

P. 120/30/11

The Mining Magazine

Managing Director and Editor: W. F. WHITE. Assistants: St. J. R. C. SHEPHERD, A.R.S.M., D.I.C., F.G.S.; F. HIGHAM, A.R.S.M., M.Sc., F.G.S.

PUBLISHED on the 15th of each month by MINING PUBLICATIONS, LIMITED
AT SALISBURY HOUSE, LONDON, E.C. 2.

Telephone: London Wall 8938. Telegraphic Address: *Oligoclase*. Codes: *McNeill*, both Editions, & *Brinley*.
BRANCH OFFICES { New York: Amer. Inst. M. & M.E. SUBSCRIPTION { 12s. 6d. annum, including postage.
Chicago: 360, N. Michigan Blvd. { U.S.A., \$3 per annum including postage.

Vol. XLII. No. 1. LONDON, JANUARY, 1930. PRICE ONE SHILLING

CONTENTS

	PAGE		PAGE
EDITORIAL		NEWS LETTERS	
Notes	2	Johannesburg	29
Mr. Walker's Retirement; The Stantrg Mine; New Year Honours; Imperial College Dinner; A New Book on Alluvial Mining; Lena Goldfields; Rhodesian Railways.		A National Industry; A New Copper Belt; State Diamonds; A promising Platinum Producer; Transvaal Emeralds; Dry Mining Investigations; Death of Dr. P. A. Wagner.	
Silver	3	Brisbane	31
In view of the report of the work at the Royal Mint and the low price of silver a return to a finer silver coinage is suggested.		The New Mount Morgan; Foreign Capital for Oil Prospecting; Mount Isa Progress; Another Mining Trust Venture; The Coal Trouble; North Broken Hill; Electrolytic Zinc Company.	
A Plea for Dolcoath	3	Vancouver	33
The relations between this old Cornish Mining Company and the Government are examined.		Institute Meeting; The Kootenays; Portland Canal; Boundary.	
Tin	4	Toronto	35
The progress of Tin Stabilization is reviewed.		Sudbury District; Porcupine; Kirkland Lake; Rouyn; Chibougamou, Que.; Manitoba; Huronian Belt.	
The Suction Cutter Dredge	5	Camborne	37
A résumé of the discussion on one of the papers at the December meeting of the Institution is given.		Cornish Mining in 1929; South Crofty; Wheal Kitty; Lambriggan.	
REVIEW OF MINING	6	PERSONAL	38
ARTICLES		TRADE PARAGRAPHS	38
The Stantrg Lead-Zinc Mine, Yugoslavia	9	Mirrlees, Bickerton and Day Oil Engine ..	39
<i>Dr. A. Branmhall</i>		Climax Hay Dust Trap	40
The author describes an ore-body which, in respect of mode of emplacement, is of exceptional interest.		METAL MARKETS	41
The Relative Efficiency of Ore-dressing Processes	16	STATISTICS OF PRODUCTION	43
<i>R. T. Hancock</i>		PRICES OF CHEMICALS	45
The author describes a new formula for calculating efficiencies of ore-dressing processes.		SHARE QUOTATIONS	46
Tin Lodes in Nova Scotia.		MINING DIGEST	
<i>E. H. Davison</i>	20	The Geology of Northern Rhodesia (continued from the December issue, p. 369)	
The author gives an account of the geology of the Gold River Area, Lunenburg County, Nova Scotia, where both tin and gold deposits are found.		<i>J. A. Bancroft and R. A. Pelletier</i>	47
BOOK REVIEWS		The Suction-Cutter Dredge <i>G. W. More</i>	50
Thorne and Hooke's "Mining of Alluvial Deposits by Dredging and Hydraulicicking"	24	Deep Mining Method at the City Deep	53
<i>H. W. Laws and W. R. Rumbold</i>		<i>A. V. Lange</i>	
Nicolesco's "Gisements Pétrolifères de la Perse"	24	The Allenby Concentrator, British Columbia	56
<i>H. B. Milner</i>		<i>H. R. Taylor</i>	
Nash and Bowen's "The Principles and Practice of Lubrication"	26	SHORT NOTICES	59
<i>Wilfred E. Gooday</i>		RECENT PATENTS PUBLISHED	59
Steinmann's "Geologie von Peru"	27	NEW BOOKS, PAMPHLETS, ETC.	60
<i>S. J. Truscott</i>		COMPANY REPORTS	61
Whitelaw's "Surveying as Practised by Civil Engineers and Surveyors"	27	Anglo-Burma Tin; Apex (Trinidad) Oilfields; Associated Gold Mines of Western Australia; Ayer Hitam Tin Dredging; Batura Monguna Tin; Camp Bird; Consolidated Tin Mines of Burma; Ex-Lands Nigeria; Frontino and Bolivia (S.A.); Gold Mining; Hongkong Tin; Kamunting; Lake View and Star; Lena Goldfields; Malayan Tin Dredging; Meru Tin; Mexican Corporation; Naraguta Korot Areas; Naraguta (Nigeria) Tin Mines; Nigerian Consolidated Mines; Rambutan; Santa Gertrudis; Sulphide Corporation.	
<i>F. W. Armstrong</i>	27	DIVIDENDS DECLARED	63
Crookall's "Coal Measure Plants"	28	NEW COMPANIES REGISTERED	64
<i>A. J. Maslen</i>			
Rutley's "Elements of Mineralogy"	28		

EDITORIAL

REGULAR readers of the MAGAZINE will be sorry to learn that prolonged ill-health has necessitated the retirement of Edward Walker from the editorship, a position he has occupied since 1916. Mr. Walker will for the present remain on the board of Mining Publications, Ltd., so that he will not altogether lose touch with those with whom he has worked so happily for many years, and it is hoped the relief from responsibility will result in an improvement in his health.

IN this issue is published an article on the Stantrg Mine in Yugoslavia, which has been written by Dr. Alfred Brammall. The author describes a mode of emplacement which is of exceptional interest. The correct interpretation of geological data has been of inestimable value during the development of this mine, which before long promises to be a considerable producer of lead and zinc.

AMONG the New Year Honours appear the names of Sir Thomas Gregory Foster, Provost of University College, London, and until lately Vice-Chancellor of the University, who becomes a Baronet, and Professor John Samuel Brame, of the Department of Chemistry and Metallurgy, Royal Naval College, Greenwich, who is awarded the C.B.E.

THE annual dinner of the Imperial College held on December 9 was as usual the occasion of some pronouncement as to the future of the College. At this function it fell to Professor W. W. Watts to remark that the new Statutes of London University presented problems which the Governors of the College were trying loyally to solve. Let us reiterate the hope that the Royal School of Mines will lose nothing by any changes which may occur. The occasion served also to introduce to many the new Rector, Colonel H. T. Tizard, who took the chair in the absence of Lord Buckmaster.

THE extent to which alluvials are nowadays being mined for the recovery of gold, platinum, and tin—especially tin—makes the appearance of a new book on this subject of special importance, particularly as no like text-book has been published for some years. It is with pleasure, therefore, that we announce the production by Mining Publications, Ltd., of "Mining of Alluvial Deposits by Dredging and Hydraulicking," the authors of which, Messrs. W. E. Thorne and A. W. Hooke, are too well known in their special field to need any introduction here. A review of the book will be found elsewhere in this issue.

THE statement made by the chairman of the Lena Goldfields at the meeting last month—that although the company is now making a profit of £30,000 a month they find themselves unable to get any remittance to this side—is certainly not calculated to attract further capital for Russian mining. When the Lena company resumed operations under the concession agreement doubts were expressed in well-informed quarters as to the wisdom of their action, the view being held that it was one thing to get the gold out of the mines and an entirely different thing, under present conditions, to get it out of the country—and the Lena company must by now have reached the same conclusion.

IN our issues of June and September last the development of those railways which may in future serve the Northern Rhodesian and Katanga copper fields was referred to at some length. Further progress seems forecast by the decision of the Government of Southern Rhodesia to appoint a commission, headed by two former Union railway engineers, to investigate the potentialities of the proposed Sinoia-Kafue project and also to inquire into the advantages of the extension of the line from Beit Bridge, spanning the Limpopo River, to connect with the main line at West Nicholson or some point on the Somabula line. Simultaneously it is

announced that railway rates are to be reduced and that of this reduction Northern Rhodesia is receiving the greater portion of the benefit, as rates there are at present higher than in Southern Rhodesia. Thus the Rhodesian railway authorities appear to be making a bid for some of the traffic which must eventually travel over the Benguela railway when the Belgian section is completed.

Silver

For the person who possesses it, undoubtedly the first requirement of a shilling is that it shall purchase one shilling's worth of goods. It is also undoubtedly true, such is the integrity of our commercial system, that the shilling of to-day ranks equally with the now occasional Victorian coin in this respect. This fact is so much taken for granted that it requires some mental effort to realize that our modern silver coinage has not the same intrinsic value as that of our forefathers. This train of thought is engendered by two events of the past month—(1) the report for 1928 of the Deputy Master of the Royal Mint and (2) the record low price of the metal.

The report on the work of the Royal Mint treats a matter-of-fact subject in a manner which makes much of it excellent reading. Dealing with the issue, in 1928, of the new coinage introduced by Order of Council in 1927, the report admits that the experiments with silver-copper-nickel alloys carried out during 1920-1922 were discouraging, but the worst features in these earlier efforts have now practically disappeared. The composition of the present coinage is a quaternary alloy, consisting of 50% silver, 40% copper, and 5% each of nickel and zinc, the introduction of the last-named metal being the novelty, although the quantity used for this purpose is not likely to be of much assistance to zinc producers. Here, however, we are mainly concerned with two issues—the fact that there is only 50% of silver in the new coins and the admission of the authorities that it is not yet felt that a complete solution of the silver-coinage-alloy problem has yet been found.

As regards the low price of silver, the world is faced with the position that the demand for this metal does not equal the production, but whether this will mean the formation of a silver research association

remains to be seen. For many years there has been a decline in the use of silver for currency purposes, due to the increased adoption of the gold standard and, at any rate in the case of our own country, to the high price ruling for the metal on the termination of the War. Of the countries which still retain a silver currency the most important is China, which has always absorbed a large part of the total production of the metal. Of late, however, in spite of the improved political situation, that country has been a seller, the probability being that currency hoarded by the war-lords and their bankers to pay for munitions is now being unloaded. Mexico also still retains a silver standard, but as she is a producer it is as such that the low price of silver affects her, as it becomes necessary to curtail production. Certain Central American states and Persia also keep to the silver standard, but the amount absorbed by these countries can only be a small one. Lastly, there is a vast amount of silver currency in circulation in India, but here the coinage is fixed on a gold-exchange basis and the situation is not therefore felt so keenly. The recent slump in the silver market seems to be mainly due to over-production, which is accentuated by the heavy selling from China. In view of the admission in the report that the best silver-alloy for our own coinage is not yet found, it might be suggested that further search should be hardly worth while, now that silver-metal is at such a low figure.

A Plea for Dolcoath

It is doubtful whether the name of any mine is better known than that of Dolcoath, and there have been periods when it was a name to conjure with. The present, however, does not seem to be one of those happy times and unless some modification of the conditions with regard to the Trade Facilities loan is forthcoming it is not easy to see how the mine can be reopened. At the meeting last month some plain speaking was indulged in, but we feel it was fully justified. Whilst it is desirable as far as possible not to dwell on the lack of impartiality existing in many directions during the progress of the War, one cannot refrain, in dealing with the present position of Dolcoath, from pointing out how the Cornish mines were penalized, the price of their produce being fixed on account of

national—or perhaps more correctly international—considerations. The loss, however, was not borne by the nation, but by the miners and their employers. While in other parts of the country strikes were threatened and higher wages secured, the Cornish miner continued steadily at work without any increased remuneration. It must be remembered, too, that, although the price the mines received for their produce was fixed, there was no restriction of the charges for supplies, most of which, especially coal, were much heavier.

That the injustice of the treatment meted out to these mines was recognized by those in power at the time is evident from the appointment of a Board of Trade Committee to consider the question. This committee submitted its report in March, 1920, and stated:

It has been strongly impressed upon us, and we think with considerable justification, that the tin-mining industry is entitled to special consideration on account of the following reasons:—(1) The price of tin was depressed by direct Government action, and if the Government had not intervened the price would have reached and been maintained at a much higher figure during the later period of the War; (2) the price of tin, in consequence of Government action, was depressed to the extent of approximately £100 per ton, with subsequent loss to the Cornish tin-mining industry; (3) the tin-mining industry in Cornwall did not receive Government assistance similar to that given to certain other industries, nor was its labour protected to the same extent during the War.

In view of the character of the Board of Trade Committee's report it was felt that some consideration should be given to the claims of the mines affected, which had not only exhausted their resources, but in many cases had had to borrow money to keep going. There was, however, a change of Government and the matter was shelved.

The position now is that £77,000 is owing to the Government. Those associated with the company are satisfied that they can raise the necessary capital to restart the mine if the Government will agree to let their loan stand on the same basis as the new capital. This proposal has so far been refused. The Government spokesman has stated that they have no funds at their disposal for helping Cornish mining, but no further grant is asked for, so far as Dolcoath is concerned. When so much money is being allocated in other directions with the object of lessening or preventing unemployment, it is not easy to understand

the refusal by the Government of the proposal which has been placed before them. The reopening of Dolcoath will put several hundred men again into work—and in Camborne alone there are said to be 700 unemployed—and take them off the dole, the receipt of which must, from what we know of the Cornish miner, be repugnant to him. At the meeting last month, on the proposal of a shareholder, a resolution was passed asking the Trade Facilities Committee to reconsider their decision and to co-operate with the directors in assisting to raise the further funds required to restart the mine and it is to be hoped, for the credit of the Government and the welfare of the Cornish miner, that it will meet with a favourable result.

Tin

Greater progress has been made during the past month in the direction of putting the tin mining industry on a sounder basis than during any previous similar period, although much still remains to be done. No one was surprised to learn that the proposal that the smelters should hold a percentage of the ore was jettisoned and, as we stated a month ago, the desired result now looks like being achieved by a restriction of working hours. The Dutch, however, have yet to be heard from on this point and, in view of the fact that the Banka and Billiton mines are mainly Government-owned, that their working costs are low—as they employ mainly imported Chinese labour—and that they meet the position of low prices by closing down their low-grade mines, there may be some difficulty in securing their adhesion to any scheme for restricting output.

The latest proposal put forward by the Council of the Tin Producers' Association is that during the current year all mining operations shall cease from 10 p.m. on every Saturday till 6 a.m. on the following Monday, and also for a week during the current month and a week during next month, and, if deemed necessary, a week in March. These recommendations have been communicated to the members of the Council at present in Malaya and Australia and have been approved by members in the East. As to Nigeria—in which country there is a difference in the working hours—the Council are assured that producers will adopt an equivalent curtailment to that

recommended for the East. With regard to Bolivia, the Council are also assured of the support in principle of the majority of the production in that country, although some modification of the scheme may be necessary in the case of lode-mining operations.

A further move which should also prove advantageous to the tin-mining industry is the fusion of four out of the five smelting companies. Whether the fifth—the Straits Trading Company—will come in later remains to be seen. The four in the combine—details of which are given in our Company Registrations—are the Eastern Smelting, Williams Harvey, Cornish Tin, and Penpoll. As was pointed out by Sir George Penny, at the meeting last month of the Eastern Smelting Company, the pooling of research and general interests cannot do other than result in higher efficiency in smelting practice, combined with a corresponding reduction in costs, which will naturally be of material advantage to the tin mining industry.

The Suction Cutter Dredge

Two papers were published for discussion at the December meeting of the Institution, one by G. A. More entitled "Suction-Cutter Dredging for Tin in Malaya" and the other by E. J. Vallentine entitled "Some Notes on Bucket Dredging"; the former will be found summarized elsewhere in this issue and it is hoped to deal with the latter next month. The interest of the first proved, however, to be so much greater than that of the second that it occupied the attention of the members for the whole of the time available, the proceedings being rather in the nature of a *post mortem*. Both the authors were absent and the usual procedure of introducing papers by deputy was departed from. Discussion was, therefore, embarked upon immediately and as this in its early stages was mainly of an adverse character there was a feeling that an introduction would have been desirable. That the opening remarks should be directed against the suction cutter dredge was hardly surprising, considering its record in the East, although had the firm responsible for their installation on many of the properties some five years ago been in a position to effect certain improvements the verdict might have been different. The only suction cutter dredge installed in Nigeria did not

add to the reputation of the engineer responsible and involved the company concerned in heavy expenditure. The attack was led by Dr. W. R. Jones, who was supported by Messrs. W. J. Payne, L. G. Attenborough, E. T. McCarthy, and J. H. Ronaldson. At this stage, however, Dr. Cullen interposed and, as all the remarks had come from what might be regarded as the opposition, called upon Professor Truscott to give some views on the other side. This was certainly an unusual experience—to have a paper introduced after its author's arguments had been severely criticized.

Although at a disadvantage, Professor Truscott ably dealt with the paper, throwing into prominence the hopeful aspects of the subject. He disposed, for example, of the bogey raised by one of the opponents by his remark that tinstone in clay could be as easily lost in bucket dredging as with the suction cutter dredge. Professor Truscott also emphasized the incapacity of the bucket dredge to deal successfully with pinnacled ground or ground with a hard bottom and under such conditions indicated a possible sphere of usefulness for, at any rate, some suction principle. In this stand he had the support of Sir Albert Kitson, who felt that the argument had been too one-sided. Sir Albert made a good point when he suggested that it did not follow that a suction cutter dredge was failing in its task because second and third re-treatments of the ground produced further recoveries of tinstone, for there might conceivably be something wrong with the tin-dressing system, resulting in some of the tinstone going over with the tailings. He also reinforced the previous speaker's arguments as to the possible utility of this type of dredge in uneven ground, instancing potholes in stream beds, where gold is apt to concentrate.

Speaking generally it would seem that, while the opponents of the suction cutter dredge at present hold the field—and for very good reasons—there may be more to be said in favour of this type than was heard at the meeting. Some modification of the cutter may yet be looked for, though Mr. Payne thinks that every conceivable kind has been tried, and Dr. Cullen's plea for further dispassionate consideration of the claims and possibilities of the suction cutter dredge—notwithstanding its past misdeeds—merits attention.

REVIEW OF MINING

Introduction.—The New Year has not opened badly. The improvement in the gold position encouraged the view in some quarters that the Bank rate would be reduced, but no change has been made, the rate remaining at 5%. There has been a sharp set-back in the price of silver, a new low record having been touched. The anticipated substantial improvement in tin is yet to come and other base metals at the moment are not too good.

Transvaal.—The output of gold on the Rand during December was 813,574 oz. and in outside districts 37,560 oz., making a total of 851,134 oz., as compared with 861,593 oz. in November. At the end of December the number of natives working at the gold mines was 184,280, as compared with 186,941 at the end of November.

The accompanying table gives details of the dividends paid by the Rand gold mining companies during 1928 and 1929. There are no notable variations in these figures during the period under review:—

	1st half, 1928.	2nd half, 1928.	1st half, 1929.	2nd half, 1929.
	s. d.	s. d.	s. d.	s. d.
Brakpan	4 9	5 0	4 9	5 0
City Deep	—	—	—	—
Consolidated Main Reef	1 3	1 0	1 0	1 0
Crown Mines (10s.)	2 6	3 0	3 3	3 3
Geduld	3 3	3 6	3 0†	3 3†
Geldenhuis Deep	—	6	6	6
Government Areas (5s.)	2 3	2 3	2 3	2 3
Langlaagte	1 6	1 6	1 6	1 6
Meyer & Charlton	—	—	—	—
Modder B (6s.)	2 0	2 0	2 0	2 0
Modder Deep (5s.)	3 3	3 6	3 3	3 6
Modder East	1 9	2 0	2 0	2 0
New Modder (10s.)	7 0	7 0	7 0	7 0
New State Areas	1 6	1 6	1 6	1 6
Nourse	6	6	6	6
Robinson Deep (A, 1s.)	1 6	1 6	1 6	1 6
Robinson Deep (B)	—	—	—	—
Rose Deep	6	—	—	—
Simmer & Jack (2s. 6d.)	—	—	—	—
Springs	3 3	3 6	3 6	3 9
Sub Nigel (10s.)	3 0	3 0	2 0	2 0
Van Ryn	6*	6*	6*	6*
Van Ryn Deep	4 0	4 0	3 6	3 6
Village Deep	—	6	6	6
West Springs	9	1 0	1 0	1 0
Witwatersrand Gold	6	—	—	6

* Tax paid.

† On increased capital.

The total dividends of the Rand mines for 1929 at £8,085,018 show an increase of £105,000 as compared with 1928.

Although at the quarterly meeting last month of the Transvaal Chamber of Mines Mr. John Martin, who presided, stated that the native labour supply was below anything experienced on the gold mines for over two years, he expressed a hopeful view as to the future. He pointed out that the maintenance of the white staffs at their

present level was due to the confident expectation that measures would be adopted, in co-operation with the Government, for materially improving the native labour position and ensuring an adequate and stable supply.

An agreement has been entered into by which the Robinson Deep will acquire the mining rights and certain plant and machinery of the Village Deep, the purchase price being £337,500, of which £300,000 is payable on completion of transfer and the balance twelve months later. There is subsequently to be a reorganization of the Robinson Deep capital, but the rights attaching to the "A" shares are to remain unaltered.

Whilst some disappointment may have been felt by shareholders of the Simmer and Jack Mines at the non-payment of a dividend for the past year, there would seem to be good reason for the course adopted. Although an inadequate native labour supply restricted operations, development values during the year were of such an encouraging nature that the capital expenditure programme decided on some time ago was accelerated, which will naturally benefit the working of the mine and be reflected in profits at an earlier date than would otherwise have been the case.

There is a general feeling on the Rand that it would be a mistake to close down the New Kleinfontein mine, concerning which a Government Commission is holding an inquiry. In some quarters direct Government assistance is urged, whilst in others it is felt that the continuation of operations might be ensured by a remission of taxation.

Diamonds.—The profit of the Premier Company for the year ended October last was £273,319, as compared with £356,821 for the preceding year, the Government share being £163,991 and the company's proportion £109,328. There was a substantial decrease in the number of loads washed, owing to native labour shortage, and also a decline in the average yield.

Southern Rhodesia.—The output of gold during November was 46,219 oz., as compared with 46,923 oz. in October and 47,705 oz. in November of 1928. Other outputs in November were: Silver, 7,135 oz.; copper, 125 tons; coal, 108,783 tons; chrome ore, 31,899 tons; asbestos, 4,096 tons; mica, 14 tons; diamonds, 62 carats.

Following on the announcement in the *MAGAZINE* for December of the agreement between Turner and Newall and the Rhodesian and General Asbestos Corporation, in which the former firm offered shareholders of the latter five Turner shares for every four Rhodesian shares, a further step in the amalgamation of Rhodesian asbestos interests is to be recorded, Messrs. Turner and Newall having exercised their option to purchase the Havelock property on the South Swaziland border at a price approximating a quarter of a million sterling.

Northern Rhodesia.—During the quarter ended September 30 last six more bore-holes were completed by the Roan Antelope Copper Company, four of them on the Roan Antelope property, one on the Roan Extension, and one on the Muliashi area. The first five show the ore-horizon to be very uniform in thickness with the copper content averaging about 3.5%. The Muliashi hole showed 1.9 feet of payable ground assaying 2.11% copper. Surface plant for sinking the Beatty Shaft was finished, but owing to shortage of native labour work was confined to improvements in the workings already completed. The erection of power-plant, compressors, and other surface buildings is proceeding smoothly.

Work done by Rhodesian Congo Border Concession, Ltd., during the past year has shown the extent of the ore-bearing strata to be approximately 100 miles in length. In accordance with the arrangements between the company and the British South Africa Company 14 areas covering approximately 74,000 acres have been taken up for further development.

