearing zone.

(4) The manner of occurrence of the tin-oxide in the formation and the favourable geological structure, together with the proved occurrence of tin-bearing material, at intervals, for approximately three miles to the north-northwest, suggest the distinct possibility of the existence of an extensive tin-bearing formation on M.C. 4, both to the north and south of the present workings.

(5) Tin-bearing reefs and lodes, unlike gold deposits, are not subjected to surface enrichment by chemical processes, and the occurrence of further rich shoots of tin-oxide may be anticipated in the unoxidised rock below the downward limits of the weathered material at present being worked.

(6) A prospecting boring campaign is necessary to prove the extent of the deposit, and the results obtained from mining operations to date amply justify the expenditure of at least £1,000 on this work.

(7) The various known occurrences of tin-bearing pegmatites exposed in shallow workings on the other mineral claims of the company's holdings require further prospecting before an estimate of their value can be formed. On present indications, they do not appear to have the possibilities of the deposit at present being worked on M.C. 4.

Plans.

The following plans accompany this report:—

(1) Geological Map of Mineral Claims Nos. . . 4, 8, 15, 16 and 17, and W.R. 286. Scale 5 chains = 1 inch.

(2) Plan of open-cut, Mineral Claim No. 4, showing lines of proposed boresites. Scale 100 feet = 1 inch.

Photographs.

A series of photographs of the open-cut and rock formations exposed therein has been added to the Departmental collection.