West Africa.—The returns for the past year must have prepared shareholders of the Ashanti Goldfields Corporation for the increased final dividend of 40%, which with the interim distribution paid in July last brings the total for 1928-29 up to 65%, or 10% more than for 1927-28.

The Fanti Consolidated report for the year ended December 31 last—published on January 8—shows a profit of £135,237, or £31,930 more than for 1928. As in the previous year, £30,000 is placed to reserve, which now stands at £60,000, and the final dividend and bonus recommended will bring the total distribution for the year to 18 $\frac{3}{4}$ % as compared with 12 $\frac{1}{2}$ % for 1928.

Australia.—The exhaustive statement of Mr. Agnew at the Lake View and Star meeting towards the end of last month

—which will be found elsewhere in this issue—indicated that the views held by Dr. Maclaren and others as to the various lodes likely to be met with in the company's extensive area—a small sketch plan of which was given in the *MAGAZINE* for July, 1928—are being fulfilled. As Mr. Agnew was at pains to point out, however, there is need for the shareholders to have patience.

At the Briseis meeting last month the Chairman referred to the prospect of resuming operations. The Tasmanian Government—who are anxious to see work restarted—have expressed their willingness to assist and suggestions have been made to them by the directors. These have been accepted by the Tasmanian Parliament, with certain modifications. As soon as the directors know the character of these, they intend to formulate their scheme and submit it to the shareholders. It will be remembered that illustrations showing the character of the disaster at the Briseis mine were given in the *MAGAZINE* for August last.

Malaya.—A circular to shareholders of Tronoh Mines gives up-to-date information as to the position of the company. This shows that there are now four dredges in operation, two on the old property and two on the Tanjong area. The output of these for 1929 is estimated at 1,939 tons, as compared with 1,197 tons for 1928. The pontoon for the fifth dredge, which is also to operate in the Tanjong area, was launched in November last. Particulars are also given of the various companies in which Tronoh Mines is interested. Perhaps the chief of these is the Sungei Besi Mines, in connection with which the hydro-electric power scheme is all but completed. As to the Sungei Besi's Village area, on which stripping operations were commenced about the middle of last year, the necessary plant and machinery have been ordered and some of it is already in transit to the mine. The new opencast in the Village area is being laid out and equipped with electrically-operated shovels, which are expected to result in considerable working economies being effected as compared with the operations at the old mine. When the designed scale of operations is attained it is anticipated the Sungei Besi output will be doubled. As to the Sungei Way Dredging, a third dredge is stated to be now on order and its manufacture well in hand.

For the year to June 30 last the production

of the Kepong Dredging Company—whose dredge commenced working at the beginning of June, 1928—was 319½ tons, obtained from 899,700 cubic yards, an average of 0.8 lb., which realized £39,422, an average of £123 7s. 8d. per ton. After allowing for depreciation on plant, etc., the profit was £7,502.

The view entertained in some quarters as to the inadequacy of the amount provided to complete the programme of the Perak River Hydro-Electric Power Company, Ltd., has proved to be justified. In July last it was announced that an additional expenditure of £350,000 would ensure the completion of the engineering works. Three months later, however, it was stated that a further £250,000 would be required, bringing the total additional amount to £600,000, to which has to be added £250,000 advanced by banks in connection with the extension of the stream stations. The F.M.S. Government, on having the position placed before them, have intimated their willingness to advance on loan the £850,000 required at 5% interest.

Burma.—In order to clear off its indebtedness, the Anglo-Burma Tin Company propose to create £80,000 7% first mortgage debentures, the creditors having expressed their readiness to accept same in settlement of their debts. At the meeting last month it was also stated that the vendors had intimated their willingness to return 30,000 shares of the purchase consideration received in respect of the Thabawleik property.

Canada.—The mineral output of the Dominion for last year again established a record at \$303,876,000. The gold production was 1,915,000 oz., towards which Ontario contributed 1,606,000 oz., whilst the output of copper was 242,402,000 lb., of which British Columbia produced 103,000,000 lb. The silver output at 22,368,000 oz. showed an increase in quantity but a decrease in value as compared with 1928.

Cornwall.—At the meetings on January 3 the scheme for amalgamating the East Pool and Tolgus companies was approved. The capital of East Pool is to be increased to £300,000 by the creation of 200,000 new shares of 5s. each, and Tolgus shareholders are to receive one East Pool for every three Tolgus shares. The development work proposed provides for the opening of the Tolgus property through the East Pool workings.

Derbyshire.—The report of the Mill Close Mines, Ltd., for the year to March 31

last records a gradual improvement in the grade of the ore mined and states that the indications of the existence of a better grade ore being found at depth and over an increasing area continue to be promising.

Yugoslavia.—The Novo Brdo Company, which has been actively prospecting in Yugoslavia, has now concentrated on the exploration of the Kijmitsa Valley in the Janjevo area. Preliminary investigations have shown the existence of two separate mineralized zones carrying lead and zinc minerals and, subject to the results of work now in hand, a diamond drilling programme is to be started.

The Consolidated Gold Fields and Tin.—The statement not long ago that the Consolidated Gold Fields of South Africa had secured an interest in the London Tin Syndicate has been followed by the announcement that it is now to be represented on the board by two of its directors. The Gold Fields is also taking over the management of Ex-Lands Nigeria, on the board of which it will also have two representatives.

Another Tin Combine.—The latest proposal is that the London Tin Syndicate, which recently absorbed the Ropp and Bauchi companies, should take over two further Nigerian undertakings, Anglo-Bauchi and Mongu, and two trust companies, the London Malayan and Tin Selection. In the preparation of this scheme some careful calculations must have been necessary, for it provides for shareholders of the Tin Selection Trust receiving seven London Tins for every 16 shares held and London Malayan three London Tins for every eight, whilst as to Anglo-Bauchi and Mongu, whose shares are of the nominal value of 5s. and 10s. respectively, the former are to receive one London Tin for every 16 and the latter a dividend of 9d. per share in respect of the past year and one London Tin for every six shares held. Should the amalgamation be approved it is proposed subsequently to split each £1 London Tin share into one 8 per Cent. Non-Cumulative Preference share and one Ordinary share of 10s. each and certain proportional distributions of the Preference shares are to be made to the London Tin, Tin Selection Trust, and London and Malayan shareholders in lieu of cash dividends. The amalgamation will increase the issued capital of the London Tin Syndicate to approximately 2¼ millions sterling.

THE STANTRG LEAD-ZINC MINE, YUGOSLAVIA

By A. BRAMMALL, Ph.D., M.Sc., F.G.S., A.I.M.M.

The author, in collaboration with G. F. HATCH and T. MARRACK, B.Sc., A.R.S.M., F.G.S., describes an ore-body which, in respect of mode of emplacement, is of exceptional interest.

ANCIENT MINING ACTIVITY.—Recent development-work in Southern Yugoslavia bids fair to revive an industry which flourished in the mountainous parts of the peninsula as a whole during the Middle Ages and which, according to ancient records, may date back to Roman or even earlier times. Some indication of the importance and extent of this ancient mining activity is afforded by countless areas of mineralized ground punctured with pits which recall old shell-holes and are often clustered in zones elongated in the local tectonic direction. Within these pitted areas occur old shafts, adits, slag-heaps and

for its content of silver, for pillars and walls of blende-rich ore as well as pyrites were sometimes left standing, and some occurrences show tool-marks of such a character as to suggest that they were selectively picked over for galena before being abandoned. Occasional discoveries of pig-lead (and lead alone) point to the same conclusion.

THE TREPÇA MINING PROPERTIES.—Numerous pitted areas occur within a Mining Concession acquired by the Trepça Mines, Ltd., and extending from Kosovska Mitrovica to the north-east and south-west for about twenty miles. The region is thinly populated and mountainous, with altitudes



FIG. 1.—PLAN OF THE TREPÇA MINING CONCESSION SHOWING THE AREAS COVERED BY OLD WORKINGS.

spoil-dumps, with occasional open-cast workings and local depressions which suggest caved ground.

In some of these ancient mining districts occur the ruins of once-flourishing townships, the size and importance of which may be gauged from local tradition and the evidence afforded by piles of rubble marking the sites of former buildings, by traces of paved roads and the stark relics of church or mosque.

The best index, however, to the scale on which these ancient mining communities worked is to be found underground. Many old shafts cleaned out and prospected are found to connect with extensive galleries and many-chambered stopes, the latter often of impressive size. Galena seems to have been the mineral specially sought, probably

up to 2,000 metres. The total area of the Concession is between four and five hundred square miles (Fig. 1).

Present operations are concentrated on development work at the Stantrg Mine and several points in the immediate vicinity. The Mine is situated about 5 miles east of Kos. Mitrovica, at an altitude of 760–1,000 metres above sea-level.

At Stantrg a large lead-zinc ore-body was located about 2½ years ago as the result of investigating an old open-cast associated with many large pits. Development work, pursued entirely from adits and at horizons above the bed of the Trepça stream, has now reached an advanced stage.

Operations have recently been extended to adjoining areas where preliminary prospecting has established geological conditions

generally similar to those at the Stantrg Mine. At Meljenica for example (1 mile north-east of the Mine) a maze of old galleries and stopes has been entered from old shafts; at Trepca Hill, about $1\frac{1}{2}$ miles east of the Mine, still larger stopes have been entered—from a shaft bottomed at a depth of 109 metres from surface.

LOCAL GEOLOGY.—The area of present operations lies within the Vardar Zone recognized by Kosmat.¹ This is a wide zone of compression, thrust, and over-ride, with the Dinaridean (N.N.W.—S.S.E.) trend, extending from the Gulf of Salonica northwards into the Pannonian Basin and thence via Kos. Mitrovica into and beyond the Kapaonik.

The area is seamed with irruptive andesites, andesitic breccias, agglomerates, and fissure-tuffs. At many localities bedded tuffs etc. mantle the higher ground. These irruptives are considered by Kosmat to be of Miocene age.

The horizon most prone to mineralization is the limestone, from which the Stantrg ore-body for example originated by replacement-processes to be described in a later section. Limestone is also the locus of the extensive stope-work recently discovered at Meljenica and Trepca Hill. The limestone is brought to surface by broken anticlinal folds at Stantrg, Meljenica, and Trepca Hill. It is highly probable that the limestone at each of these localities represents one and

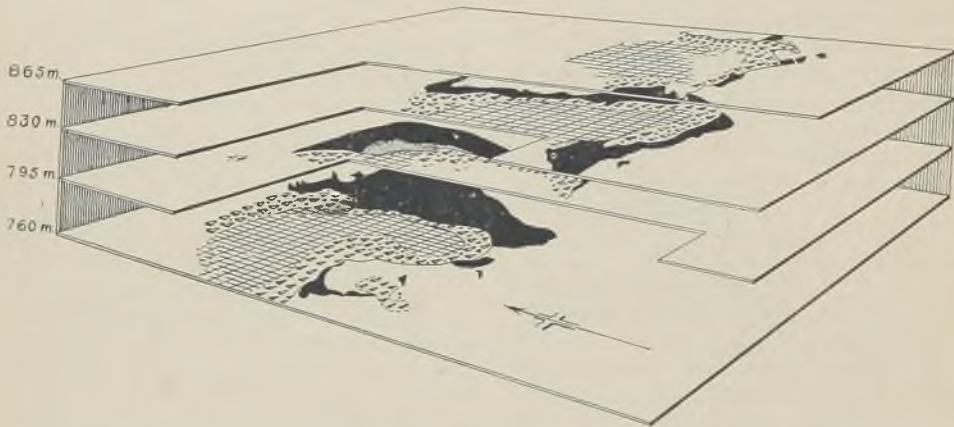


FIG. 2.—THE STANTRG MINE: BLOCK-DIAGRAM OF THE PLANS (IN PART) OF THE FOUR MINE-LEVELS, SHOWING THE MAIN ORE-BODY (SOLID BLACK) REPLACING CRYSTALLINE LIMESTONE ABOUT ITS CONTACT WITH AN ANDESITIC CONE-COMPLEX AND SCHIST.

The dominant formation is the Stantrg Series, consisting of a compressed and crumpled fold-complex of schists and phyllites, quartzites and clay-slates, stratigraphically above crystalline limestone. This Series recapitulates the features of regional schists etc. considered by Kosmat to be of Older Palaeozoic age, the folding being, in the main, early Tertiary and of Alpine type. Numerous small masses of more or less altered dolerite ("greenstones") are intrusive into the schist-series. To similar minor intrusions in the regional schists of other areas Kosmat attributes an age ranging from Jurassic to Lower Cretaceous. A Flysch-facies (grits, sandstones, shales, and marls) is locally infolded with the schists.

¹ F. Kosmat: "Geologie der zentralen Balkanhalbinsel" (Die Kriegsschauplätze, 1914-1918, Heft 13), pp. 80-122.

the same stratigraphical unit, but evidence which might decide this point is concealed by tuff and pit-spoil supporting a thick growth of scrub.

GENERAL MINERALIZATION.—In Southern Yugoslavia, mineralization characterized by the blende-galena-pyrite association occurred on a regional scale—pene-contemporaneous with vulcanicity attributable to granodiorite magma accumulated at numerous foci beneath the fold-complex of the region as a whole. Replacement, impregnation, veining, and fissure-infilling are widespread effects, and gossanous outcrops abound. These features are so closely related, in time and space, to emplacements of andesitic and allied irruptives that a direct genetic connection between ore-bodies and magma in this region must be presumed.

In the Trepca Concession, several minor lodes and numerous gossanous outcrops

traverse both tuffs and limestone within and around the pitted areas. Doubtless similar occurrences, now obliterated, became the focal points of ancient mining activity.

The large ore-body at Stantrg was exploited by open-cast methods in the first instance, and later by shafts. Several large stopes and much filling material have been encountered at high horizons in the ground beneath the old open-cast mine. Old workings occur even on the lowest level of present development. An old adit discovered at this level was cleaned out and enlarged; it remains in use as a drainage

The core-mass is a cream- to dun-coloured rock allied to dacite or quartz-trachy-andesite. Like the matrix of the breccia, it is somewhat altered.

The cone-complex is an asymmetrical structure plugged into the limestone of the Stantrg anticlinal. Its axial plane is roughly parallel to that of the anticlinal. In horizontal section its outline, as traced by the outer margin of the breccia, is roughly a semi-ellipse. It rises steeply from depth and expands with ascent, its forefront, or forward lip, dipping inwards less steeply than the sides (Fig. 3).

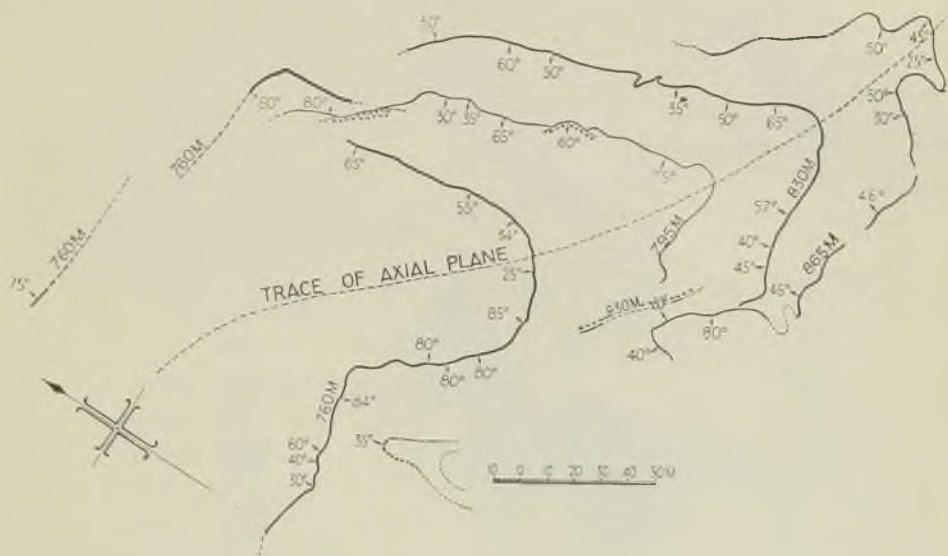


FIG. 3.—PLAN OF THE OUTER MARGIN OF THE CONE-COMPLEX AS ENCOUNTERED IN THE MINE-LEVELS. THE CONTACT PLOTTED IS THAT BETWEEN LIMESTONE AND BRECCIA EXCEPT WHERE ANDESITE IS SHOWN.

adit. Though the ancients must have removed a considerable ore-tonnage, of unknown grade, the main ore-body was left essentially intact.

THE STANTRG ORE-BODY.—(1) *Mode of Occurrence, and Origin.*—The main ore-body occurs between crystalline limestone and an irregular cone of irruptive explosion-breccia jacketing a plug of massive igneous rock (Fig. 2).

The breccia is composed of blocks and fragments of the local schists etc., with occasional blocks of andesite and pyritous vein-quartz, set in an igneous matrix which, though modified by hydrothermal alteration and impregnated with pyrite, silica, and carbonates (including rhodochrosite), is similar in type to the massive rock forming the core of the cone.

The ore-body originated by the replacement of the limestone by sulphides, silica etc., the process being promoted by the arresting and blanketing effect of two main dipping contacts: (a) between breccia and limestone, (b) between schists and limestone. The effect of these contacts was to dam back solutions rising through the limestone under pressure from below, and thus to promote replacement of the limestone preferentially at and about these contacts from which mineralization proceeded outwards. It is probably not a mere coincidence that ore of a grade considerably above the average occurs where the two contacts intersect to form a bay the walls of which diverge downwards.

The effectiveness of the breccia-contact alone is strikingly displayed in the plans of

the mine-levels (Figs. 4 and 5). On the 830 m. level for example, the ore-body occurs as an almost continuous ring welded on to the breccia-contact, from which it extends outwards to a fretted margin steeply banked against limestone. The frequency with which such marginal contacts (i.e. between ore and limestone) are roughly parallel to the prevailing strike of foliation or to its conjugate direction, suggests that migration of the

stope-work entered from the 865 m. level, on the north-east flank of the main ore-body, suggests that irregular masses and pockets of ore were emplaced in direct relation to this contact and to zones of shear and over-ride in the underlying limestone.

(2) *Development of the ore-body.*—The Stantrg ore-body has been opened up through four main adits, at vertical intervals of 35 metres, the method of development being

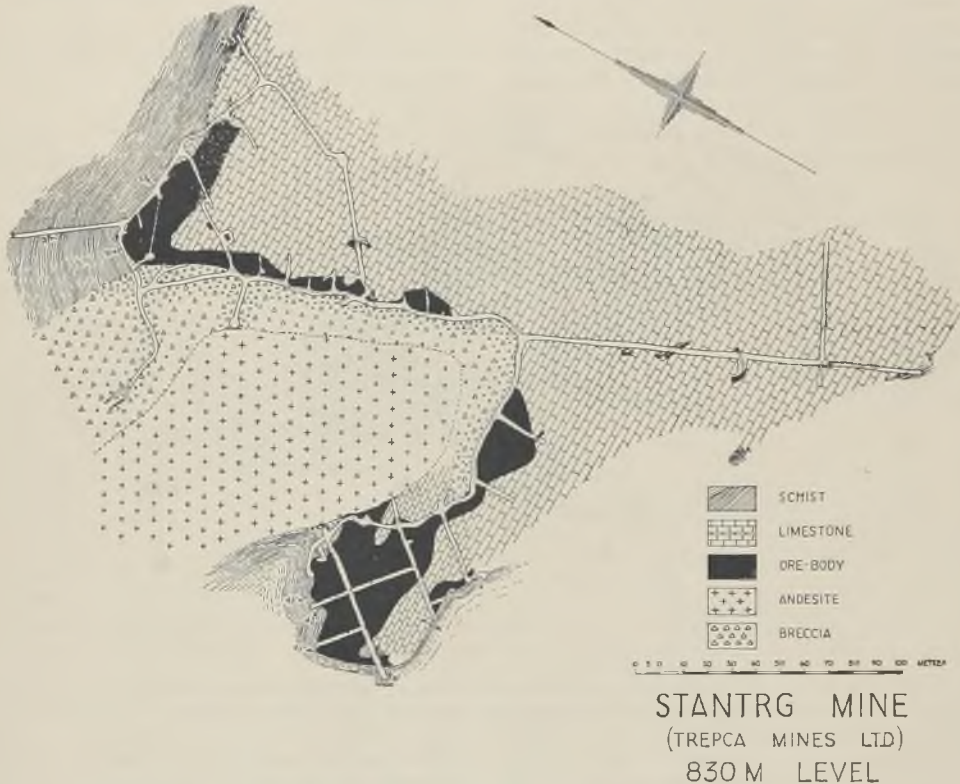


FIG. 4.—PLAN OF STANTRG MINE SHOWING THE MAIN GEOLOGICAL FEATURES.

mineralizing solutions was to some extent controlled by joints and fissures of tectonic origin. This feature of orientation is also displayed by many ore-shoots and veins encountered in the limestone, schists, andesite etc. remote from the main ore-body. Where it apparently fails, as on the steeper (west) side of the anticlinal, the trend of contacts observed reflects more localized fissure-systems related to crenulations of the main anticlinal and to zones of faulting and shear.

As the plans indicate, the schist-contact was much less effective as a blanket than the breccia-contact. On the other hand, ancient

to drive along the breccia-contact and to crosscut at regular intervals through the ore-body, which on the lowest level shows a width of some 50 metres. As shown in the plans, the circuit of the breccia-contact is essentially complete on two levels (760 m. and 830 m.). Work in progress on the intermediate (795 m.) level and the highest (865 m.) level indicates the continuity of both cone-complex and ore-body from depth to height.

Diamond-drilling from the 760 m. level continues to afford satisfactory evidence that ore of the type and grade proved on this level extends in depth (Fig. 6). A deep adit

at a horizon 150 metres below the 760 m. level is now being driven from the west, and will have a length of about 2½ kms.

(3) *Type of Ore-deposit.*—The various facies of the Trepca ore-deposits are descriptively covered by Niggli's "Intrusive (plutonic) hydrothermal Group"¹ or Lindgren's Group B.2.b(a).²

The main Stantrg ore-body is a replacement-deposit in limestone and conforms to Lindgren's "mesothermal" sub-group. The massive ore is a coarse aggregate of argentiferous galena, ferruginous blende, and iron-

blende, and iron-pyrites, with small amounts of gangue-minerals.

Typical "epithermal" features are displayed by many vein- and fissure-occurrences—notably those in propylitized andesite. Pyritous disseminations in kaolinized tuffs, etc., and precipitations from hot-springs (e.g. travertine) mark the non-economic extremes.

In mid-July last, the calculated ore-reserves stood at 1,750,000 tons, of an average grade of 11.5% Pb., 10.5% Zn., and 3 oz. of silver per ton.

(4) *Fissure-infillings.*—Mineralized veins

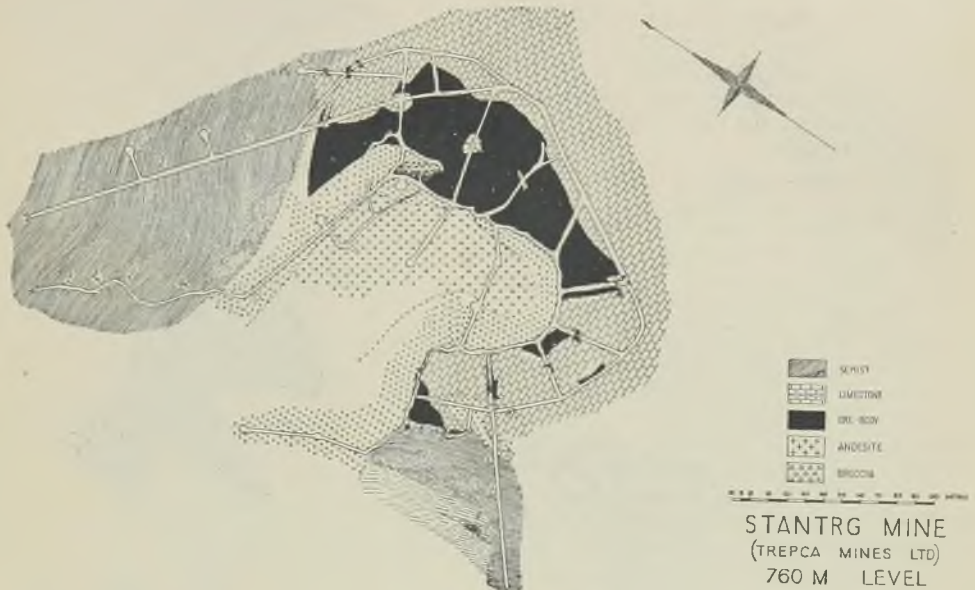


FIG. 5.—PLAN OF STANTRG MINE SHOWING THE MAIN GEOLOGICAL FEATURES.

pyrites in varying proportions. Arsenopyrite, disseminated chalcopyrite, jamesonite (in vughs), and interstitial specularite occur in small amounts. Bismuth is present in traces; the gold-content is insignificant. Gangue-species comprise calcite, dolomite, rhodochrosite, siderite, and quartz.

The incoming of pyrrhotite and magnetite suggest transition to "hypothermal" conditions of origin. In some facies, pyrrhotite is the predominant sulphide. One occurrence (on the 760 m. level) is of special interest: it is composed of euhedrons of galena, up to 7 in. in diameter, embedded in a very coarse matrix consisting of pyrrhotite, galena,

and fissures, and their gossanous outcrops, occur in limestone, schist, andesite, breccia, and tuff; they present very complex and diverse features.

Occurrences range from veinlets and irregular stringers to intricate link-vein plexus, unit veins, and lodes, infilled with gangue-minerals, sulphidic aggregates, or gossanous residuum. The detailed description and classification of these occurrences are outside the scope of the present paper, but a brief reference to their mode of origin is appropriate.

Reviewing conceptions put forward to explain comparable occurrences elsewhere: (a) For the "fissures" themselves, the following modes of origin are indicated:—

- (i) Open when mineralization began.
- (ii) Produced by crustal stresses acting simultaneously with, but independently of,

¹ "Ore Deposits of Magmatic Origin." (P. Niggli. Translated from the original German edition by H. C. Boydell, 1929). Page 44.

² "Mineral Deposits." W. Lindgren. Page 238, and pp. 516-780.

forces promoting the circulation and ascent of mineralizing solutions.

(iii) Forcibly opened, by irruptive solutions having the character of magma-residuum.

(iv) Potential only when mineralization began, a fissure-form emplacement of mineral being effected by metasomatic processes selectively searching rock-zones weakened by permeability etc.

(b) "Infillings" then fall into the following groups according to the mechanism presumed:—

(i) By the passive admission of solutions, the fissures being either infilled to the extent of the space available; or infilled while being at the same time widened by pressures exerted on the walls by robust growth of crystals.

(ii) Irruptive, analogous to igneous dykes and veins.

(iii) Products of complex reaction and exchange of material between wall-rock and solutions energised by heat and pressure, that is, replacement bodies.

If porosity be taken into account, occurrences of impregnation (by sulphides, silica, carbonates etc.) become special limiting cases under (a) and (b) above.

The emplacement of the Stantrg ore-body as a whole, and the fabric and textural detail of its numerous facies, support the view that this ore-body originated by metasomatic replacement of limestone at a stage when orogenic forces had largely expended themselves and crustal adjustments, tensional in the main, were restoring static conditions. The irruptive andesites, breccias etc. represent some of the results of tension-relief, and other results include mineral-veins etc., which were either contemporaneous with or only a little later than the irruptives. For particular occurrences of veins, etc., a status under (a) i-iii could be claimed, but mineralization accompanied by metasomatic replacement is a widespread feature, even in andesitic types. To cite an example from this region, a "mineralized" hornblende andesite, the original feldspars of which have been replaced by quartz-mosaic; the hornblende has been pseudomorphed by microgranular pyrite, and the groundmass replaced by micro-crystalline quartz impregnated with pyrite; the contours and angles of each original mineral, and the texture of the original andesite, are preserved.

POSSIBLE SUBSIDIARY ORE-BODIES.—Stantrg may be regarded as a focal point of mineralization for the locality, and conditions here afford some guide to possibilities at other points.

These conditions may be summarized thus:—

(a) An anticlinal, with a core of limestone overlaid by schists.

(b) Andesite, andesitic breccia etc. irruptive into the anticlinal and transgressing the limestone.

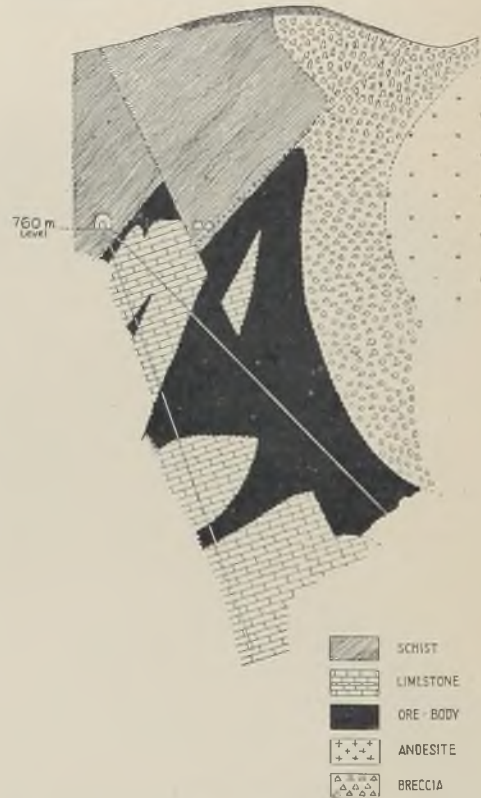


FIG. 6.—A VERTICAL PLANE-SECTION THROUGH DRILL-CHAMBER NO. 11, 760 m. level (point K, Fig. 5), bearing N.37° E.—S.37° W. Showing the continuity of mineralization to depth.

Where these conditions are accompanied by evidence of ancient mining activity, they are specially significant.

As already stated, mineralization at Stantrg proceeded by replacement of the limestone about its contact with breccia and schist. As regards the blanketing effect of the breccia in particular: there is no reason to suppose that this was determined, to any significant extent, by the space-form (that of a cone) assumed by the breccia. Hence the conditions defined above would

justify the close prospecting of any locality where they have been achieved. Such a locality occurs only 0·7 km. S.S.W. of the mine.

The same conditions are repeated at Meljenica and Trepca Hill, to which passing reference has already been made.

MELJENICA, TREPCHA HILL, AND STANTRG HILL.—At Meljenica, a few old shafts have been opened, and are found to connect with large stopes and extensive galleries in gossanous limestone associated with irruptive breccias and tuffs. At the bottom of one of these shafts unoxidized ore, showing good zinc-values, has recently been uncovered.

At Trepca Hill, still larger stopes have been entered. Here also, relics of original ore-body have been left standing.

At Stantrg Hill, which overlooks the mine, ancient mining activity is indicated by numerous pits. As these pits are clustered in a zone on the strike of the anticlinal of limestone explored in the mine, prospecting is in progress here.

At each of the three localities last mentioned, investigation of old workings has disclosed much useful information concerning the probable character and tonnage of ore-body removed by the ancients. Standing water has been encountered on the lowest horizons explored, and it is at these depths that relics of ore-bodies have been discovered. The depth reached by the ancients was probably fixed by the mean level of the water-table, and the ground below this level is being prospected.

Other pitted areas to be investigated lie within a 3-kilometres radius of the ruined church at Trepca, the site of an ancient township which occupied a central position in this once-flourishing mining district.

The largest pitted area in the Trepca Concession lies some 5 km. due east of Trepca, and extends over the greater part of the Gumniste plateau. No serious prospecting has yet been done on this area.

IRRUPTIVE BRECCIAS.—Irruptive breccias have been located at several points in the schist ground on both flanks of the cone-complex in the mine. Only short lengths of outcrop have as yet been uncovered, but these are roughly parallel to the flanks of the cone-breccia and dip inwards towards the locus of the cone, their relationship to which remains to be determined.

GENERAL.—Kos. Mitrovica is the present rail-head of the branch line from Skoplje, which is on the main line from Belgrade to Salonica. The distance by rail from Salonica

is about 180 miles, and from Belgrade about 340 miles. A new railway now under construction from Kos. Mitrovica to Kraljevo will reduce the rail distance from Belgrade to about 200 miles; it should be completed in 1930.

Communication between Kos. Mitrovica and the Stantrg Mine has recently been improved by the construction of a graded new road laid and surfaced to meet all essential transport requirements.

Crushing, concentrating, and power plant is being erected near Kos. Mitrovica, on a site situated on the left bank of the River Ibar and close to the new railway. The concentrating plant will have an initial capacity of 500 metric tons of ore per day, and is designed to treat ore exclusively by oil-flotation processes. The ore will be conveyed from the mine to the plant by aerial ropeway 4 miles long.

On the mine site, present equipment includes compressor-plant, well-equipped offices, workshops etc., bath-houses for the miners, and housing for the resident engineers and technical staff. Construction-work under a housing scheme for miners has made good progress.

Labour supply is adequate and co-operative in attitude, and relations with both local authorities and State Departments are excellent.

Thanks are due to the Board of Directors, Trepca Mines, Ltd., by whose courtesy this preliminary account is published.

Two New Alloys.—The British Non-Ferrous Metals Research Association announce that, as the result of some years' work on a particularly insidious form of breakdown on lead cable sheaths, it has determined on an alloy as a substitute for lead which is also applicable in other cases where lead is now used, notably in domestic water supply service. The composition of the new alloy is: Lead 98·25%, tin 1·5%, and cadmium 0·25%. Another alloy having similar mechanical properties, but which is less resistant to corrosion, consists of 99·25% lead, 0·5% antimony, and 0·25% cadmium. The former is recommended for plumbing purposes where specially corrosive waters are found and both have been accepted by the G.P.O. and Admiralty for cable sheaths. It will be recalled that a Tin Industrial Applications Committee was recently formed to work in co-operation with the Research Association for the promotion of new uses for tin.

THE RELATIVE EFFICIENCY OF ORE-DRESSING PROCESSES

By R. T. HANCOCK

The author describes a new formula for calculating efficiencies of ore-dressing processes

Some years ago Edwin Edser read a paper before the Institution of Mining and Metallurgy in which he suggested that the efficiency of any given process of concentration might be mathematically represented by an exponential formula. He took results which had been obtained by Prof. S. J. Truscott in his researches on slime treatment on Cornish frames, and calculated certain exponents which in his opinion agreed sufficiently well in parallel experiments to justify his conclusions. As a matter of fact the agreement was not particularly good, and I devised an entirely different formula which gave remarkably close results, but confined my contribution to the subsequent discussion to the statement that no particular formula could ever be expected to give entirely satisfactory results owing to individual peculiarities in the physical nature of different pulps, and to an attack on the exponential formula in particular owing to its obvious breakdown when applied in certain possible cases. This was hardly constructive criticism, but my experience in a similar case had been that the discussion section of the Institution's proceedings was not a good medium for the publication of original work of this nature.

I had already worked out and published a method of representing the efficiency of an actual result in ore-dressing, and by comparing the efficiencies obtained in two different cases on the same ore it could be seen whether any improvement had been effected by varying the conditions of treatment, but a means of discovering at once from a single result in which direction and to what extent the conditions should be varied was still lacking.

This information would be available if a mathematical formula embodying the behaviour of the pulp while undergoing concentration could be devised, but I had already committed myself to the statement that the attempt could hardly be successful. Nevertheless, the results obtained by the new formula had been so good when compared with Truscott's actual figures, and its form is so consistent with what we may imagine to take place during concentration, that it may be worth while to make it public.

My formula for arriving at the efficiency of the result of an act of concentration is pure mathematics, and is beyond criticism on this account. This new formula, purporting to give the efficiency of the concentration process itself, and predict its results at any stage, depends for its truth on the assumption that concentration follows the empirical law which the formula embodies, and its adequacy can only be checked by reference to actual results. Such results are rare in the literature, and all entirely inaccessible to me at the moment.

Construct a square of unit length in the side. Along the y -co-ordinate plot recovery values, such that 0.84 represents 84% recovery, and so on. Similarly along the x -co-ordinate plot concentration values, such that 0.05 represents a concentration to 5% of the weight of the original ore.

Now a line diagonally from the origin to the opposite corner will be the graph of a concentration process of zero efficiency throughout. Percent recovery and percent concentration will be equal at any point on the locus, and as, by my original "result" formula, efficiency is measured by the difference between recovery and concentration, when these are equal to each other the efficiency of the process is zero. Such would be the process of "concentration" performed by a sample-splitter, where the weight is very much reduced, but the assay remains the same.

Where the result of an act of concentration is such that its object, which is the separation of the ore from the waste, is to a certain extent achieved, the locus of the point representing the result will occupy a definite position on the chart. A recovery of 70% in a concentrate having only 5% of the weight of the original ore would be represented by a point 0.70 up, and 0.05 to the right, and may be considered as a point of arrest on a curve which terminates at the origin of co-ordinates and commences at the diagonally opposite corner, and whose shape is characteristic of the particular ore and of its response to the particular process. By varying in an appropriate manner the point of arrest at which the division between concentrate and tailing is made, but without varying

the ore or the process otherwise, another position for the point on the chart is obtained, and it can be assumed that it lies on another portion of the same curve. If the curve is capable of being represented by a mathematical formula, then both points should be obtainable from the same formula, and because this is practically the case with these particular results of Truscott's I am emboldened to think that the formula I propose does closely represent the course of a concentration process. If with the same ore, but with a radical alteration in the process, another point is obtained, this should not lie on the former curve, but may be made to take up another position on its own curve by an appropriate division of concentrate from tailing, or in other words by aiming at a higher or lower degree of concentration, with a corresponding degree of recovery in the reverse sense. In Truscott's researches on the treatment of tin slimes on Cornish frames, this variation to secure the movement of a point along its own curve could be effected by varying the length of the frame or the time allowed for treatment before washing off. Radical variations would be in the nature of the concentrating surface, its slope, and the rate of flow. The influence of these on efficiency of concentration can be calculated from the results obtained, and the value of the formula, if reliable, is obvious.

The equation chosen to embody the necessary features has the form :

$$y = \frac{a}{a + bx} \dots (1)$$

where y = recovery, 100% being represented by unity,

x = concentration, 100% being also represented by unity,

a = a constant, having any values between 0 and 1,

b = a constant, assumed = $1 - a$.

Assuming any value for a , values of y corresponding to any value of x can be calculated and the curve corresponding to this value of a plotted through the points obtained. These curves somewhat resemble hyperbolas, concave towards the diagonal between the origin and the opposite corner. The lower the value of a , the more the curves tend to recede from the diagonal, representing processes of higher degrees of efficiency. If $a = 1$, the efficiency of such a process is zero, and the curve and the diagonal correspond.

If the other diagonal through the remaining corners of the square, and at right angles to the former, be considered, it will be found to cut all the process-curves for any values of a at points where $y + x = 1$, and the tangents to all the curves at these points have a value = 1.

But without bothering with any calculus, it can be seen by simple inspection that where $y + x = 1$ along any curve, the value of $y - x$ is a maximum, and as by my original formula the efficiency of the result of concentration is measured by the difference between recovery (= y) and concentration (= x), we get the striking and rather unexpected result, assuming the truth of the new formula, that for any particular process of ore-dressing the maximum possible efficiency is obtained when concentration is arrested at such a point that

$$\% \text{ Recovery} + \% \text{ Concentration} = 100$$

This corollary exposes the weakest point in the defence of the proposed formula. It can easily be imagined that with a certain ore a particular constituent of the crushed rock, such as mica, is almost entirely removed at an early stage of concentration, without any corresponding loss of values. Then at the actual point of maximum efficiency recovery plus concentration might not exactly reach 100. And with an ore in which the valuable constituent slimed very easily the opposite effect might be produced. And certainly in the re-treatment of a tailing, where the distribution of the remaining values is abnormal, the formula would break down altogether. With a classified ore the values might be expected to hang back during concentration, so that here again the sum of recovery and concentration at the point of maximum efficiency might fall short of 100, yet as the effect of efficient previous classification should be to increase the recovery in a smaller bulk of concentrate, it should only vary to a small extent one side or the other if at all. Certainly for a normal or classified ore everything points to the region where % recovery plus % concentration equals 100 as being that where maximum efficiency is reached. And an explanation should be sought where any sensible deviation from this standard is observed. Generally speaking, it may be taken that where 100 is exceeded, it is desirable to push concentration further.

Given the recovery and degree of con-

centration obtained from a process arrested at any particular stage, the value of a in formula (1) can be obtained thus :

$$a = \frac{x - xy}{y - xy} \dots (3)$$

whereupon the recovery, or concentration, associated with arrest at the appropriate stage, such that recovery ($=y$) plus concentration ($=x$) is equal to 1, and corresponding to the maximum efficiency obtainable from that process, is given by the formulas :

$$x = \frac{\sqrt{a - a}}{b} \dots (4)$$

$$y = \frac{1 - \sqrt{a}}{b} \dots (4a)$$

Formula (3) can only be used when b is assumed $= 1 - a$, as must be done when only one result of a process is available and it is desired to get some idea how it compares with a theoretical optimum, but this latter may quite easily be 2% out.

Formulas (4) and (4a) can be used when the true values of a and b are known, as will be shown later.

The value of x as given by (4) is compared with that used in (3), and if it is less, it indicates that with the given process it is desirable to carry concentration a little further. Similarly with y and vice versa.

Another trial of the same ore, with one or more of the conditions of the process altered, may give when tested by the formula

$$\text{Efficiency} = \text{Recovery} - \text{Concentration}$$

a lower efficiency result than was disclosed by the first run. Yet if the two concentrations are worked out by the formulas here given to obtain the optimum values of x in each case, it may transpire that the second is actually the more efficient method when the division between concentrate and tailing is made at the proper point, and that its seeming inferiority is simply due to a less correct balance between concentration and recovery.

The standard formula for the calculation of recoveries from assay results is :

$$\text{Recovery} = \frac{\text{assay of conc. (assay of feed - assay of tail)}}{\text{assay of feed (assay of conc. - assay of tail)}}$$

As recovery is equal to concentration multiplied by enrichment ratio ($=e$), we can convert the formula

$$y = x \times e = \frac{x}{a + bx} \text{ into } \frac{1}{e} = a + bx$$

which is the equation of a straight line in $1/e$ and x , by dividing throughout by x , and inverting.

In the Mining Digest of the MAGAZINE for January, 1929, are given a number of data relating to test runs carried out in the Ore-Testing Laboratories of the Department of Mines at Ottawa on ores from the Rouyn district of Western Quebec.

The most complete is on group 3 (a).

Test.	Weight %	Sums.	Values %	Sums.	Calculated Values.
1. Concentrate	35.3	35.3	95.0	95.0	96.6
Middling .	8.5	43.8	2.6	97.6	97.6
Tailing .	56.2		2.4		
2. Concentrate	17.9	17.9	92.3	92.3	92.2
Middling .	9.8	27.7	2.9	95.2	95.5
Tailing .	72.3		4.8		
3. Concentrate	14.5	14.5	89.9	89.9	90.3
Middling .	8.2	22.7	5.3	95.2	94.1
Tailing .	77.3		4.8		

In each of these tests a middling was made in addition to the concentrate, and so there are two points of arrest in each test, and by adding the middling to the concentrate in each we obtain the equivalent of six points of arrest defining the process curve illustrating the application of flotation to this ore.

A plot of the data in their original form led nowhere, but converting them into values of the weights recovered and the reciprocals of the enrichment, and plotting these against one another, gave a series of points falling with considerable exactness along a straight line, and from this line the equation of the process was found to be :—

$$y = \frac{x}{0.018 + 0.982x}$$

and the values of recovery obtained from this formula are shown in the last column of the tabulation.

With a range of weights of concentrate from 43.8% to 14.5% the agreement is remarkably good, and leaves no room for doubt that the formula is reliable.

As a matter of fact, in the above example, the constants were deliberately shaded so as to obtain $a + b = 1$. In this particular case the graph almost justified it.

But examining in a similar way some of the very much less complete data on other ores given in the paper, it became quite evident that my original supposition on theoretical grounds that $a + b = 1$ is not justified, and that in practically every case $a + b$ slightly exceed 1, and in consequence maximum efficiency is not to be found at the point where % concentration plus %

Another observation was that where it was possible to obtain sufficient figures, say three, from the data on other ores from the district, the slope of the graphs was sensibly parallel in all cases, indicating a practically constant value of b , but there was a good deal of variation in the derived value of a in the different cases. It almost seemed that b was a constant for the process, and a a constant for the ore.

In the case of group 3 (e), three points gave a very good line, concentrate ranging from 58.2% to 8.7%, and the formula calculated from it was

$$y = \frac{x}{0.027 + 0.995x}$$

Now these investigations do show that over the range of recoveries and concentrations with which the millman is concerned a practical working formula is available, but the man with the actuarial mind will object that if the curve is extrapolated to the point where $x = 1$, or the point where no concentration has so far taken place at all, the recovery is less than 100%, which is a ridiculous state of things, and the practical man will point out that it is the general experience that if concentration is pushed far enough a practically pure concentrate is produced which is lost without change if concentration be carried to the limit.

A remarkable example of this kind is illustrated by a graph accompanying my article on "The Physical Bases of Tin Dressing", which appeared in the *MAGAZINE* of February, 1921. It gives the results of an experiment by Truscott on the Cornish frame, set forth in the manner suggested above, in which the concentrate collected on sections of the frame at right angles to the flow was separately collected and assayed.

The actual figures yield the formula :

$$y = \frac{x}{0.0056 + 1.2970x}$$

Extrapolating to $x = 1$, the apparent recovery where concentration has not even commenced is only 76.8%. The explanation of this anomaly is simple. The sample treated contained slime which passed in fluid suspension down the frame without undergoing any concentration at all. As far as any effect of the dressing process upon it was concerned, it might as well have been in solution. The loss in this way is quite a different thing from the ordinary loss of the tractable portion of the values during treat-

ment. Effectively, the sample only contained 76.8% of its real value in a form which was amenable to treatment. Multiplying the reciprocals of the enrichments as shown by assay by this factor, and re-calculating, the formula becomes :

$$y = \frac{x}{0.004 + 0.996x}$$

and it is found that at optimum concentration 93.8% of this tractable portion is recovered in a weight of 6.2%, whereas the recovery of the actual content given by assay is only 71.3%. The incipient production of a practically pure concentrate is also shown on this graph.

Similarly with ore 3(e), which probably contained some oxide copper not recoverable by the straight flotation process, a condition practically absent in 3(a).

It seems probable that with most commercial ores the excess over unity of the sum of the constants a and b is small, and that where only one single result of concentration is available for examination it is legitimate to assume that the region of maximum efficiency will be found at or just beyond the point where % concentration plus % recovery equals 100.

Where the constants are definitely known, the optimum value of x and of y can be obtained as follows:—

$$x = \frac{\sqrt{a - a}}{b} ; y = \frac{1 - \sqrt{a}}{b}$$

consequently the sum of recovery and concentration at maximum efficiency is $\frac{1 - a}{b}$

In the case of the Rouyn ores, these formulas give

	3(a) %	3(e) %
Optimum concentration	11.8	13.8
Optimum recovery	88.2	84.9
Maximum efficiency	76.4	71.1

The efficiencies calculated by these formulas are metallurgical efficiencies. Commercial efficiency is of course much more important. Dressing and transport costs, as well as smelter schedules must be known before the one can be converted into the other. Finally these resolve themselves into a single factor which "loads" the influence of the recovery of waste in the concentrate, as compared with its straight influence in metallurgical calculations. Those interested are referred to my paper on "The Application of Formulas in Ore Dressing" (*Trans. Cornish Institute of Engineers, 1920-1*).

TIN LODES IN NOVA SCOTIA

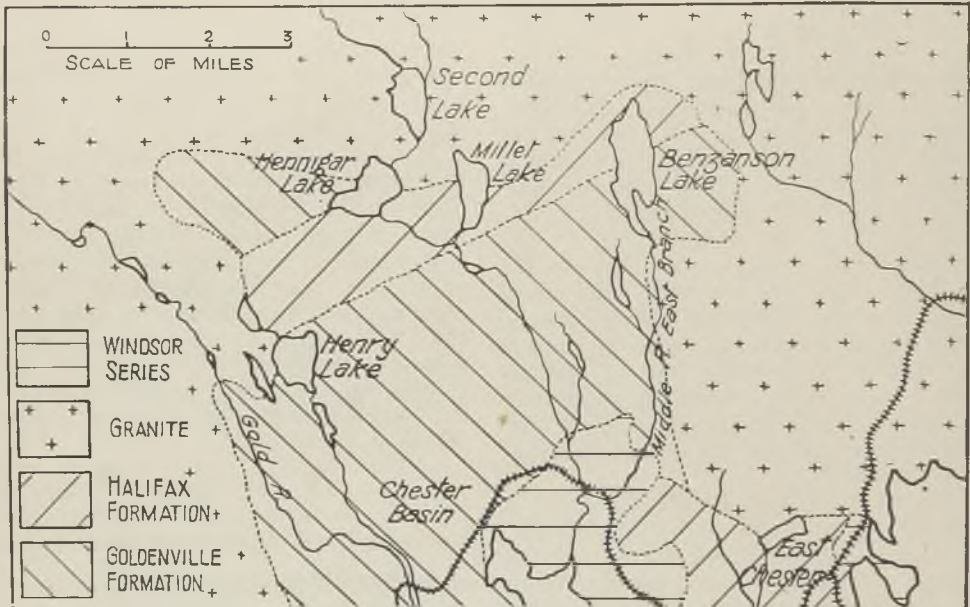
By E. H. DAVISON, B.Sc., F.G.S.

The author gives an account of the geology of the Gold River Area, Lunenburg County, Nova Scotia, where both tin and gold deposits are found.

INTRODUCTION.—The gold deposits of Nova Scotia are, of course, well known to mining engineers and geologists, but the occurrence of tin in these regions has seldom been mentioned. The author is therefore of opinion that a record of the occurrence based on a recent visit will be of interest. The Gold River rises in the high ground

The coast roads are good, but those running north and south across the peninsula are decidedly rough. The Canadian National Railway runs along the coast, giving access to several seaports.

GENERAL GEOLOGY.—The greater part of the area is granite country but round Chester Basin there is an area of sedimentary



GEOLOGICAL SKETCH-MAP OF THE GOLD RIVER AREA, LUNENBURG COUNTY, NOVA SCOTIA.

near New Ross Road and flows for 45 miles almost due south to Chester Basin some 50 miles south of Halifax. Its watershed is undulating country with numerous lakes and clothed with timber, the cleared farming land being a very small proportion of the whole area. The country is covered with glacial drift in the form of boulders thickly strewn over the surface which make the clearing of the land a painfully slow operation.

The climate is much milder than that of the interior of Canada. Summers are hot and the winters are similar to those of the north of England. Farming and lumbering are the chief occupations, the timber including hemlock, birch, spruce, pine, etc. A side line is the manufacture of barrels for packing the apple crop grown farther north.

rocks overlying the granite. These consist of the gold-bearing series which are of Cambrian or Precambrian age, and overlying beds of Lower Carboniferous age. The succession is as follows:—

Lower Carboniferous :

Windsor Series. Limestone, Sandstone, and Gypsum.

Devonian :

Muscovite Granite and Porphyries. Biotite Granite.

Cambrian or Precambrian (gold-bearing series) :

Halifax Formation. Slates.

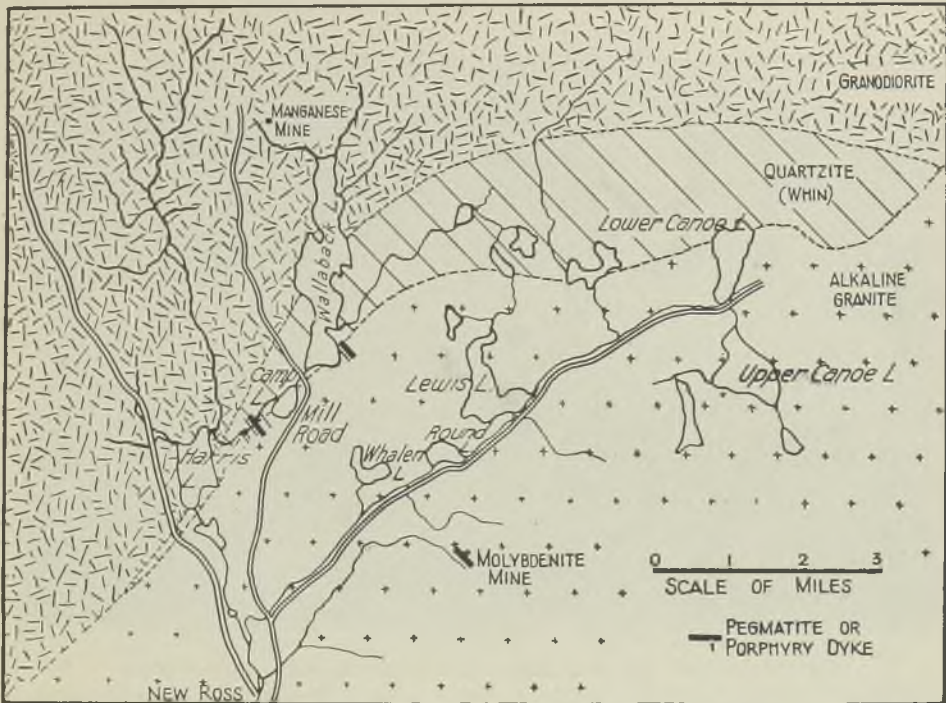
Goldenville Formation. Slate and quartzite (Whin).

The Windsor Series occupies a small area

to the south-east of Chester Basin and here a large number of sink-holes or swallet-holes are found, due to the solution of gypsum or limestone by percolating water. Beds of iron ore also occur.

To the north of Chester Basin an area about 5 miles square of the gold-bearing series occurs. This series consists of slates above with interbedded slates and quartzites

muscovite, and biotite with areas of pink-coloured granophyre, veins of greisen, pegmatite, and quartz, which carry a varied mineral association, including tourmaline, fluorite, gilbertite, topaz, cassiterite, molybdenite, mispickel, bornite, scheelite, and wolfram. The granite is also penetrated by dykes of quartz-felspar porphyry and the petrology and mineralogy of the



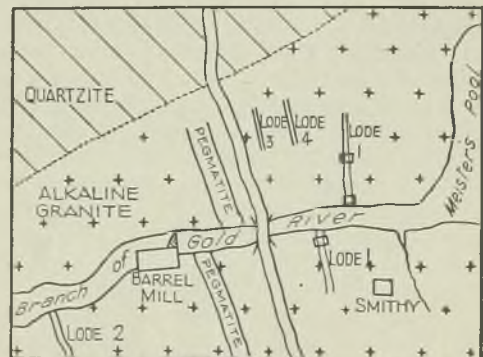
GEOLOGICAL SKETCH-MAP OF THE NEW ROSS TIN AREA, NOVA SCOTIA.

below, the slates often being pyritic while the quartzites are pyritic and gold-bearing. The whole series is folded into a series of anticlines and synclines the axes of the folds running somewhat north of east. The gold-bearing quartzite beds occur along the crests of the anticlines.

There is also a lenticular outcrop of the Goldenville formation extending from near New Ross to north-east of Wallaback Lake, which is locally called "whin," and this is intruded by narrow dykes of dolerite. This outcrop lies between the muscovite granite to the south-east and the biotite granite to the north-west.

THE GRANITES.—The greater part of the south-eastern area is built up of the muscovite granite, a muscovite-biotite granite of grey-colour composed of white orthoclase, quartz,

area is strongly reminiscent of the granite areas of Cornwall. This area will be fully dealt with in describing the tin deposits.



THE MILL ROAD TIN AREA, NOVA SCOTIA.

The north-western area is composed of the biotite granite, which is a grey granite composed of white felspar, quartz, and biotite. So far as my examination went it contained no greisen veins or tin-bearing veins, but at least one pegmatite dyke occurs which is a very coarsely crystallized rock composed of quartz, pink orthoclase, fluorite, and gilbertite mica, while molybdenite is reported to occur south-west of New Ross.

THE TIN DEPOSITS.—In the muscovite granite, near the lenticular outcrop of the Goldenville series from a point about one

content. The values of the lodes so far opened up vary from 12 lb. to 28 lb. of black tin per short ton. The area is at present being thoroughly prospected, both superficially and in depth.

THE GOLD DEPOSITS.—In this area the gold is found in the sedimentary rocks of the lower Gold River area. The sedimentaries consist of slates and quartzites, which are folded into anticlines and synclines with axes running almost east and west. The gold occurs in quartzite beds on the flanks and crests of the anticlines and also



TIN PROSPECTING PIT, MILL ROAD, NEAR CHESTER BASIN, NOVA SCOTIA.

mile south of Mill Road to a point on the eastern side of Lake Wallaback a number of tin-bearing bodies have been located. These bodies consist of veins of greisen with or without central quartz veins carrying cassiterite and other metallic minerals. A typical greisen vein is composed of quartz and white mica or gilbertite mica with grains of cassiterite, patches of mispickel, fluorite, and tourmaline, while bornite and wolfram also occur in small quantities. When there is a central quartz vein it contains cassiterite, mispickel, and pyrites, with tourmaline and occasionally topaz. The veins run approximately east and west, and are parallel to the porphyry dyke which occurs at Mill Road. The exposure at Wallaback Lake also shows a pegmatite vein which is coarsely crystallized and is composed of quartz, pink felspar, gilbertite mica, and tourmaline, with a small tin

in true fissure veins which cut the anticlinal axes and strike somewhat east of north. In the quartzite beds the gold is both free and also in pyrites and mispickel, which in some cases carry the bulk of the gold. In the fissure veins the sulphides are less conspicuous, most of the gold being free, while the values of the fissure lodes are usually higher than those of the quartzite beds. Samples taken from the fissure lodes have given assay values as high as 4 oz. per ton, while the quartzite beds vary from 8 to 30 dwt. per ton.

In the area to the east of the Gold River, and extending some three miles up from the mouth, there are a large number of derelict gold mines, their stoppage being due to the small size of the areas or units leased and also to inefficient mining methods. A large area is now in process of development and exploration.

THE MOLYBDENITE DEPOSIT.—On the Windsor Road, north-east of New Ross and to the south-west of New Ross, pegmatites occur which carry molybdenite. The author was only able to see the first of these, which was opened up during the war but never reached the producing stage.

The pegmatite is a coarsely crystallized rock composed of quartz, orthoclase, gilbertite mica, and tourmaline, with a considerable proportion of fluorite. The

felspar in a fine-grained felsitic groundmass. They strike almost east and west and show well-marked chilled margins against the granite walls.

BASIC IGNEOUS ROCKS.—Along the shores of Lake Wallaback the sedimentaries are cut by narrow dykes of dolerite which in the proximity of the granite have been altered to garnetiferous epidiorite, while in the Windsor Road area sills of amygdaloidal basalt occur.



TIN PROSPECTING SHAFT, WALLABACK LAKE, CHESTER BASIN, NOVA SCOTIA.

molybdenite occurs in large plates, and aggregates in the felspar and quartz, and also in the tourmaline. Other minerals which occur are bornite, and mispickel with topaz. I was informed that ore yielding 6% of MoS_2 had been produced when the mine was working and from the quantity of molybdenite on the waste heap this seems quite credible.

To the north of New Ross and to the south of the Windsor Road molybdenite mine pegmatites occur which might yield felspar of commercial value. They are normal pegmatites with gilbertite and muscovite mica. The felspar crystals are exceptionally large and could be concentrated by hand picking.

THE PORPHYRIES.—In the Mill Road area at least two dykes of porphyry cut the muscovite granite. They are quartz-felspar porphyries with phenocrysts of quartz and

NOVA SCOTIA AND CORNWALL.—The geology of the Mill Road area is very similar to that of West Cornwall, the Cornish granite being of the same type as the muscovite granite of Nova Scotia, while the porphyries, greisens, and pegmatites are also very like those of Cornwall.

Royal Society of Arts.—At the meeting of the Royal Society of Arts on January 22, at 8 p.m., Mr. Gilbert Stone will read a paper entitled "Some Observations on the Mining Laws of the British Empire." Sir Richard Redmayne will preside. At the meeting on January 29, at 8 p.m., Sir Thomas Holland will read a paper entitled "International Movement of Mineral Products during Peace and War." The Rt. Hon. Viscount Chelmsford will preside.

BOOK REVIEWS

Mining of Alluvial Deposits by Dredging and Hydraulicking. By W. E. THORNE and A. W. HOOKE. Cloth, large octavo, 171 pages, illustrated. Price 20s. London: Mining Publications.

An American engineer, engaged as contractor on Bolivian railways, always used to refer to Trautwine, Peele, and other books of reference as his "leather brains" and leather brains for alluvial mining have hitherto been conspicuous by their absence.

It is true that by reference to a multitude of pocket books and manufacturers' tables the necessary information or formulæ can be dug out, a long and tedious process often involving a series of chits to one's nearest neighbour, but now Messrs. Thorne and Hooke have gathered all the requisite formulæ, tables and information into one concise volume. The book deals with the mining of alluvial deposits by dredging and hydraulicking and we wish the authors had gone a step further and added a chapter on gravel pumping to make their work complete.

Part (1) deals comprehensively with:—Prospecting and valuation; Water supply and measurement, pipe lines, water races, flumes; Method of working; Sluice boxes and hydraulic elevating; Tailing disposal, and dams and reservoirs, with a few notes on power shovels and excavators. All the formulæ for the above are given, together with short explanations and examples of working. Sketches and diagrams greatly add to the value of this section.

Table (1), illustrating the authors' log-book for drill records, is new to the reviewers and they are afraid that the engineer in charge of four or five drills would find it an exceedingly difficult task to complete it. The simpler the log the better chance of obtaining correct returns.

The section on Dredging gives a good general idea of the various types and the uses to which these machines are put, and the authors quote from their experience in the Klondyke, Siberia, and other countries. It is, however, unfortunate that the examples given are somewhat out of date and particularly that their experience apparently did not extend to the Malay States, and that the only mention of the big dredging industry in that country is a short quotation from an article written on the subject in 1917.

From the point of view of the mining engineer it would, perhaps, have been better if some subjects had been treated in greater detail, such for instance as the paragraphs on Sampling tailings, Operating life of property, Size of dredges and power, with some modern examples.

The authors rightly set great store by experience; but, while the whole subject of Dredging is covered in a manner understandable to a layman, on some points the engineer would have welcomed a more comprehensive statement of the conclusions to which the authors' experience had led them.

On page 144 an amusing comparison is made between the amount of silt deposited in a river by a dredge and a farmer respectively, and a conclusion is reached with which it is doubtful if a Government Mines Department would agree.

One or two passages are not quite clear and the section would be improved by more tables and comparative figures of present day practice, but it is evident the authors have a practical knowledge of their subject.

There are some useful tables in the appendix, but in the note preceding the table for estimating the quality of tin ore by Sp. Gravity the authors state that the table is compiled "on the assumption that the impurity is iron." Iron is often used as a synonym for ilmenite, but such a loose expression should not be endorsed in a book of reference.

All engineers connected with the mining of alluvial deposits will welcome this latest and important addition to their literature.

H. W. LAWS.

W. R. RUMBOLD.

Gisements Pétrolifères de la Perse.

By C.-P. NICOLESCO. Folio, paper covers, 80 pages, illustrated. Price 50 francs. Paris: *La Revue Pétrolifère*.

La Revue Pétrolifère, that enterprising oil journal in Paris, conceived the idea that a contemporary technical account of the oil occurrences in Iraq should be given to its readers. In view of French interests in these developments in Iraq, this desire is understandable, but to carry it into effect is another matter altogether, as the author soon discovered. Although geological exploration in this territory has been in active progress during the last ten years or so, comparatively little information is

available to the public; having regard to the complicated circumstances, political and otherwise, surrounding operations there, some measure of secrecy is reasonable, but liable to be annoying to those in search of "copy." The way could to some extent be paved, however, by a full consideration of the published information on the Persian oilfields which, as is well known, present much geologically in common with those of the northern region. Accordingly the author set himself the task of compiling a very full account of the oil occurrences in Persia, in so far as material is available, preparatory to a consideration of those of Iraq, though he guardedly states that the study of Iraq, thus rendered more complete, can only be in proportion to actual knowledge of occurrences in that country, by which, presumably, he means "publishable knowledge." We doubt whether this latter will amount to much, and in any case inference from Persian conditions may not in itself prove more than a guide to anything save the broadest outlines of the subject.

In saying that this is the most comprehensive account of the oilfield geology of S.W. Persia, as far as published work counts, is not necessarily to admit that it is the best or that it contains much which has not seen the light of day, in one form or another, elsewhere. The author's acknowledgments embrace all the well-known papers, besides many comparatively unknown save to students of Persian geology. We find, among others, the contributions of Busk, Mayo, R. K. Richardson, Pilgrim, and Tipper frequently quoted; equally the work of Lees, de Böckh, Lister James and other members of the Anglo-Persian Oil Company's geological staff are specially mentioned. Had the author been able to avail himself of the British Association (1928) paper by de Böckh, Lees, and F. D. S. Richardson, his tectonic section would have been considerably modified and incidentally strengthened.

Although mainly geological in treatment, the subject is interpreted widely by the author who, after a general introduction, starts off with an account of the political history of the industry in Persia, giving some description of the original D'Arcy concessions and the way in which these gradually developed into the oilfields now operated by the Anglo-Persian Oil Company. He then discourses on the indications

of oil found not only in Persia, but in Iraq, Afghanistan, Baluchistan, extending into N.W. India, and gives a useful map locating those places actually concerned. There follow some paragraphs on the geomorphology of Persia, illustrated by an orographical map after Stahl.

The section on geology opens with an interesting summary of the work of pioneer geologists and briefly traces the evolution of theories from 1910 onwards; it includes a diagrammatic geological map of the country together with a tabular scheme of the rocks associated with the principal oil occurrences, in which essential lithology, palæontological evidence, nature of the deposits (origin), thicknesses, etc., are shown.

The section on stratigraphy is founded largely on the published work of Busk, Mayo, R. K. Richardson, and Pilgrim and is quite general in treatment. The author here makes a rather interesting comparison between the several theories put forward as to the age of the oil-bearing rock, the Asmari Limestone, from which it is seen that this formation has during the course of time shifted its position in the stratigraphical record from Cretaceous to Miocene; it would now appear to have gained stability as a Middle Oligocene—Lower Miocene member of the sequence. The petrography and palæontology of the principal rocks are also mentioned, illustrations being taken from R. K. Richardson's paper. The section on tectonics is weak, largely because it is based on older hypotheses, though we find that the author gives his own interpretation of R. K. Richardson's sections across the centre of what he often calls the "*Maidan-i-Naphturn*" oilfield, a name now discarded in favour of the more historical, certainly more æsthetic title "*Masjid-i-Sulaiman*."

There is a short section on palæogeography and then comes a lengthy dissertation on the origin of oil, reservoir rocks, gypsum and salt deposits and their relationship to the normal sediments and to petroleum. The remaining sections include data on analogies between Persian oil and that of other fields in the world, on production, transport, refining, consumption, export, and import. A bibliography of 107 references concludes the essay.

In short, this paper may be commended to those who wish to gain a general knowledge of the oil industry in Persia, more especially from the geological side, and who

have not time to look out the various original papers from which the author gets much of his information. Those whose experience entitles them to claim a more intimate knowledge of this interesting region will not find anything in it which they do not already know, or which is not easily accessible to them from other sources.

H. B. MILNER.

The Principles and Practice of Lubrication. By A. W. NASH and A. R. BOWEN. Cloth, octavo, 315 pages, illustrated. Price 15s. London: Chapman and Hall.

The authors of this book provoke comment in their first sentence. They say: "Lubrication is no longer an art." They then proceed to display the accumulated knowledge of the subject, from which it is seen that the fundamental principles, the physical chemistry of lubrication, are only just emerging from the realms of mystery. In this country, the works of Sir William Hardy and Sir Thomas Stanton, to mention the more prominent of recent researchers, are directed to the conversion of hypotheses to theories of lubrication, from which formulated knowledge a science of lubrication is gradually developing. Meanwhile, the subject possesses a considerable technology and Professor Nash and Dr. Bowen have presented their facts and opinions in a concise and attractive form.

Within the circumscribed area of ascertained truths they will meet few antagonists, but in the field of practice, where it is often so difficult to translate experience into written advice, there will be found those who, while agreeing with or disregarding unconsciously the verity of the main theses, will quarrel with the authors in regard to their minutiae. That this may be is further evidence, were it needed, that lubrication, dependent so largely for its success on the personal skill of the engineers who practise it, is still an industrial art. "The Principles and Practice of Lubrication" will it is hoped, attract the attention and enliven the active interest of those engineers who are engaged in the design, construction, and maintenance of plant and machinery, the correct lubrication of which has been considered as an afterthought.

The authors emphasize the importance that lies in the correct application of lubricating oils and greases and their

arguments endorse the view that without full recognition of that technique the best products may give indifferent results or, to say the least, are wastefully employed. Thus is the lubrication engineer introduced in order to practise his "art of lubrication".

It might be assumed from the amount of research devoted to lubricants and from the number and comparative ease in application of the usual oil tests that the preparation of a selective specification is a simple matter. This assumption is dismissed summarily and judiciously, and its dismissal is due not to artlessness but to the lack of scientific knowledge adequate to the task. In dealing with the real value of such tests the reader should be referred to "The Significance of Tests of Petroleum Products" published by the American Society for Testing Materials.

Touching the subject of references it is to be trusted that, in the future editions the book deserves, the bibliography will be lengthened to include particularly the works of Mr. R. O. Boswall and Mr. W. S. Osborne and specifically those of Sir William Hardy.

That the writers are in harmony with the ideas of rationalization is evident from their desire to encourage in oil salesmanship the spirit of service—"of selling, not oil, but lubrication." This calls for an ever-growing appreciation of the commercial value of technical knowledge and experience in order to keep in step with the progress that is being made in engineering and other industries in which lubricants are staple commodities.

A chapter is devoted to "Mechanical Friction Testing Machines" and these, in the hands of a "skilled scientific investigator" may give interesting if not valuable results so far as their natural limitations allow, but the authors remark wisely that "the real evaluation of an oil is a prolonged and unbiassed test under the actual working conditions." It is incumbent upon the conscientious supplier of lubricants to base his recommendations on these sound premises and to discard the necromancy associated with colour, flash-point and "viscosity."

The moral of the book, applicable alike to manufacturer, distributor and user, is "know thy business" and to maintain this counsel to its logical conclusion the final chapter deals with the care of lubricants, an economic aspect which is fraught with mechanical as well as monetary advantage.

Written for petroleum technologists students, engineers, and oil salesmen, "The Principles and Practice of Lubrication" is a welcome contribution to its subject.

WILFRED E. GOODAY.

Geologie von Perú. By G. STEINMANN; with contributions on Useful Minerals by R. Stappenbeck; on Earthquakes by F. Sieberg; and a Geological Map by C. Lisson. Paper backs, octavo, 448 pages, illustrated. Price 28 marks. Heidelberg: Carl Winter's Universitätsbuchhandlung.

Beginning with an outline of the situation and topography of Peru, this book quickly gets into what constitutes its greater part, namely, the representation in Peru of the stratigraphical systems making the earth's geological record. This description begins, as is customary, with the Pre-Cambrian fundamental gneisses and continues through to the Quaternary; representative fossils are illustrated; and occasional cross-country profiles are given. The volcanic and intrusive rocks which characterize the Tertiary system in the country receive special mention.

Following these details the broad lines of Peru's geological history are described, this description concluding with mention of the uplift of the Cordilleras, the sinking of the Pacific belt, the presence of volcanoes towards the south, and the evidences of Quaternary glaciation at high levels. Then comes an outline of the present tectonics of the Cordilleras, their alignments, their folds, and their eruptive rocks.

About 75 pages are then devoted to an enumeration of metalliferous and non-metalliferous deposits of economic importance or interest, divided under particular metals and minerals. Among the many occurrences mentioned are the Cerro de Pasco copper deposit, the Lobitos oil field, and the Huancavelica quicksilver deposit,—these deposits being of special interest.

A short account of Peru's earthquakes brings out the interesting point that they have been due to earth dislocations rather than to volcanic activity, the present volcanoes of Peru being relatively few and quiescent.

In the preface the author explains that in spite of its comprehensive title the book describes only the most salient geological features of Peru. Much of the country,

and especially the wooded eastern slopes which reach down to the Amazon headwaters, is not only an unknown country geologically but also to a large extent one unknown geographically. The book nevertheless is one which will be welcomed not only by geologists generally, but also by mining engineers who have interest in this part of the world.

S. J. TRUSCOTT.

Surveying as Practised by Civil Engineers and Surveyors. By JOHN WHITELAW. Eighth edition, thoroughly revised and enlarged by Colonel Sir GORDON RISLEY HEARN. Cloth, octavo, 590 pages, illustrated. Price 16s. London: Crosby Lockwood and Son.

Revised and enlarged by one so competent, the eighth edition of this standard work, consisting of 12 chapters and a liberal appendix and including 297 well executed figures, covers a vast amount of ground under modest headings: surveying with the chain only; surveying with the aid of angular instruments; levelling; adjustment of instruments; rail and road surveys and setting out; tacheometry; tunnel alignment and setting out; surveys for water supply works; hydrographical or marine surveying; astronomical observations used in surveying; surveys abroad in jungle, dense forest and unmapped open country; trigonometrical or geodetic surveys.

The aim of the book, as indicated in the preface to the first edition, is to give to the student of engineering sufficiently full details of the work which he may be called upon to carry out in actual practice: an aim comprehensive and tolerably ambitious, yet perfectly reasonable. The fact that the book has run through seven editions is ample proof that by satisfying a demand it has served its purpose.

The reviser has considerably increased the value of the work by making good some former outstanding omissions and by pointing out or describing some of the improvements effected within the last few years in respect of instruments and practice; so that included now, among other subjects, are photogrammetry, aerial surveying, the micrometer theodolite, the Bosshardt tacheometer, and the self-adjusting level.

It is to be regretted, however, that the reviser has been prevented, apparently by lack of space in so packed a volume, from

dealing more fully with matters such as plane-tabling, triangulation adjustments and the exact tabulation of results in field and office. Plane-tabling, the first of these, is disposed of in sections covering only about 9 pages; triangulation adjustments occupy about 4 pages; and tabulation of numerical results appears to be represented by 15 examples, of which 5 concern traversing, 8 levelling, 1 tacheometry and 1 sounding. Treatment of this nature, rectifiable in the future though it be, must be regarded as not quite compatible with the sub-title and the statement that the original work has been thoroughly revised and enlarged.

Nevertheless, the revised work, because of its general freedom from errors, its scope so broad and liberal and its considerable attractiveness, is a book to be strongly recommended to those for whom it was intended.

F. W. ARMSTRONG.

Coal Measure Plants. By Dr. R. CROOKALL. Cloth, octavo, 80 pages, illustrated by 39 plates. Price 12s. 6d. London: Edward Arnold and Co.

In this book Dr. Crookall, of the Geological Survey of Great Britain, has given us a most useful addition to our text-books on the fossil plants of the Coal Measures. The work will doubtless be of great value not only to geologists, but also to mining engineers. The author gives the diagnostic characters of 240 of the common and characteristic plants, with 39 excellent plates on which they are all figured. Dr. Crookall states that the main object of the work is to assist in the identification of the species with a view to their practical use in geology and mining. It is certain that geologists, museum curators, mining engineers and others living on or near our coalfields, will greatly appreciate the value of this book in reducing the amount of labour required in the identification of species. The reviewer has himself tested its value in naming coal-measure plants in his own collection.

Several excellent books are available dealing with fossil plants, including the familiar coal-measure forms, from the structural and evolutionary points of view, and appealing mainly to those who have had a botanical training, but hitherto no book of moderate size has appeared dealing with the external morphology only and with special reference to British plants.

The author has had the great advantage of working on the unique collection made by the late Dr. R. Kidston, now preserved at the Museum of Practical Geology. Unfortunately, Dr. Kidston's comprehensive memoir on "Fossil Plants of the Carboniferous Rocks of Great Britain" (*Mem. Geol. Surv.*, 1923-5) was left unfinished on the death of the author, but we are promised its completion at an early date.

Thanks mainly to the labours of Dr. Kidston, the use of assemblages of fossil plants in subdividing the British Coal Measures, and for the correlation of one coalfield with another, has now received general recognition. In the present work Dr. Crookall gives full lists of the characteristic plants in the Radstockian, Staffordian, Yorkian, and Lanarkian floras, with notes and diagrams showing the relative frequency with which the various groups of plants occur in the several divisions, and with the aid of his descriptions, drawings and photographs, identification of the genera and species should not be difficult.

A. J. MASLEN.

Elements of Mineralogy. By FRANK RUTLEY. Revised by H. H. READ. 22nd edition. Cloth, octavo, 394 pages, illustrated. Price 6s. London: Thomas Murby and Co.

"Rutley's Mineralogy" has long been a favourite with mining men, and as an elementary college text-book it has won for itself an unrivalled place. In Rutley's time this deservedly popular little book ran through eighteen editions. Since the thorough revision by Dr. Read in 1916 three more have been exhausted, and now the twenty-second has been reached. The chief alterations made in this new edition concern the data and statistics relative to minerals of economic importance. The changed circumstances of the many countries affected by the War are beginning to lead to a new stability in industry, and the time is therefore opportune for a revision of the information dealing with mineral production. "Rutley" is so well known and appreciated that further words of commendation are no longer called for. We welcome its ever fresh appearance; remind our younger readers of its merits; and wish it many happy returns.

Copies of the books, etc., mentioned under the heading "Book Reviews" can be obtained through the Technical Bookshop of *The Mining Magazine*, 724, Salisbury House, London, E.C. 2.

NEWS LETTERS

JOHANNESBURG

December 5.

A NATIONAL INDUSTRY.—Dr. Hans Pirow, the Government Mining Engineer, in the course of an admirable address to the members of the Union Parliament during their recent visit to the Witwatersrand, emphasized the national character of the gold-mining industry. Sixty-two per cent of the white employees are South African born, and South Africans occupy some of the foremost official positions. Even among the shareholders South Africans are increasing in number and importance, although we are still dependent on overseas support for the capital to open up new mining ventures. Under the mining leases system, the State is acquiring an ever-growing portion of the profits derived from the mines. "In every way, therefore," Dr. Pirow remarked, "the gold-mining industry is becoming more and more a purely South African industry, with the result that the problems of low-grade ore, of native labour and of maintaining avenues for employment on the mines are coming to be regarded as national problems, and not as problems affecting only the industry and its shareholders."

A NEW COPPER BELT.—It is reported that a new copper belt has been discovered in the Selati district, Northern Transvaal, and that the main lode, a large and high-grade ore-body, was struck by a prospector named William Valentine while following up indications offered by the numerous ancient workings there. Valentine says the belt is at least three miles long and runs into the Kruger National Park. He has pegged 700 claims along the belt, also a prospecting area 4,500 yd. long and 1,800 yd. wide. Twenty-two prospecting shafts have been sunk to prove the property, generally to a depth of 30 ft., and in every instance a copper-bearing ore-body was encountered. Samples of the ore in the first three shafts gave the following excellent assay values: No. 1 sample, depth 30 ft., large ore-body, 5.8% copper; No. 2 sample, depth 20 ft., all ore, 4.2% copper; No. 3 sample, all ore in shaft, 7.6% copper. In one part of the claims the ore-body is exposed and is said to be over 60 ft. wide. The working conditions are said to be very favourable. Motor roads connect the property with the South African Railways' Mica Siding (22 miles)

and Gravelotte Siding (50 miles). The nearest seaport is Lourenço Marques, about 180 miles distant. There should be no difficulty about labour, as there are three native locations within five miles of the workings. The Selati River runs through the southern portion of the property, and the thickly wooded forest on the claims will provide fuel and hard mining timber. Valentine estimates that a 2% copper extraction will cover all expenses.

STATE DIAMONDS.—South African diamond cutters, who buy rough stones from the Government, allege that the Namaqualand State diggings are now producing fewer high-quality gems, and there are now very few parcels that are worth from £10 to £12 per carat. The cutters complain that too many low-quality yellow stones are coming to them and that the prices charged by the Government are excessive. They have decided to make representations to the recently appointed Diamond Control Board on the subject. The diggers on the alluvial fields are feeling the effects of the share slump in Wall Street. Buyers for overseas firms have ceased operations until the diamond market recovers, and very little business is being done by the local buyers. Prices for common goods have fallen about 50%, but top prices are still being paid for high quality stones. The diggers are asking the Government to finance them over the depression.

A PROMISING PLATINUM PRODUCER.—With an extraction of only 50% the Waterval (Rustenburg) Platinum Mining Co.'s profits for the three months since the reduction plant was started have averaged £5,000 per month. The company is treating oxidized norite ore and enjoys the distinction of being the first mining concern to reach the producing stage in the Transvaal's richest platinum field. It is officially stated that the recovery might have been higher but for the fact that a good proportion of the metallics is found to be in too fine a state of division for much improvement in recovery with the present plant. Experiments are now proceeding with a view to improving the position and encouraging results have been obtained. With better extraction it can reasonably be expected that there will be marked improvements in profits. An advance in that direction of only 10% would mean a very material improvement in the monthly profits. The development drives in the mine have con-

tinued to show not only exceptionally consistent values, but the values are being well maintained at 7.6 dwt. over a stoping width of 18 in., which is approximately the stoping width the mine is being worked on to-day. At present the company is treating oxidized ore only, of which, it is estimated, there are 425,000 tons on the property. On a 10,000 ton per month basis this will give three and a half years' life, while if the sulphide zone is taken as well, the total ore contents of the property can be estimated at 7,855,000 tons. The lowest exposure of values is in boreholes sunk to a depth of 170 ft., where values were indicated as good as, if not better than, current development shows. There are good reasons for anticipating that later on there will be every justification to increase the scale of operations with a consequent increase in the output and profits.

TRANSVAAL EMERALDS.—One of the latest visitors to the Transvaal emerald fields is Mr. Fritz Klein, a precious stones expert, who says he saw a number of occurrences there which promise to turn out good commercial propositions. Mr. Klein is a member of the firm of Pittar, Levenson, and Co., London, the largest emerald-dealers in the world, and he has a very extensive experience of the world's emerald producing fields and of the Continental and American markets for both rough and cut stones. He has also for years been actively engaged in the actual mining and production of emeralds, more especially in Colombia, where the finest gems have so far been obtained. Mr. Klein believes that the Transvaal will become an important producer of emeralds, and he hopes that as a result of his visit his firm will be able to buy the greater portion of our production.

DRY MINING INVESTIGATIONS.—A sub-committee of the Miners' Phthisis Prevention Committee is engaged in considering the suggestions for dry mining on the Witwatersrand which were put forward by Dr. J. S. Haldane when he visited Johannesburg with the British Association. Dr. Haldane outlined a theory that phthisis might be prevented by mixing other dust with the quartz dust in the mines. In this way, also, he pointed out, the difficulties of wet mining might be overcome. No experiments have yet been carried out on the lines suggested, but the sub-committee is carrying out careful investigations, and will present its report within a short time. The old

Miners' Phthisis Prevention Committee reported in 1916 very definitely in favour of the lavish use of water, and the mines cannot go back on that report without thoroughly considering the problem. It is understood that the sub-committee is at present confining its investigations to the limits which should be imposed on the use of water and the question of using less.

Some idea of the burden imposed on the gold mines by the Miners' Phthisis Compensation Act may be gathered from the following facts and figures: The total amount that has been paid out in miners' phthisis compensation to miners and dependents was, up to September 30, £11,208,015. In the first year the amount paid out was £50,601. It rose in the following year to £355,644, and increased almost annually thereafter, reaching a maximum of £951,152 in 1926. In the last five years the average amount paid in benefits was about £72,000. The Miners' Phthisis Board obtains its funds from the various mining companies in quarterly levies. If all the mines were to close down immediately the Board would need £8,000,000 to invest at 4½% to enable it to make all payments and provide for all future commitments in respect of miners' phthisis and tuberculosis. To meet this enormous liability the Board has arranged with the mines that are making profits to set aside annually sums based on the productive lives of the mines. Apart from the annual contributions, the mines have accordingly, in the last three years, set aside £1,294,633. The average annual amount set aside is £431,544.

DEATH OF DR. P. A. WAGNER.—The death occurred in Johannesburg on November 11 of Percy A. Wagner, D.Sc., D. Eng., F.G.S., the brilliant South African geologist. Dr. Wagner's research was known throughout the world, and his knowledge of South African geology was profound. He had an intimate knowledge of the country, and was rightly recognized as the leading authority on the mineral deposits of the sub-continent. His work for the Government up to February, 1927, resulted in many valuable contributions to geology.

Dr. Wagner was born at Richmond, Cape Province, in October, 1885, and was the son of the late John M. Wagner. He was educated at the South African College, Capetown, the South African School of Mines and Technology, Johannesburg, and

at the Freiberg School of Mines and Heidelberg University in Germany. Wagner, as a young man, went to Freiberg to study under Professor R. Beck with the intention of taking his Doctor's Degree in Geology, choosing as his thesis "The Origin of Diamonds in Kimberlite Pipes." It has been said that Professor Beck had been studying this subject ever since his visit to South Africa with the British Association in 1905, and that after Wagner had been only a few months at Freiburg, Professor Beck acknowledged his pupil's competence to handle the subject and passed on the whole of his own material. Later Wagner went for a period to Heidelberg to study under Rosenbusch. The year after Wagner had left Freiburg, Beck, when lecturing on diamonds-deposits, said that undoubtedly the finest work on the origin of diamonds was Wagner's Thesis.

BRISBANE

November 18.

THE NEW MOUNT MORGAN.—Mr. A. A. Boyd, who was for many years general manager of the old Mount Morgan Company, and is now a director and technical adviser for the new owners of the mine (Mount Morgan, Ltd.), lately returned from a visit to the United States and Canada, where he studied the latest mining methods practised in those countries. He has since been to Mount Morgan, and as a result the work being carried on there by the new company has been expedited. For some time before the old company went into liquidation and continuously since, work has been carried out in the recovery of copper by precipitation from the mine water. With the object of dealing with this water more effectively and expeditiously than hitherto, pumps of special design have been ordered from England. In the meanwhile, the opening up of the Linda level, at a depth of 450 ft., is being pushed on, and it is also intended to proceed at once with trials of a new leaching process for ore treatment. If these prove to be successful, as they promise to do, the ore lying above the Linda level will be the first to be treated by the process and the results will be a guide in the treatment of the great bulk of ore below that level.

The liquidators of the Mount Morgan Gold Mining Company, Ltd., will in January make a further distribution among holders of the company's stock of 3s. a share on the

1,000,000 £1 shares which formed its capital. There has already been distributed in the process of winding-up a sum totalling £1,000,000. Shareholders thus get back more than the nominal value of their shares, but it has to be remembered that for several years before liquidation no dividend was paid by the company. In August 1927, when liquidation proceedings began, the market value of the shares was about 12s.

FOREIGN CAPITAL FOR OIL PROSPECTING.—A bill to amend the Petroleum Act which regulates oil prospecting in Queensland has been introduced by the Government in the State Legislature, and is certain to be passed. Previously the law confined the holding of prospecting permits or leases to natural-born British subjects, but the new measure removes such restriction. It provides for the acquisition of permits and leases by foreign companies registered under the company laws of the State. Against this provision there has been a strong outcry, mostly by those financially interested in existing prospecting enterprises, who claim that there would be great danger to the industry and to the State in allowing foreign capital to come in, as it would probably obtain control. On the other hand, it is considered that the prospecting ventures already in hand have reached a stage when much more capital is needed, and that such capital is not available locally, and also that the Government has sufficient power under the old Act to avert any danger that might threaten under the proposed legislation. The new measure contains several other provisions intended to encourage and help oil prospecting. Among these is one increasing the number of permits or leases which may be held by one person or company from two to four, but which stipulates that not more than two shall be within 200 miles of the first two granted. There are quite a number of permits still in existence, and have been held for nearly two years, on which nothing has been done, and the present Minister for Mines is determined that these will be cancelled unless the holders comply with the conditions under which they were granted.

MOUNT ISA PROGRESS.—The number of men working at Mount Isa had increased by the beginning of October to about 1,400. Of these, 770 were employed by the contractors who are erecting the milling plant on the north-west side of Mill Hill, as well as the power house and smelters on the

eastern side of the hill. In accordance with the plan laid down for future working, operations are being conducted at Davidson's shaft from three different points. The ventilating drive that is to connect No. 46 with No. 36 shaft had last month reached about half the required distance, and is probably finished by this date. The main supply shaft, in which water is making at the rate of about 5,000 gallons hourly, is down nearly 300 ft., and the main haulage shaft over 300 ft., where a considerable quantity of water has also been making. The Doherty shaft, on the Black Star lode, has been deepened to 356 ft., but here a stoppage in the sinking was caused because the influx of water proved too much for the power available. A similar trouble prevented, for a time, the resumption of work in the Lawlor shaft, but in both cases the difficulty was only temporary.

In connection with the diamond drilling campaign 738 ft. of boring was completed in four weeks at three holes on the Black Star lode. From one of these (5B) the core from 1,116 ft. to 1,120 ft. showed 12.5% of lead and 10.2% of zinc, with 13.5 oz. of silver to the ton. Good progress has been made with the laying of the pipe line between the Rifle Creek dam and Mount Isa. The reservoir was in October last emptied of the small quantity of water in it, and the scour valves were cleared of obstruction. A thunderstorm a few days ago put 15 ft. of water in the dam, which is 50 ft. high, and there then seemed a probability of more rain. The company, however, seems to be obtaining from other sources sufficient water to meet present requirements. A farcical incident at the mines is a "beer strike," which has been persisted in for a couple of weeks or more. Although naturally very thirsty at this time of the year, the workmen are obstinately refusing to pay the hotel keepers what are considered the exorbitant charges made for liquor.

ANOTHER MINING TRUST VENTURE.—An agreement has been made by the Queensland Government, and ratified by Parliament, giving to Mining Trust, Ltd., under stipulated conditions, certain mineral leasehold concessions at Lawn Hills, in the Burketown silver-lead field, North Queensland. This belt has been known for some forty years, but is so remotely situated that several attempts to exploit it on anything like a comprehensive scale have

failed. The nearest port to the Lawn Hills field is Burketown, on the Albert River, about 30 miles from where it flows into the Gulf of Carpentaria, and some 55 miles north-east of the mines. About twenty years ago a Government geologist reported that the future of the field depended on the low-grade deposits, which had then, and are still, to be prospected and opened up, but which could be profitably exploited with modern installations and railway communication. In the agreement mentioned, which was made by the Government with Mr. Leslie Urquhart, the Mining Trust, Ltd., is given the right to prospect for five years 100,000 acres on this field. Under this agreement the Trust, on its part, has to spend in the first year on geological examination alone the sum of £10,000, and to incur a further outlay of £90,000 within the five-year term of the lease.

THE COAL TROUBLE.—A compulsory conference, called together under the arbitration laws to deal with the coal stoppage in the principal coal mines at Newcastle and Maitland, New South Wales, has failed to effect any settlement. The chairman of the Coal Tribunal (Mr. C. Hibble), who was also chairman of the conference, told the latter body that the cost of production in the industry must be reduced by at least 4s. a ton, and that the only way in which this reduction could be made was by the miners agreeing to share in the reduction to the extent of 1s. a ton. After this pronouncement, the president of the combined mining unions' committee issued a statement, in which he said the Federal Labour Government "must redeem its pre-election promise to re-open the mines on a basis of no wage reduction." On the same day it was announced that the New South Wales Cabinet would endorse contracts already prepared to enable the State Government to bring about the immediate re-opening of three highly productive mines—Pelton, Rothbury, and Cessnock; also that employment in these mines would be offered to members of the Miners' Federation on the 1s. a ton wage cut plan devised by the Bavin Ministry. Representatives of the unions threaten that if this is done, the mines named will be declared "black," which means that unionists will be ordered not to work in them or handle the coal therefrom if any is mined. It is understood that at the compulsory conference the miners' representatives insisted that there should be no wage

reduction, and that the owners were equally firm in their determination not to open the mines without such a reduction. The latest development is that the N.S.W. Government has called for volunteer labour at once for the Rothbury mine, and one result is that there are threats from the unionists of a general strike, although much doubt prevails that such a drastic step will be taken.

NORTH BROKEN HILL.—In the year ended June 30 the income from mining of North Broken Hill, Ltd., was £1,407,554, compared with £1,229,804 in the preceding year. As the expenditure at the mine decreased from £896,157 to £875,413, the gross profit improved by £333,657, to £532,141. Dividends aggregating £332,500 were declared. Of 422 tons of crude ore treated, nearly 64% gave an average return of of 15% of lead, 12·1% of zinc, and 8·6 oz. of silver to the ton.

ELECTROLYTIC ZINC COMPANY.—At the annual meeting of the Electrolytic Zinc Company of Australasia, held in Melbourne on October 31, it transpired that the net profit for the year ended June 30 was £367,918, which is well up to the average, and that the reserves are £1,500,000, indicating a sound internal position. The reserves are being used in the business as working capital for the whole undertaking, in the expansion of activities on the West Coast of Tasmania, in plant extension at the main works at Risdon in that State, and for investments in companies carrying on allied industries.

VANCOUVER

December 10.

INSTITUTE MEETING.—The local branch of the Canadian I.M.M. held a well-attended and most successful meeting here on November 27, 28, and 29, when a large number of papers on a wide range of subjects were read and discussed by some of the most prominent local engineers. The chairman for the year, Mr. J. D. Galloway, Provincial Mineralogist, opened the meeting with a review of mining in the Province during the past year. He predicted that the value of the mineral output for the year would exceed \$70,000,000 and thereby make a new high record, the previously greatest value having been \$67,188,842 in 1926. Returns that have been received by the Department of Mines to date indicate that in round figures the output will be made up of 180,000 oz.

of gold, 10,000,000 oz. of silver, 105,000,000 lb. of copper, 300,000,000 lb. of lead, 174,000,000 lb. of zinc, 2,375,000 long tons of coal and structural materials, and miscellaneous minerals and metals to the value of \$5,300,000. The amount of ore treated is estimated at 6,500,000 tons; all the large producers having mined a larger tonnage of ore than in 1928, though the grade has been slightly lower. The disbursement of dividends is placed at \$12,500,000, or about one million dollars more than last year. This increase has been made chiefly by the two large copper producers, Granby Consolidated Mining, Smelting and Power Company and Britannia Mining and Smelting Company. Mr. Galloway considers the most promising new developments of the year to be along the Tulsequah River, in the Atlin division, where immense bodies of ore carrying zinc, lead, copper, silver, and gold are being opened. The chief value is in zinc, which considering the unsatisfactory condition of the zinc market, is their weakest feature. The Kinman property, now being developed by Consolidated, is a promising copper deposit. The Ferguson mine, along the Ingenika River, and the Emerald group, in the Sibola district, continue to develop well, but both are situated in inaccessible districts.

Mr. Dale L. Pitt, general manager for Premier Gold Mining Company, gave an exceedingly interesting account of some of the difficulties that had to be met and overcome in the construction of the 5½ miles of aerial tramway from the Prosperity and Porter-Idaho mines to the mouth of the Marmot River. The upper end of the line is in exceedingly rugged country. The chief difficulty was the hauling of the cable across the Marmot Glacier, a stretch of nearly 4,000 ft. To do this the cable was made up into 35 coils of about 100 ft. each and each coil carried on a separate horse, the remainder was held between the animals and kept the pack train together.

Probably the most lively discussion was produced by Mr. W. N. Kelly's paper on "Pulverized Coal with Special Reference to its Application for Industrial and Domestic Purposes." Mr. James Dickson, Chief Inspector of Mines for British Columbia, made the interesting contribution to the discussion that coal obtained from the Crow's Nest Pass mines was used in Regina to fuel boilers for a steam-electric plant and that the resulting electricity is being sold as

cheaply as $1\frac{1}{4}$ cents per kilowatt-hour. The statement was substantiated by the sales agent for the Crow's Nest Pass Coal Company.

THE KOOTENAYS.—The International Joint Commission has given the West Kootenay Power and Light Company permission to proceed with the excavation for the dam at Granite, where Kootenay Lake emerges into the lower Kootenay River, which is tantamount to permission to proceed with the dam, and the company is erecting camps and taking power and compressor plants to the site. It expects to start on the excavation by December 15 and to keep 100 men employed steadily during the winter. The dam will raise the low-water level of Kootenay Lake six ft., which will regulate the flow of water to the company's three hydro-electric stations on the Kootenay River, and materially increase their average, though not their maximum, capacity. The combined rated capacity of the three stations is 154,000 h.p. The estimated cost of the dam is \$1,250,000. The driest summer in southern British Columbia since meteorological records have been kept has created an acute water shortage, but so far has not curtailed the Consolidated Mining and Smelting Company's production. For productive purposes the company is using as much current as it ever has done, but to conserve current it has shut off all heaters, electrically heated boilers, and all but essential lighting. The Sullivan mine is independent of hydro-electric energy, as besides the hydro-electric stations on the Elk and Bull Rivers, the East Kootenay Power Company, which supplies power to the mine, has a steam-electric plant of 10,000 kilowatt capacity at Crow's Nest Lake, and Consolidated has an auxiliary steam-electric plant of 4,500 kilowatt capacity at the mine. The latter, with the company's share of power from the former, can maintain the Sullivan at capacity. On the other hand, Cork-Province mines has had to close its mill, having sufficient power only to run the compressor. Ruth-Hope has curtailed production, and several other concerns will have to follow suit or maintain it at the cost of development.

Whitewater mines has called a special general meeting for December 20 to consider increasing its capital to 2,000,000 shares by the creation of 800,000 new shares. These are to be offered to existing shareholders at 30 cents, shareholders to be entitled to buy one share of the new issue for each share

held of the old. Preferred shareholders are to be allowed to exchange each share for three of the new issue. There are 65,000 preferred shares outstanding. If the resolution is approved, the new capital will be used to develop the property well ahead of production and in the mean time the mill will be closed. Owing to lack of capital the mine has been worked on a hand-to-mouth policy and, at present metal prices, without profit to its owners. Base Metals Mining Corporation put its new mill into operation on November 15 and expects to have it running at capacity, 300 tons, by December 15. Reno Gold Mines produced its first two bricks of bullion, valued at between \$15,000 and \$16,000, in November. The company reports the average grade of ore treated is \$41.25 in gold and \$1.25 in silver per ton, and the recovery is 95%. The mill is a continuous-decantation cyanide plant. Most of the stock of the company is held in England.

PORTLAND CANAL.—The Premier Gold Mining Company has declared the customary dividend of 6%, amounting to \$300,000, covering the last quarter of this year. It has put the tramway from its Prosperity and Porter-Idaho properties into operation and has made a first shipment—one of about 600 tons. The company is continuing the development of the Silverado property, which is on the mountain on the opposite side of the Bear River to Stewart. During the first 10 months of this year the company mined 255,790 tons of ore and produced approximately 2,076,000 oz. of silver and 87,000 oz. of gold.

BOUNDARY.—Deep development at the Granby Consolidated Mining, Smelting and Power Company's Copper Mountain mine is disclosing a larger volume and higher grade of ore, and the company is planning to increase production. A temporary bunkhouse to house 80 men had been erected and a large new boarding house will be erected in the spring. The Hedley Gold Mining Company has suspended operations until the spring. During the last decade the mine has been operated without profit, but with only a small loss, in the hope that richer ore may be found. During the period it has produced bullion to the value of nearly \$2,750,000. Under the conditions, it has been the custom to close the mine during the winter, when operating cost is greater. The production for last year was approximately 13,000 oz. of gold.

TORONTO

December 18.

SUDBURY DISTRICT.—A preliminary estimate of the production of the International Nickel of Canada for the year just closed placed the value at \$40,000,000 approximately, which will represent an increase of at least 30 % over the \$31,000,000 produced in 1928, when divided between the properties of International and Mond. The tonnage of ore handled is estimated at about 2,000,000 tons, with a recovery indicated as slightly over \$20 to the ton, as compared with 1,459,910 tons in 1928. The indications are that the profits will exceed \$20,000,000, the operating costs being estimated at about \$10 per ton.

A fire which broke out underground in the Levack Mine of the International on December 15 resulted in the deaths of four men and a loss estimated at \$200,000 and 250 men were thrown temporarily out of employment.

The Falconbridge will begin production early in the new year. The construction of a smelter has been completed with an initial capacity of about 200 tons per day, which can easily be raised to 500 tons if found necessary. The tonnage of ore indicated by diamond drilling above the 50 ft. level is reported at over 5,000,000 tons carrying approximately an average of 2½% copper. Better values have been obtained in driving on the 1,000 ft. level, and diamond drilling below that horizon is meeting with encouraging results.

The Sudbury Offsets is conducting a diamond drilling campaign with satisfactory results, having encountered 64 ft. of good nickel-copper ore. Development work on another claim of the company near Copper Cliff has been temporarily suspended.

The Manitoba Flin Flon, which has claims in a section of the district which has shown good mineralization, is conducting diamond drilling operations which have shown some good values. The Baldwin Mining and Development Syndicate has secured 28 claims west of the producing area of the district. Preliminary development work in stripping and trenching has disclosed sufficient favourable indications to warrant development.

Following an important discovery made recently by the Northern Aerial Mining Exploration in the Opipisway Lake area, many prospectors have gone in and about 60 claims have been taken up.

PORCUPINE.—The output of bullion in this field during November was valued at \$1,395,689, as compared with \$1,921,922 for the previous month, the falling off being caused by the fire at the mill of Dome Mines Ltd. The directors have not yet decided as to whether a new mill will be built or whether an arrangement will be made to utilize the surplus mill capacity of some of the other mines in the district. Their decision is likely to await the result of development work at depth in the greenstone formation. This is being pushed forward rapidly in order to ascertain the full size and possibilities of the known ore-body in the territory north of the sedimentary basin.

The McIntyre Porcupine has nearly completed its heavy development programme with the sinking of its No. 11 shaft to 4,100 ft., through which it is proposed to switch the mine's entire production. The shaft has now been placed in full commission, hoisting 1,500 tons daily in addition to development rock. This, it is anticipated, will affect considerable economy in operating costs. Recent development has added considerably to the ore reserves, the value of which, at the close of the fiscal year March 31, was estimated at \$16,176,205, but with the ore now placed in sight it is expected that the next annual report will show an increase of about 50%, which ensures a mill supply for about four years at the present rate of operation.

The Canusa Mining and Exploration company is completing financial arrangement for the reopening of its property. Former operations disclosed the occurrence of good commercial ore on the 300 ft. level.

The Hayden Gold Mines Co. has cut its main vein on the 300 ft. level. It is 10 ft. wide and well mineralized, assaying \$4 10 to the ton over the full width. Cross-cutting will be started on the 700 ft. level to cut the downward continuation of the vein.

KIRKLAND LAKE.—During November the six producing mines of this camp yielded bullion valued at \$1,159,894, as compared with \$1,148,728 in October.

The Wright-Hargreaves has considerably improved its position and is now treating ore at the rate of 550 tons per day, production during November being reported at over \$175,000. Good ore is being taken from the upper levels, and an important ore shoot has been opened up on the 2,250 ft. level.

An official preliminary estimate of the production of Lake Shore during 1929 puts the total value at \$6,162,000 from the treatment of 425,000 tons of ore—an average recovery of \$14.50 per ton. Development at depth is largely increasing the ore reserves. On the 2,000 ft. level, driving has been done for 1,000 ft. on the vein, showing a width of 10 ft. of high grade ore carrying free gold and tellurides.

The Teck-Hughes, during the first ten months of the year produced gold to the value of \$4,164,000 and its ore reserves are officially stated to be sufficient to supply the mill for three years. The results of development on the six lower levels are somewhat variable, but on the lowest horizon at a depth of 3,000 ft. high grade ore has been opened up over a width of 12 ft. averaging \$25 per ton, with a further width of good ore as yet undetermined.

At the Sylvania the mill is operating at a capacity of 200 tons daily, production during the first ten months reaching approximately \$580,000. The output for the full year is expected to be about \$700,000, which will be somewhat under the output of 1928, owing to a slightly lower average grade of ore. A large tonnage of ore has been found at depth of between 1,000 and 1,500 ft. in the vicinity of the new shaft.

The Continental Kirkland has been closed down indefinitely after considerable development has been done opening up two veins, which did not, however, yield profitable ore.

The Kirkland Lake gold mine is cross-cutting at the 3,850 ft. and 4,000 ft. levels, in the hope of encountering the extension of rich veins found on the Teck-Hughes property adjoining.

The mill of the Telluride with a capacity of 250 tons per day has been completed, and a contract has been placed for electric power. Selective methods will be used in breaking ore for the mill, which will enable a \$40 per ton grade to be maintained for some time.

The Bidgood has completed its winze and sump at the 975 ft. level, a vein which was intersected showing good values. This is being driven on.

ROUYN.—The Noranda is actively pushing construction and development with a view to increasing its output. Tests have shown the smelter to have a capacity of 2,000 tons per day. The concentrator is being brought up to a capacity of at least 500 tons per day,

and the foundations have been laid for a new concentrator, which is expected to be in operation by May next. With both of these in operation the concentrating capacity will be well over 1,000 tons daily. Shaft No. 4 has passed the 1,300 ft. level, its objective being 1,500 ft. No. 3 shaft will be continued to a corresponding depth and connections established. Driving is proceeding at the rate of about 800 ft. per month. B. ore-body is indicated to be large and rich at 1,250 ft. in depth. There appears to be more than 500,000,000 lb. of copper in sight, with a further substantial reserve indicated. This ore also contains about 800,000 oz. of gold, valued at \$16,000,000, which is additional to the gold in the indicated ore reserves.

The Granada Rouyn will erect a gold mill with a capacity of 100 tons per day in which the process of gravity concentration and oil flotation will be adopted, and a contract has been made for electric power. Some very rich ore has been encountered in recent development.

The Abana has proved the downward continuation of the ore-body to a depth of 800 ft. and the shaft will be continued to that depth. The management has decided to instal a concentrator with a capacity of 300 tons per day.

The Amulet had made further discoveries by diamond drilling at depth. Mill construction is well advanced, and it is hoped to begin production by the end of March.

The shaft on the Waite-Montgomery is being put down to the 700 ft. level, and further development is anticipated. Enough ore to insure continuous production at the rate of 4,000 tons a month has been broken and development is steadily going forward.

CHIBOUGAMOU, QUE.—New copper and gold discoveries have aroused much interest in this field, which is rendered accessible during the winter by an air and traction service. Exploration work is being actively conducted by the Chibougamou Prospectors Ltd., with good results. Many prospectors and engineers are going in and many claims are being staked. One of the most significant discoveries recently made is at Opemiska Lake in the western section of the region. Several properties in this section have changed hands at high figures, Ventures Ltd. securing 25 claims at a cost of \$250,000, and R. T. Rea and associates having purchased 15 claims for \$200,000. Active development operations will be carried on by many companies during the coming spring.

MANITOBA.—The ore reserves on the Sherritt-Gordon are officially stated to be 5,254,575 tons, this being the combined tonnage of the east and west zones, including the low-grade incompletely developed area, and the supply is sufficient to keep the plant operating for 10 years treating 500,000 tons annually. The company will be ready to produce when the Flin Flon smelter is ready for operation, which should be about the end of 1930. The construction of a power line to the property is making good progress. The Cold Lake Mines Ltd. has let a contract for 2,500 ft. of diamond drilling on its property which adjoins the Sherritt-Gordon.

The Soondegah Mines Ltd., which owns 51 claims, is carrying on an active exploration campaign which has disclosed promising copper and gold values.

The Great Lakes Mining Drilling and Development Syndicate has been organized and has secured 68 claims and is arranging for extensive work during the winter.

At the Jack Nutt tin mine at Bernic Lake the serious difficulties occasioned by flooding have been overcome and work is proceeding satisfactorily. Additional machinery has been installed and the shaft will be deepened.

HURONIAN BELT.—With the reorganization of the Huronian Belt company as the Huronian Mining and Finance company, the control of the Vipond, Keeley Pioneer, and other properties passes from British into Canadian hands. The arrangements have been duly sanctioned by the shareholders of the companies interested. English holders retain their interest in the new company and thoroughly approve of the plan for the management of operations under local control.

CAMBORNE

January 4.

CORNISH MINING IN 1929.—The past year, with its steadily declining prices for tin, has demonstrated that, in the majority of Cornish tin mines, a capacity exists to increase returns. This, as evidencing the underground resources of those mines, is gratifying, and is an indication of the effective manner in which the managers have conducted exploratory and development operations in the face of depressing conditions.

From the shareholders' point of view dividend results of the past year are bad. Geevor interim dividend, at the rate of 10% per annum, last October, stands by itself, except for Tehidy Minerals, which,

however, is not a mining company, but an owner of extensive mineral rights, acquired from the Tehidy and Robartes estates.

The largest Cornish producer of black tin in 1929 was East Pool and Agar, with 1,028 tons, an increase of 115 tons on the output of the previous year. Geevor, at 834 tons, shows an increase of 156 tons. South Crofty's output of 796 tons exceeded by 4 tons that of 1928. This trio of old-established companies maintained their positions by adjusting their output to meet the requirements of a declining market, without any curtailment of essential development expenditure. Consequently all three begin the New Year under favourable conditions, as far as underground resources are concerned, and two of them fortunately possess, in addition, substantial cash reserves, that is, South Crofty with £45,000 and Geevor with over £30,000.

Considerably increased returns have also been made from Levant and Jantar. Wheal Kitty more than doubled the previous year's output, and Polhigey, where crushing was commenced early in the year, produced 286 tons of black tin in 1929, and in recent months has been selling 35 tons.

The total output of black tin from Cornwall during 1929 must amount to well over 4,000 tons, when figures from all sources, including rivers and foreshores, are available, the sales from the seven mines named above being over 4,230 tons.

Two companies, both of Anglo-Oriental parentage, ceased operations during the year—Parc-an-Chy, founded in October, 1926, with an authorized capital of £175,000 in 5s. shares, of which 600,000 were issued and fully paid, and Wheal Vlow, where operations were begun early in the following year.

Operations were suspended at their Roskear centre by the Dolcoath company late in 1928. During 1929 strenuous efforts were made by the directors to secure additional capital, but without success; and, at the last meeting of shareholders, in December, it was decided to make a final appeal to the Trades Facilities Committee for further financial assistance.

At Tolgus, too, operations from the new shaft ceased in 1928, because of the disappointing results obtained in that portion of the property, in driving and in diamond boring. Exploratory work from East Pool into Tolgus rights, however, produced satisfactory results. Consequently a scheme was

formulated by the boards of the two companies for their amalgamation. At special meetings of the shareholders in both companies, held on January 3, the scheme was unanimously adopted. Under the scheme of amalgamation the reserves of ore standing in Tolgus can be exploited by means of East Pool shaft, and treated at the East Pool Mill, and levels extended eastwards into Tolgus unwrought ground.

SOUTH CROFTY.—This company has resumed work on its Castle-an-Dinas wolfram mine, which has been in a state of suspension during the last few years of unremunerative prices for wolfram ores. With wolfram at its present price concentrates running 60% of WO_3 are worth about £100 a ton. Working costs at Castle-an-Dinas are low, as there are no pumping or hoisting charges, the mine being worked by adits.

WHEAL KITTY.—The first communication of Wheal Kitty with Wheal Friendly has been followed by the rapid extension westwards of Wheal Kitty's deepest level underneath the former workings in Friendly, which are now completely drained. These workings are thereby rendered accessible from Wheal Kitty, so that Wheal Friendly ores can be hoisted through Wheal Kitty shaft. The communication of the two mines has greatly improved ventilation in both, and has also lessened the costs of pumping.

LAMBRIGGAN.—At this, the only lead and zinc mine at work in Cornwall, the larger pitwork has been completed to the bottom of the mine, 400 feet; and at that depth a crosscut has been driven south 155 feet to the lode, which has just been intersected at an increased depth of 160 feet and found to be of good value and width. Development at both Nos. 1 and 2 levels has yielded satisfactory results for several months past.

PERSONAL

REGINALD ALLEN has left for Colombia.

H. H. W. BOYES has left for Nigeria.

LORD BRABOURNE has been elected Chairman of the Consolidated Gold Fields of South Africa, Ltd.

ARTHUR DICKINSON is home from New Guinea.

J. V. N. DORR has been awarded the James Douglas medal for 1929.

C. J. INDER has returned from Panama.

R. M. KATELEY has left for Nigeria.

A. J. KELMAN is home from Malaya.

LAKE AND CURRIE'S offices are now at 12a, Charterhouse Square, E.C. 1.

R. J. LEMMON is visiting New York and Canada.

After occupying the position for over 21 years, JOSIAH PAULL at the end of last year retired from the management of the South Crofty mine, where

he will be succeeded by his son, who has for some time been acting as assistant manager. Mr. Paull will, however, continue on the board of the company and act in a consultative capacity.

A. J. TRAVIS is home from Queensland.

SIR GILBERT C. VYLE has been re-elected President of the British Engineers' Association for the year 1929-30.

BERNARD WILKINSON has left for the United States.

GERARD W. WILLIAMS is home from East Africa.

ALLAN A. DAVIDSON, who had not been in very good health for some time, died on January 7 at a London nursing home.

C. W. MOORE, who was for many years closely associated with the Consolidated Mines Selection Company, died suddenly on December 28, at his home at Buckfastleigh, South Devon.

We have to record with regret the death, on December 29, at the age of 62, of S. J. SPEAK, a past president of the Institution of Mining and Metallurgy and an honorary member of the Institution of Mining Engineers. In connection with the first appointment an extensive biographical note appeared in our issue of March, 1922. Mr. Speak was a good friend of the MAGAZINE and was well known to its readers as a contributor, notably on the Rhodesia Broken Hill mine, the value of gold, the energy consumed in crushing, and on the Korean miner.

TRADE PARAGRAPHS

Ruston-Bucyrus, Ltd., of Lincoln, issue a leaflet calling attention to the alliance of Ruston and Hornsby Ltd., and Bucyrus-Erie Co. for the manufacture of excavators which takes effect from January 1, as announced in these columns in our issue of October last.

Westinghouse Electric International Co., of 2, Norfolk Street, London, W.C. 2 (Head Office: New York), send us a number of leaflets devoted to a variety of their products such as motors for driving pumps, linestarters, Westinghouse Nuttall gears, induction motor generators, and "Deion" contactors.

Hadfields, Ltd., of Sheffield, issue a new catalogue describing high speed and other types of crushing rolls which are made in sizes ranging from 36 in. by 12 in. to 54 in. by 24 in. for corresponding approximate b.h.p. of 28 to 30 and 65 to 80. Particulars of smaller rolls, both gear and belt driven, are included and also of some special types of rolls such as cubing mills.

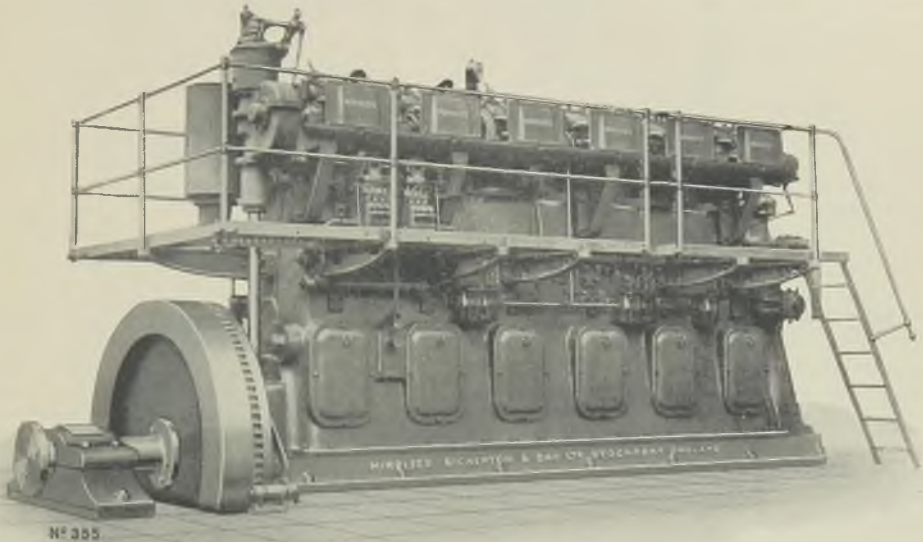
Ruston and Hornsby, Ltd., of Lincoln, inform us that they have received instruction to put in hand nine Ruston marine auxiliary oil engine generating sets, each of 306 k.w., to be installed on motor liners for the New Zealand Shipping Co. Each engine will be a five cylinder unit capable of developing 450 b.h.p. at 270 r.p.m. and will drive a G.E.C. dynamo.

Sullivan Machinery Co., of Salisbury House, London, E.C. 2, send us the first number of a new publication entitled *Engineering Graphic* which is to be issued quarterly as a house organ of the company. This first number contains a variety of interesting illustrated articles, notably some views from Northern Rhodesia and a detailed description of the driving of a water tunnel for the Boston Metropolitan water district.

Consolidated Pneumatic Tool Co., Ltd., of 170, Piccadilly, London, W. 1, send us a pamphlet which has been prepared for their South African subsidiary company. This gives a description, accompanied by photographs, of their works at Fraserburgh, in Scotland, which were established in 1904 and where there are some 200 employees, the majority of whom belong to the district and a large proportion of whom were fishermen or farm workers before they were taught their present arts and crafts. They also issue a new catalogue describing electric and pneumatic scaling equipment, which is fully illustrated, giving a number of examples of different tools for different duties.

International Combustion, Ltd., Grinding and Pulverizing Offices, of 11, Southampton Row, London, W.C. 1, report that new orders have been received for the following equipment: For

engine column, which also forms the water jackets for the cylinder liners, is one casting, which gives a column of very deep section and consequent great stiffness. Large inspection doors are fitted at back and front of engine for access to main bearings, etc. The cylinder liners are removable and are made of a hard, wear-resisting cast-iron and are free to expand downwards. The cylinder covers are of a semi-steel mixture with seats machined in them to receive the casings for the different valves which all operate vertically, thus any wear of the guides does not materially affect the working of the valves. To enable the valves to be quickly removed, the valve operating levers are made in two parts and hinged so that one half of the lever can be swung back and the valve and its seating can then be lifted out. The pistons and connecting rods are fitted with "floating"

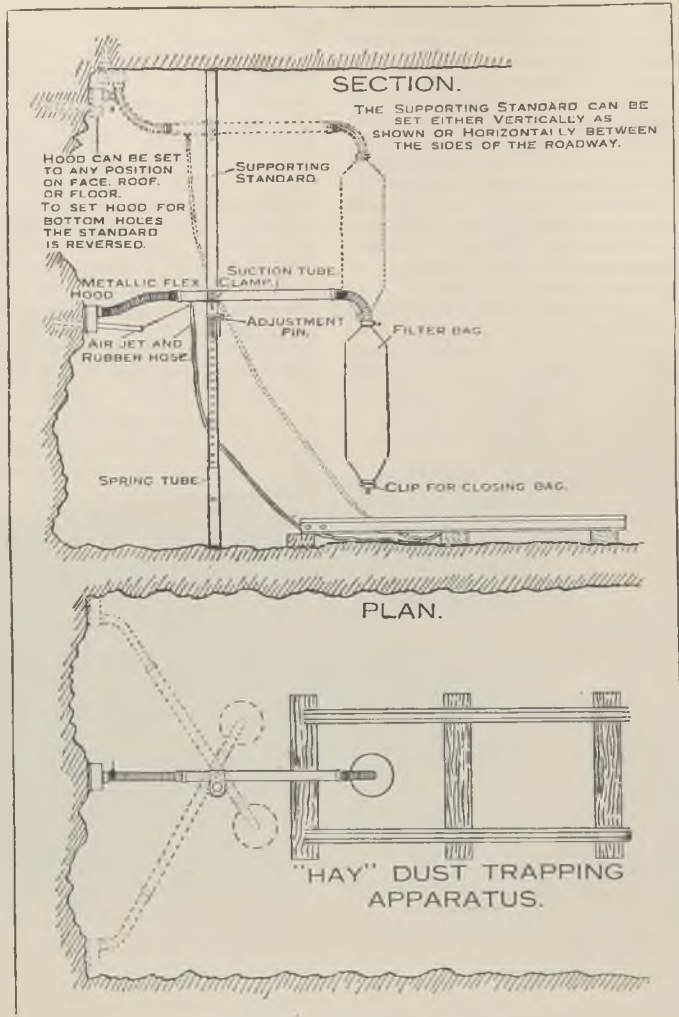


MIRRLEES, BICKERTON AND DAY 6-CYLINDER OIL ENGINE OF 450 B.H.P.

England: One 3-roller Baby Raymond mill for ochres and oxides, one Rovac rotary filter, 17 sq. ft. area, and one 4 ft. by 5 ft., type 30, Hum-mer screen for cork. For Yugo-Slavia: One 4 ft. by 6 ft., type 6, Hum-mer screen for copper ore. For Rhodesia: Five 4 ft. by 6 ft., type 60, Hum-mer screens for copper ore. For Japan: Two 8 ft. by 5 ft. Hum-mer screens for tin ore. For France: One 4 ft. 6 in. Hardinge mill and one 3-roller Raymond mill. For Spain: One 5-roller Raymond mill for phosphate. For Holland: Three type 37 Hum-mer screens.

Mirrlees, Bickerton and Day, Ltd., of Grosvenor Gardens, London, S.W. 1, and Stockport, now furnish us with particulars concerning their 6 cylinder oil engines of which three have been ordered by Panama Corporation as stated here last month. We reproduce here a photograph of one of these units. Each engine is of the totally enclosed type and develops 450 b.h.p. at 300 r.p.m. The cylinder bore is $13\frac{3}{8}$ in. and the stroke 19 in. They are of the 4-stroke cycle type and start immediately from cold by compressed air. Each

gudgeon pins and special "stepped" bearings. This feature was originated by the firm some years ago and has proved a noteworthy advance in piston design. This combination of floating piston pin and stepped bearing are claimed to have many advantages. A simple valveless plunger pump driven from a small crank on the crankshaft delivers the lubricating oil under pressure to the main bearings of the engine and connecting rods and is then collected in the sump of the bedplate. The pump draws the oil from this sump through a removable strainer. A regulator and pressure gauge are fitted in the delivery system. An independent semi-rotary hand pump is fitted to enable all bearings to be primed with oil before the engine is started to eliminate any possibility of the engine working initially with dry bearings. The pistons are independently lubricated from sight feed mechanical lubricators. The fuel oil is injected into the cylinders by compressed air supplied by a simple three-stage air-compressor forming an integral part of the engine. The same compressor also supplies air for starting purposes. Air injection



THE CLIMAX HAY DUST TRAP.

of the fuel gives excellent combustion combined with low working cylinder pressures. These conditions produce a clean exhaust and a minimum of carbonization in the cylinders and also a minimum of wear of the working parts.

CLIMAX HAY DUST TRAP

Attention was drawn in these pages last month to the fact that the Climax Rock Drill and Engineering Works, Ltd., are manufacturing this device which was described in some detail in our issue of September, 1926. In view of some slight modifications since introduced interest attaches to the diagram here published, and we are indebted to Capt. P. S. Hay, of the Safety in Mines Research Board, for the following additional information:—

This equipment has recently passed the departmental tests of the Mines Department and has been approved by H.M. Chief Inspector. Dealing with the modifications introduced, the filter bag is made of flannel reinforced with four stout straps running the full length of the bag and arranged equidistant

around its circumference. In turn the flannel filter has a cover of strong twill. At the bottom there is an orifice, closed by a steel clip, for emptying. The extremities of the stretcher bar are serrated to ensure a firm grip in the rock surface and to prevent rotation.

Some results obtained with the Kotze konimeter in a test in Llanbradach Colliery in October last are tabulated below :

Slide No.	Position of sample.	Count particles per c.c.
1.	Control spot, before drilling commenced	48
2.	Control spot, before drilling commenced	20
3.	Control spot, before drilling commenced	106
4.	After drilling for 30 seconds with dust trap in operation, sample taken close to driller's mouth	168

Slide No.	Position of sample.	Count particles per c.c.
5.	Sample taken 1½ minutes after drilling commenced, dust trap in operation, sample taken close to driller's mouth . . .	76
6.	Sample taken close to filter with dust trapper in operation after drilling for 2 min. 50 sec. . .	104
7.	Ditto, sample taken at lower end of filter 5 minutes after drilling commenced . . .	80
8.	Control spot taken before drilling commenced and while new bag was being fitted . . .	92
9.	Sample taken after drilling for 1 minute with dust trapper in operation. Sample taken close to new filter bag . . .	56
10.	Sample taken after drilling had been in progress for 3 minutes. Sample taken close to new filter bag . . .	44

Note : Samples 8, 9 and 10 were taken to determine the efficiency of an improved type of filter bag.

METAL MARKETS

COPPER.—The copper market wore a very mediocre aspect during December, interest, both on the part of merchants and consumers, being restricted. The approach of the end of the year, with its accompanying stocktaking activities, necessarily tended to curtail fresh buying. Trading conditions in the United States, following the Wall Street collapse, were not very good, but American producers, although handicapped by fairly large stocks, maintained the price of electrolytic copper at 17.95 cents. per lb., and were inclined, ostensibly at least, to take a cheerful view of 1930 prospects. It would not, however, be surprising, if next year sees the big interests forced eventually to modify their ideas of price, which, in the opinion of most consumers, are at present distinctly excessive.

Average price of cash standard copper : December, 1929, £68 7s. 3d. ; November, 1929, £69 8s. 4d. ; December, 1928, £69 7s. 7d. ; November, 1928, £68 2s. 3d.

TIN.—Despite an appreciable recovery in values at one time during the month, the tendency of tin prices in December was, on balance, downwards. Sentiment was discouraged by the growth of stocks in Great Britain, by the comparatively high " world visible supplies," by the dubious nature of the restriction proposals put forward by the Tin Producers' Association, and by the generally adverse business atmosphere. On the other hand, it was recognized that the price was low and discounted much that was adverse in the position whilst a favourable impression was made by the fusion of four leading British tin-smelters, which, it was thought, marked a definite step towards eventual price-control. The outlook for the early part of 1930 is uncertain, but should a general business revival be witnessed tin would almost certainly join in the movement. Failing such a recovery, however, it is very possible that tin quotations may be shaded further before a definite reaction is witnessed.

Average price of cash standard tin : December, 1929, £179 10s. 2d. ; November, 1929, £180 13s. 7d. ; December, 1928, £227 13s. 11d. ; November, 1928, £232 19s. 5d.

LEAD.—The Lead Producers' Association seems to have secured rather more control over this market once more and prices have kept pretty steady during the past few weeks though at a comparatively low level. Although demand in Europe is quiet and supplies ample, producers have at times been able to secure premiums for prompt metal by creating an artificial shortage. In America, a better inquiry is reported and this may eventually affect sentiment in this country. In view of the low level of the quotation, the outlook for 1930, given a fairly active trade demand, may be regarded with a certain amount of cautious optimism.

Average mean price of soft foreign lead : December, 1929, £21 9s. 6d. ; November, 1929, £21 12s. 7d. ; December, 1928, £21 6s. 8d. ; November, 1928, £21 7s.

SPELTER.—During December prices were maintained at a comparatively low level, and the undertone remained nervous in view of the failure, so far, of the efforts to reconstruct the International Cartel and having regard to the dullness of demand. The Christmas holidays and the approach of the stocktaking period kept business activity restricted. The price looks cheap, however, and might be expected to improve if general industrial conditions were to become more favourable. It is likely, of course, that the present poor quotation will eventually tend to reduce production and stimulate consumption.

Average mean price of spelter : December, 1929, £20 7s. 5d. ; November, 1929, £21 2s. ; December, 1928, £26 12s. 2d. ; November, 1928, £24 16s. 3d.

IRON AND STEEL.—The Cleveland pig-iron market became somewhat quieter in the course of December, and certain blast furnaces which had been blown out for repairs were therefore not replaced by fresh units immediately. The Christmas holidays, during which the furnaces continued in blast whilst the consuming steelworks were shut down, did not improve the position, as stocks of pig-iron tended to accumulate. The outlook for 1930 is consequently somewhat dubious, but output is not excessive and makers should have no serious difficulty in disposing of their output if business conditions are moderately favourable in the New Year. Certain home and export British steel prices have been advanced. The position of steelworks in this country at present is not too favourable.

ANTIMONY.—At the close of December English regulus was still quoted at £45 to £52 10s. Chinese regulus was quiet with spot material priced at about £31 5s. to £32 ex-warehouse, with shipment metal quoted at around £28 5s. per ton c.i.f.

IRON ORE.—December was a dull month so far as fresh business was concerned, as practically all works had fully covered their requirements, not only for December, but well into 1930. The year just past, however, has proved a better one for the iron ore industry than for some time, most mines having succeeded in disposing of all their output at higher prices than ruled in 1928. Current quotations are purely nominal with best Bilbao rubio around 23s. 9d. to 24s. 3d. per ton c.i.f.

LONDON DAILY METAL PRICES

Copper, Tin, Zinc, and Lead per Long Ton; Silver per Standard Ounce; Gold per Fine Ounce.

	COPPER				TIN.				ZINC (Spelter).				LEAD.		SILVER.		GOLD.
	STANDARD.		ELECTRO-LYTIC.	BEST SELECTED.	CASH.		3 MONTHS.		SOFT FOREIGN.		ENGLISH.		CASH.	FORWARD.	D.	D.	
	CASH.	3 MONTHS.			CASH.	3 MONTHS.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.					
Dec.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	d.	d.	s. d.	
11	68 13 9	68 3 9	83 0 0	—	179 16 3	182 17 6	20 2 6	21 7 6	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	84 11 1/2	
12	68 16 10 1/2	68 6 10 1/2	83 0 0	—	179 6 3	182 8 9	20 0 0	21 6 3	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	84 11 1/2	
13	69 1 3	67 18 9	83 0 0	75 15 0	185 17 6	188 17 6	20 2 6	21 7 6	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	84 11 1/2	
16	69 2 6	67 18 9	83 5 0	—	189 2 6	192 7 6	20 2 6	21 7 6	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	84 11 1/2	
17	68 11 3	67 11 3	83 5 0	75 5 0	186 2 6	189 7 6	20 1 3	21 7 6	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	84 10 1/2	
18	68 3 9	67 6 3	83 1 3	—	182 17 6	186 1 3	20 3 9	21 8 9	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	84 10 1/2	
19	68 6 10 1/2	67 9 4 1/2	83 1 3	—	183 3 9	186 8 9	20 5 0	21 10 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	84 11 1/2	
20	68 8 9	67 8 9	83 1 3	75 5 0	179 18 9	183 3 9	20 2 6	21 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	22 15 0	84 11 1/2	
23	67 18 9	67 6 3	83 0 0	—	178 3 9	181 3 9	20 0 0	21 15 0	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	84 11 1/2	
24	67 17 6	67 4 4 1/2	83 0 0	75 0 0	180 1 3	183 5 0	20 1 3	21 13 9	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	84 11 1/2	
27	67 11 3	67 6 3	83 0 0	74 15 0	177 6 3	180 13 9	20 0 0	21 13 9	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	84 11 1/2	
30	67 5 0	66 16 10 1/2	83 0 0	—	175 3 9	178 13 9	19 16 3	21 13 9	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	84 11 1/2	
31	68 0 0	67 5 10 1/2	83 7 6	—	178 3 9	181 13 9	19 12 6	21 18 9	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	23 5 0	84 10 1/2	
Jan.																	
2	71 8 9	70 1 3	83 7 6	—	180 6 3	183 13 9	19 15 0	21 8 9	23 0 0	23 0 0	23 0 0	21 8 9	21 8 9	21 8 9	21 8 9	84 11 1/2	
3	69 17 6	68 8 9	83 7 6	75 10 0	175 11 3	178 17 6	19 12 6	21 8 9	23 0 0	23 0 0	23 0 0	21 8 9	21 8 9	21 8 9	21 8 9	84 11 1/2	
6	70 3 9	68 18 9	83 7 6	—	175 1 3	178 6 3	19 8 9	21 7 6	23 0 0	23 0 0	23 0 0	21 8 9	21 8 9	21 8 9	21 8 9	84 11 1/2	
7	71 11 3	69 18 9	83 10 0	76 15 0	176 3 9	179 6 3	19 15 0	21 8 9	23 0 0	23 0 0	23 0 0	21 8 9	21 8 9	21 8 9	21 8 9	84 11 1/2	
8	71 13 9	69 11 3	83 10 0	—	178 10 0	181 13 9	19 15 0	21 11 3	23 0 0	23 0 0	23 0 0	21 8 9	21 8 9	21 8 9	21 8 9	84 11 1/2	
9	71 8 9	69 15 10 1/2	83 10 0	—	176 6 3	179 16 3	19 10 0	21 11 3	23 0 0	23 0 0	23 0 0	21 8 9	21 8 9	21 8 9	21 8 9	84 11 1/2	

ARSENIC.—There is not much business moving here, 99% Cornish white being nominally unchanged at £16 per ton f.o.r. mines, while high grade Mexican remains at £17 c.i.f. Liverpool.

BISMUTH.—A fairly good demand is reported at 7s. 6d. per lb. for merchant quantities.

CADMIUM.—Towards the close of the year the undertone of this market improved and some very fair sales were effected. Prices are fully steady at 3s. 11d. to 4s. per lb.

COBALT METAL.—Demand for this article has been rather spasmodic, the competition of ferro-cobalt being rather keen at times. However, makers continue to quote 10s. per lb., although this figure is shaded for good contracts.

COBALT OXIDES.—Business shows no new features and prices are unaltered at 8s. per lb. for black and 8s. 10d. for grey.

PLATINUM.—In the absence of any appreciable inquiry quotations have eased a little further, and refined metal is now quoted at £12 10s. to £13 per oz.

PALLADIUM.—Only a very limited interest is shown in Palladium and prices are inclined to be nominal at around £6 10s. to £7 per oz.

IRIDIUM.—If anything, this market has been rather easier, but with only a small turnover quotations are somewhat indefinite. However, sponge and powder might be called about £39 to £42 per oz.

TELURIUM.—This market is idle and quotations purely nominal at 12s. 6d. to 15s. per lb.

SELENIUM.—A steady demand continues for high grade black powder, which remains unaltered at 7s. 8d. to 7s. 9d. per lb. ex-warehouse.

MANGANESE ORE.—The closing weeks of last year were characterized by an almost entire lack of interest on the part of buyers, who for the most part are well covered, and prices can only be called nominal at about 1s. 1 1/2d. per unit c.i.f. for best Indian and 1s. 1d. c.i.f. for washed Tchiaturi ore.

ALUMINIUM.—The usual forward buying for the coming year was seen during December, but the market did not wear a particularly cheerful

appearance. Prices seem stabilized at £95, less 2% delivered.

SULPHATE OF COPPER.—English material is still quoted at £27 to £27 10s. per ton, less 5%.

NICKEL.—Demand continues on quite a heavy scale and all indications point to the increasing production being readily absorbed. Prices remain pegged at £170 to £175 per ton for both home and export business.

CHROME ORE.—Nothing of particular interest has developed in this market recently, and prices are unaltered at £4 to £4 5s. per ton c.i.f. for good 48% Rhodesian ore.

QUICKSILVER.—Only a few small parcels have been changing hands, but the price is upheld at £23 to £23 5s. per bottle for spot material.

TUNGSTEN ORE.—During December, European buyers entered the market again, but having formed themselves into a buyers' pool their position was strengthened somewhat. However, supplies were none too plentiful and prices have advanced to the current level of about 34s. to 35s. per unit c.i.f. for January-February shipment from China.

MOLYBDENUM ORE.—Only a moderate business has been seen recently, prices being fairly steady at about 37s. 6d. to 38s. per unit c.i.f. for American 80% concentrates, although now and then more is paid for higher grade material.

GRAPHYITE.—Quotations are without change, 85 to 90% Madagascar flake being about £25 to £28 per ton c.i.f. and 90% Ceylon lumps around £25 to £26 c.i.f.

SILVER.—On December 2 spot bars stood at 22 1/2d., and during the first half of the month, with some support from China, values improved slightly. Subsequently, however, with no support from India or China and easier Eastern exchanges, followed by the news of unsettlement in India, quotations began to fall away, until on December 30 spot bars touched 21 1/2d., which was the lowest level ever recorded for silver. Previously the lowest was 21 1/4d., which was touched in November, 1902. On the last day of the year quotations recovered slightly, spot bars closing at 21 7/8d.

STATISTICS

PRODUCTION OF GOLD IN THE TRANSSVAAL.

	RAND.	ELSE-WHERE.	TOTAL.
	Oz.	Oz.	Oz.
December, 1928	821,582	38,179	859,761
January, 1929	840,344	36,108	876,452
February	778,569	36,725	815,284
March	830,820	35,700	866,529
April	836,474	35,649	872,123
May	858,991	38,607	897,598
June	821,352	34,677	856,029
July	853,370	36,110	889,480
August	850,952	38,649	889,601
September	814,707	34,846	849,553
October	853,609	35,081	888,690
November	827,952	33,641	861,593
December	813,574	37,560	851,134

TRANSSVAAL GOLD OUTPUTS.

	NOVEMBER.		DECEMBER.	
	Treated Tons.	Yield Oz.	Treated Tons.	Yield Oz.
Brakpan	84,500	£141,025	76,500	£127,085
City Deep	87,500	23,247	96,000	24,074
Cons. Main Reef	22,264	22,264	57,000	20,894
Crown Mines	221,000	70,069	215,000	68,642
D'rb'n Rooipoort Deep	40,500	13,613	40,300	13,352
East Rand P.M.	143,300	38,451	143,000	38,239
Geduld	8,000	26,554	83,500	20,741
Goldenhuis Deep	66,000	14,873	63,000	14,636
Glyn's Lydenburg	6,000	2,221	6,100	1,946
Government G.M. Areas	202,000	£884,497	196,000	£873,033
Kleinfontein	51,300	11,668	51,700	£51,601
Langlaagte Estate	79,000	£111,911	72,500	£110,103
Luipaard's Vlei	22,800	5,985	23,000	6,001
Meyer and Charlton	16,800	£19,145	17,200	£19,149
Modderfontein New	147,000	72,472	147,000	72,388
Modderfontein B	69,000	24,742	69,500	24,845
Modderfontein Deep	44,200	23,358	42,800	22,638
Modderfontein East	68,500	20,284	66,500	19,484
New State Areas	76,000	£144,910	74,000	£142,539
Nourse	59,500	17,126	56,400	16,740
Randfontein	213,000	£214,672	208,000	£212,692
Robinson Deep	77,700	21,261	76,000	19,641
Rose Deep	59,000	12,086	58,000	12,044
Simmer and Jack	75,400	18,986	77,900	19,750
Springs	67,700	£136,845	65,500	£130,913
Sub Nigel	24,400	19,644	25,700	20,956
Transvaal G.M. Estates	13,150	4,732	13,700	4,583
Van Ryn	40,000	£40,179	41,500	£39,984
Van Ryn Deep	62,000	£104,587	58,000	£105,366
Village Deep	57,000	15,152	58,000	15,066
West Rand Consolidated	87,000	£96,846	90,000	£98,277
West Springs	67,700	£78,901	63,500	£75,914
Witwatersrand (Knights)	52,500	£49,728	53,000	£50,655
Witwatersrand Deep	36,000	10,290	42,300	9,635

COST AND PROFIT ON THE RAND, Etc.

Compiled from official statistics published by the Transvaal Chamber of Mines.

	Tons milled.	Yield per ton.	Work'g cost per ton.	Work'g profit per ton.	Total working profit.
October, 1928	2,612,500	27 9	19 5	8 4	1,092,162
November	2,539,700	27 9	19 7	8 2	1,041,713
December	2,505,500	27 10	19 8	8 2	1,024,654
January, 1929	2,627,320	28 1	19 9	8 4	1,085,070
February	2,467,720	28 6	20 3	8 3	990,942
March	2,581,600	28 3	20 0	8 3	1,062,331
April	2,606,420	28 1	19 11	8 2	1,065,103
May	2,694,610	28 0	19 10	8 2	1,100,461
June	2,543,550	28 3	19 10	8 5	1,065,191
July	2,649,560	28 1	19 8	8 5	1,112,246
August	2,661,800	28 1	19 9	8 4	1,111,834
September	2,530,370	28 2	19 10	8 4	1,056,839
October	2,658,100	28 1	19 8	8 5	1,113,744
November	—	—	—	—	1,071,199

NATIVES EMPLOYED IN THE TRANSSVAAL MINES.

	GOLD MINES.	COAL MINES.	DIAMOND MINES.	TOTAL.
December 31, 1928	187,970	16,059	4,444	208,473
January 31, 1929	192,526	15,845	5,056	213,427
February 28	196,150	15,940	5,685	217,725
March 30	197,646	16,065	5,787	219,498
April 30	197,412	15,900	5,554	218,866
May 31	195,733	15,852	5,473	217,058
June 30	192,595	15,928	5,029	213,552
July 31	190,331	15,914	4,845	210,790
August 31	190,062	15,867	5,071	211,000
September 30	190,567	15,791	4,814	211,114
October 31	189,739	15,533	4,555	209,827
November 30	188,941	15,320	4,561	206,822
December 31	184,280	15,326	4,811	204,417

PRODUCTION OF GOLD IN RHODESIA.

	1926	1927	1928	1929
	oz.	oz.	oz.	oz.
January	48,967	48,731	51,356	46,231
February	46,020	46,461	46,286	44,551
March	46,902	50,407	43,017	47,388
April	51,928	48,290	48,549	48,210
May	49,392	48,992	47,323	48,189
June	52,381	52,910	51,762	48,406
July	50,460	49,116	48,960	46,369
August	49,735	47,288	50,611	46,473
September	48,350	45,833	47,716	45,025
October	50,132	46,752	43,056	46,923
November	51,090	47,435	47,705	46,219
December	48,063	49,208	44,772	—

RHODESIAN GOLD OUTPUTS.

	NOVEMBER.		DECEMBER.	
	Tons.	Oz.	Tons.	Oz.
Cam and Motor	24,400	11,460	24,000	10,667
Lonely and Phoenix	6,040	5,053	6,079	5,278
Langley Reef	5,700	4,166	5,800	4,153
Mayfair	5,210	4,657	1,000	470
Rezende	6,400	2,855	6,400	2,844
Shamva	10,500	£20,801	—	—
Sherwood Starr	4,200	£9,523	4,400	£9,880
Wanderer Consolidated	6,600	1,543	10,100	2,081

WEST AFRICAN GOLD OUTPUTS.

	NOVEMBER.		DECEMBER.	
	Tons.	Oz.	Tons.	Oz.
Ariston Gold Mines	8,100	£13,600	—	—
Ashanti Goldfields	9,760	11,231	10,034	11,298
Taqaah and Abosso	8,750	£14,548	8,765	£14,566

AUSTRALIAN GOLD OUTPUTS BY STATES.

	Western Australia.	Victoria.	Queensland.	New South Wales.
	Oz.	Oz.	Oz.	Oz.
December, 1928	36,097	—	493	208
January, 1929	27,384	—	260	445
February	28,177	1,997	117	474
March	25,848	2,974	816	—
April	39,166	—	617	—
May	28,026	3,018	493	467
June	33,139	2,368	465	8
July	28,086	1,421	1,203	—
August	37,032	2,178	567	—
September	32,751	1,739	381	—
October	35,445	—	789	—
November	28,460	—	—	—
December	33,650	—	—	—

AUSTRALASIAN GOLD OUTPUTS.

	NOVEMBER.		DECEMBER.	
	Tons	Value £	Tons	Value £
Associated G.M. (W.A.)	3,744	5,676	3,674	6,033
Blackwater (N.Z.)	3,200	6,051	2,550	4,850
Boulder Perseve (W.A.)	5,109	11,781	4,843	12,679
Grt. Boulder Pro. (W.A.)	7,006	21,335	—	—
Lake View & Star (W.A.)	8,291	13,457	—	—
Sons of Gwalia (W.A.)	13,442	11,589	8,724	9,978
South Kalgurli (W.A.)	6,757	14,773	—	—
Waihi (N.Z.)	16,990	£6,192*	21,476	£7,272
		£37,924†		£54,452

* Oz. gold. † Oz. silver 4 weeks to November 16.

GOLD OUTPUTS, KOLAR DISTRICT, INDIA.

	NOVEMBER.		DECEMBER.	
	Tons Ore	Total Oz.	Tons Ore	Total Oz.
Balaghat	4,100	2,654	4,550	2,587
Champion Reef	8,115	6,016	8,410	6,938
Mysore	17,121	8,314	17,019	9,961
Nundydroog	11,000	6,726	11,072	6,931
Ooregum	13,536	6,238	13,544	6,237

MISCELLANEOUS GOLD, SILVER, AND PLATINUM OUTPUTS.

	NOVEMBER		DECEMBER.	
	Tons	Value £	Tons	Value £
Chosen Corp. (Korea) ..	8,560	10,315	9,900	11,265
Frontino & Bolivia (C'ibia)	2,000	7,987	2,400	6,960
Lena (Siberia)	—	12,600	—	11,978
Lydenburg Plat. (Trans.)	3,500	778 <i>p</i>	3,360	699 <i>p</i>
Marmajito (Colombia) ..	980	4,877	910	4,498
Fresnillo	91,684	101,840 <i>d</i>	—	—
Onverwacht Platinum ..	2,662	454 <i>p</i>	2,615	450 <i>p</i>
Oriental Cons. (Korea) ..	—	100,270 <i>d</i>	—	103,600 <i>d</i>
St. John del Rey (Brazil)	—	46,000	—	42,000
Santa Gertrudis (Mexico)	49,052	111,161 <i>d</i>	—	—

d Dollars. *p* Oz. platinum.

PRODUCTION OF TIN IN FEDERATED MALAY STATES.

Estimated at 70% of Concentrate shipped to Smelters. Long Tons.

January, 1929	5,840	July, 1929	5,802
February	4,896	August	5,610
March	5,236	September	5,332
April	5,433	October	5,966
May	5,405	November	6,135
June	5,523	December	5,849

OUTPUTS OF MALAYAN TIN COMPANIES.

IN LONG TONS OF CONCENTRATE.

	Oct.	Nov.	Dec.
Batu Caves	24	28	31
Changkat	56	65	95
Chenderiang	26½	28	29½
Gopeng	80	83	86
Hong Kong Tin	50½	50½	184½
Idris Hydraulic	35½	38½	38½
Ipoh	39½	45	51½
Jelapang	36	21½	34
Kampar Malaya	—	80	—
Kampong Lanjut	—	60	70
Kamunting	103	72	73½
Kent (F.M.S.)	42	45	45
Kepong	31	38	37
Kinta	31	33	38½
Kinta Kellas	44½	31	65½
Kramat Pulai	14½	—	—
Kuala Kampar	110	80	90
Kundang	24	25	20
Lahat	14	15	16½
Larut Tinfields	82	82	75
Malaya Consolidated	58½	89½	73
Malayan Tin	119	119	142½
Meru	30	30½	24½
Pahang	222	222½	222
Penawat	—	68½	82½
Pengkaleu	77½	71	65½
Petaling	210	178	178
Rahman	19½	59½	65½
Rambutan	10	10	11
Rantau	56	58	50
Rawang	40	30	90
Rawang Concessions	170	200	90
Relang	57½	104½	108
Selayang	22	23	5
Southern Malayan	172½	172½	178½
Southern Perak	65½	50½	59½
Southern Tronoh	41	45	48
Sungei Besi	45	48	59
Sungei Kinta	50	49	49½
Sungei Way	77½	77½	77½
Taipung	35	38	39
Tanjong	38½	41½	44½
Teja Malaya	5½	—	35
Tekka	45	46	45
Tekka-Taipung	24½	26	31
Temoh	34	44	51½
Tronoh	112½	118	122

OUTPUTS OF NIGERIAN TIN MINING COMPANIES.
IN LONG TONS OF CONCENTRATE.

	Oct.	Nov.	Dec.
	Amari	12	8
Anglo-Nigerian	46	43½	67
Associated Tin Mines	256	250	—
Baba River	5½	3	2½
Batura Monguna	2	2	2
Bisichi	95	100	112
Dafo	10	10	—
Ex-Lands	62	63	65
Filani	7½	5½	5½
Jantar	47	37	42
Jos	22½	39	26½
Juga Valley	20	25	—
Junction	2½	3	—
Kaduna	51½	59	—
Kaduna Prospectors	27	32½	—
Kassa	27½	22½	19
London Tin	245	255	—
Lower Bisichi	7½	8½	6½
Mongu	50	70	—
Naraguta	45	41	18½
Naraguta Durumi	24	19	—
Naraguta Extended	22	20	15
Naraguta Karama	37	27½	27½
Naraguta Korot	20	20	—
Nigerian Base Metals	48	44	—
Nigerian Consolidated	30	20	—
N.N. Bauchi	—	—	—
Offin River	5½	8½	7½
Ribon Valley	22	18	15
Ropp	—	—	—
South Bukeru	8½	8½	13
Tin Fields	5½	3½	2½
Tin Properties	22	25	—
United Tin Areas	28	28	20
Yarde Kerr	7	5	—

OUTPUTS OF OTHER TIN MINING COMPANIES.

IN LONG TONS OF CONCENTRATE.

	Oct.	Nov.	Dec.
Anglo-Burma (Burma)	30½	21	—
Aramayo Mines (Bolivia)	351	435	365
Bangrin (Siam)	57½	44½	48
Berenguola (Bolivia)	38	38	—
C'solidated Tin Mines (Burma)	104	100	100
East Pool (Cornwall)	87½	87½	—
Fabulosa (Bolivia)	167½	197	290
Geevor (Cornwall)	68	67	65
Jantar (Cornwall)	23	22	—
Kagera (Uganda)	28	28	—
Northern Tavoy	—	55	—
Polhigey (Cornwall)	35	35	—
San Finx (Spain)	3½*	30*	—
Siamese Tin (Siam)	145	134½	145½
South Crofty (Cornwall)	69½	68	67½
Tavoy Tin (Burma)	45	40	—
Theindaw (Burma)	8	3	—
Tongkah Harbour (Siam)	69	73	67
Toyo (Japan)	—	30	—
Wheat Kitty (Cornwall)	39	45	—
Wheat Reeth (Cornwall)	—	—	—

* Tin and Wolfram.

COPPER, LEAD, AND ZINC OUTPUTS.

	Nov.	Dec.
Broken Hill South	5,484	4,384
(Tons lead conc.)	5,817	4,389
(Tons zinc conc.)	6,750	6,750
Burma Corporation	607,000	607,000
(Oz. refined silver ..)	—	—
Bwana M'Kubwa	459	598
(Tons copper oxide ..)	4,514	4,212½
Electrolytic Zinc	226	233
(Tons zinc	519	588
Indian Copper	3,884*	3,122
(Tons copper	165	164
Messina	7,820	—
(Tons concentrates ..)	6,130	—
Mount Lyell	1,410	1,815
(Tons copper	—	—
Namaqua	—	—
(Tons lead conc.)	—	—
North Broken Hill	—	—
(Tons zinc conc.)	—	—
Poderosa	1,265	910
(Tons lead conc.)	1,838	3,477
Rhodesia Broken Hill	2,066	4,083
(Tons zinc conc.)	2,049	—
San Francisco Mexico	2,603½	—
(Tons lead conc.)	1,051	—
Sulphide Corporation	2,080	—
(Tons zinc conc.)	—	—
Tetiuhue	—	—
(Tons lead conc.)	—	—
Union Minière	4,479	5,054
(Tons zinc conc.)	4,966	4,166
Zinc Corporation	—	—
(Tons lead conc.)	—	—

* Four weeks to Dec. 4.

† Four weeks to Dec 11

‡ Four weeks to Nov. 13.

§ Four weeks to Nov. 16.

IMPORTS OF ORES, METALS, ETC., INTO UNITED KINGDOM

	Oct.	Dec.
Iron Ore	561,544	415,848
Manganese Ore	22,139	12,380
Iron and Steel	248,499	250,430
Copper and Iron Pyrites	25,064	38,306
Copper Ore, Matte, and Prec.	919	3,553
Copper Metal	16,202	11,430
Tin Concentrate	7,732	7,350
Tin Metal	931	1,639
Lead Pig and Sheet	20,299	30,596
Zinc (Spelter)	10,523	9,177
Zinc Sheets, etc.	1,715	2,142
Aluminium	1,703	1,144
Quicksilver	80,373	145,142
Zinc Oxide	1,138	919
White Lead	15,190	18,427
Red and Orange Lead	3,743	2,561
Barytes, ground	65,338	51,094
Asbestos	3,254	3,342
Boron Minerals	707	1,907
Horax	12,011	25,293
Basic Slag	3,439	5,300
Superphosphates	8,032	10,181
Phosphate of Lime	14,326	23,932
Mica	263	334
Sulphur	8,752	10,733
Nitrate of Soda	25,778	133,149
Potash Salts	589,602	214,466
Petroleum : Crude	51,163,829	34,147,507
Lamp Oil	23,536,135	24,840,206
Motor Spirit	70,037,259	50,232,378
Lubricating Oil	10,488,878	6,322,370
Gas Oil	9,456,037	12,940,544
Fuel Oil	22,633,726	25,079,363
Asphalt and Bitumen	9,954	22,412
Paraffin Wax	139,667	161,792
Turpentine	42,664	32,486

PRICES OF CHEMICALS. January 9.

These quotations are not absolute; they vary according to

quantities required and contracts running.

		£	s.	d.
Acetic Acid, 40%	per cwt.	1	16	6
" 80%	per ton	66	0	0
Alum	per ton	8	10	0
Alumina, Sulphate, 17 to 18%	per lb.	6	15	0
Ammonia, Anhydrous	per lb.	10	10	0
" 0.880 solution	per ton	15	10	0
" Carbonate	per ton	27	10	0
" Nitrate	per ton	24	0	0
" Phosphate	per ton	40	0	0
" Sulphate, 20.6% N	per ton	10	0	0
Antimony, Tartar Emetic	per lb.	10	2	7½
" Sulphide, Golden	per ton	7	7	7
Arsenic, White	per ton	16	0	0
Barium Carbonate, 94%	per ton	5	10	0
" Chloride	per ton	10	10	0
" Sulphate, 94%	per ton	5	0	0
Benzol, standard motor	per gal.	1	7	½
Bleaching Powder, 35% Cl.	per ton	6	15	0
Borax	per ton	13	10	0
Boric Acid	per ton	22	0	0
Calcium Chloride	per ton	5	10	0
Carbolic Acid, crude, 60%	per gal.	2	5	0
" crystallized, 40°	per lb.	7	7	½
Carbon Disulphide	per ton	24	0	0
Citric Acid	per lb.	1	11	0
Copper Sulphate	per ton	26	15	0
Cyanide of Sodium, 100% KCN	per lb.	7	7	0
Hydrofluoric Acid	per oz.	1	6	0
Iodine	per ton	6	0	0
Iron, Nitrate	per ton	1	15	0
" Sulphate	per lb.	39	0	0
Lead, Nitrate, white	per lb.	33	5	0
" Oxide, Litharge	per lb.	37	10	0
" White	per lb.	38	0	0
Lime, Acetate, brown	per gal.	7	5	0
" grey, 80%	per ton	16	0	0
Magnesite, Calcined	per ton	9	10	0
Magnesium, Chloride	per ton	6	15	0
" Sulphate	per gal.	3	5	0
Methylated Spirit 64° Industrial	per gal.	1	5	0
Nitric Acid, 80° Tw.	per ton	21	0	0
Oxalic Acid	per cwt.	1	13	0
Phosphoric Acid	per ton	29	15	0
Potassium Bichromate	per lb.	4	3	½
" Carbonate	per ton	26	2	6
" Chlorate	per lb.	2	2	½
" Chloride 80%	per ton	9	0	0
" Hydrate (Caustic) 90%	per ton	31	0	0
" Nitrate, refined	per lb.	20	10	0
" Permanganate	per lb.	5	6	½
" Prussiate, Yellow	per lb.	6	2	½
" Red	per lb.	1	9	0
" Sulphate, 90%	per ton	11	5	0
Sodium Acetate	per ton	20	0	0
" Arsenate, 45%	per ton	26	0	0
" Bicarbonate	per lb.	10	10	0
" Bichromate	per lb.	6	0	½
" Carbonate (Soda Ash)	per ton	5	5	0
" (Crystals)	per lb.	2	½	½
" Chlorate	per ton	14	10	0
" Hydrate, 76%	per ton	9	0	0
" Hyposulphite	per ton	10	0	0
" Nitrate, 90%	per cwt.	11	0	0
" Phosphate, comml.	per lb.	9	10	0
" Prussiate	per lb.	9	10	0
" Sulphate (Salt-cake)	per ton	2	15	0
" (Glauber's Salt)	per ton	2	12	6
" Sulphide	per ton	9	0	0
Sulphur, Roll	per ton	10	0	0
" Flowers	per ton	12	0	0
Sulphuric Acid, 168°	per ton	5	7	6
" free from Arsenic, 144°	per ton	4	0	0
Superphosphate of Lime, 33%	per lb.	3	6	0
Tartaric Acid	per lb.	1	3	½
Turpentine	per ton	45	15	0
Tin Crystals	per lb.	1	6	½
Titanous Chloride	per ton	12	0	0
Zinc Chloride	per ton	12	0	0
Zinc Dust	per ton	32	0	0
Zinc Oxide	per ton	39	0	0
Zinc Sulphate	per ton	9	0	0

OUTPUTS REPORTED BY OIL-PRODUCING COMPANIES IN TONS.

	Oct.	Nov.	Dec.
Anglo-Ecuadorian	15,012	14,427	14,338
Apex Trinidad	36,060	34,140	33,530
Attock	4,781	3,740	3,238
British Burmah	5,613	5,411	5,518
British Controlled	36,569	31,206	—
Kern Mex.	832	770	—
Kern River (Cal.)	4,849	1,739	—
Kern Romana	3,527	2,592	—
Kern Trinidad	4,868	4,336	—
Lobitos	28,768	28,669	29,847
Phoenix	42,291	48,442	48,618
St. Helen's Petroleum	9,690	7,802	—
Steauna Romana	78,320	70,640	70,150
Tampico	3,084	2,927	—
Trinidad Leaseholds	31,700	30,400	39,700
Venezuelan Consolidated	5,220	5,034	—

QUOTATIONS OF OIL COMPANIES SHARES.

Denomination of Shares £1 unless otherwise noted.

	Dec. 9, 1929		Jan. 10, 1930	
	£	s. d.	£	s. d.
Anglo-American	3	6 11	3	9 3
Anglo-Ecuadorian		16 3		17 0
Anglo-Egyptian B	2	5 6	2	7 0
Anglo-Persian 1st Pref.	1	6 6	1	6 9
" Ord.	3	15 0	3	13 9
Apex Trinidad (5s.)	1	6 3	1	8 0
Attock	1	17 6	1	3 9
British Burmah (8s.)		6 10		6 9
British Controlled (5s)		4 0		4 0
Burmah Oil	3	16 3	3	15 0
Kern River, Cal. (10s.)		6 6		6 4
Lobitos, Peru	1	17 6	1	18 3
Mexican Eagle, Ord. (4 pesos)		15 3		14 9
" 8% Pref. (4 pesos)		15 0		14 6
Phoenix, Roumania		9 6		9 9
Royal Dutch (100 fl.)	33	5 0	33	0 0
Shell Transport, Ord.	4	15 0	4	15 9
" 5% Pref. (£10)	9	10 0	9	12 6
Steauna Romana		10 0		9 0
Trinidad Leaseholds	3	18 0	3	16 3
United British of Trinidad (6s. 8d.)		6 6		7 3
V.O.C. Holding	2	16 10	2	18 9

SHARE QUOTATIONS

Shares are £1 par value except where otherwise noted.

	December 9, 1929.		Jan. 9, 1930.	
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
GOLD AND SILVER:				
SOUTH AFRICA:				
Brakpan	3 14 9	3 15 6	8 0	
City Deep	6 3	8 0	17 9	
Consolidated Main Reef	17 0	17 9	3 8 9	
Crown Mines (10s.)	3 2 6	3 8 9	1 2 6	
Daggafontein	1 0 0	1 2 6	11 3	
Durban Roodepoort Deep	10 0	11 3	1 19 6	
East Geduld	1 16 3	1 19 6	13 3	
East Rand Proprietary (10s.)	10 9	13 3	6 0	
Ferreira Deep	6 0	6 0	3 11 3	
Geduld	3 5 0	3 11 3	6 0	
Geldenhuys Deep	5 0	6 0	2 6	
Glynn's Lydenburg	2 6	2 6	1 17 0	
Government Gold Mining Areas (5s.)	1 16 3	1 17 0	1 3 6	
Langlaagte Estate	1 1 3	1 3 6	10 0	
Meyer & Charlton	1 8 9	10 0	4 12 6	
Modderfontein New (10s.)	4 12 6	4 12 6	17 0	
Modderfontein B (5s.)	15 6	17 0	1 10 0	
Modderfontein Deep (5s.)	1 6 10	1 10 0	1 8 9	
Modderfontein East	1 7 6	1 8 9	1 12 6	
New State Areas	1 12 6	1 12 6	6 3	
Nourse	9 0	9 0	15 0	
Randfontein	5 6	6 3	18 6	
Robinson Deep A (1s.)	13 9	15 0	5 0	
" B	9 6	8 6	3 6	
Rose Deep	4 9	5 0	3 6	
Simmer & Jack (2s. 6d.)	3 6	3 6	3 9 6	
Springs	3 2 6	3 9 6	1 17 6	
Sub Nigel (10s.)	1 13 9	1 17 6	6 0	
Van Ryn	6 0	7 0	1 17 6	
Van Ryn Deep	1 14 6	1 17 6	7 6	
Village Deep	7 0	7 6	5 6	
West Rand Consolidated (10s.)	5 6	7 3	17 0	
West Springs	17 0	19 0	8 3	
Witwatersrand (Knight's)	8 3	8 0	3 0	
Witwatersrand Deep	3 0	4 0		
RHODESIA:				
Cam and Motor	1 1 3	1 5 0	4 0	
Gaika	4 0	4 0	9 3	
Globe and Phenix (5s.)	9 3	10 9	18 9	
Lonely Reef	18 9	17 6	17 6	
Mayfair	17 6	15 0	16 3	
Rezende	16 3	17 6	2 3	
Shamva	2 3	1 6	1 2 6	
Sherwood Starr	1 2 6	1 2 6		
GOLD COAST:				
Ashanti (4s.)	1 4 3	1 7 3		
Taqaah and Abosso (5s.)	1 6	1 6		
AUSTRALASIA:				
Golden Horseshoe (4s., W.A.)	1 9	1 9		
Great Boulder Proprietary (2s.), W.A.	2 0	1 6		
Lake View and Star (4s.), W.A.	9 6	13 6		
Sons of Gwalia, W.A.	1 3	1 3		
South Kalgurlu (10s.), W.A.	14 4	13 9		
Waihi (5s.), N.Z.	13 0	12 9		
Wiluna Gold, W.A.	15 9	16 9		
INDIA:				
Balaghat (10s.)	4 6	4 3		
Champion Reef (10s.)	9 6	8 9		
Mysore (10s.)	13 6	11 9		
Nundydroog (10s.)	15 6	15 0		
Ooregum (10s.)	7 0	6 3		
AMERICA:				
Camp Bird (2s.), Colorado	1 3	1 3		
Exploration (10s.)	7 6	7 6		
Frontino and Bolivia, Colombia	7 6	7 6		
Mexican Corporation, Mexico	11 3	9 0		
Mexico Mines of El Oro, Mexico	2 6	3 9		
Panama Corporation	18 0	1 0 0		
St. John del Rey, Brazil	17 0	17 9		
Santa Gertrudis, Mexico	12 0	8 9		
Selukwe (2s. 6d.), British Columbia	4 3	4 3		
MISCELLANEOUS:				
Chosen, Korea	11 3	10 0		
Eddie (5s.), New Guinea	16 3	15 0		
Lena Goldfields, Russia	1 3	9		
COPPER:				
Bwana M'Kubwa (5s.) Rhodesia	1 0 6	1 3 6		
Esperanza Copper, Spain	1 1 3	1 1 3		
Indian (2s.)	2 0	2 0		
Loangwa (5s.), Rhodesia	5 10	6 9		
Luri (5s.), Rhodesia	4 0	4 6		
Messina (5s.), Transvaal	17 6	18 0		
Mount Lyell, Tasmania	1 19 6	1 16 6		
Namaqua (£2), Cape Province	16 3	16 3		
N'Changa, Rhodesia	1 16 3	2 5 0		
Rhodesia-Katanga	1 10 0	1 14 6		
Rio Tinto (£5), Spain	44 0 0	46 0 0		
Roum Antelope (5s.), Rhodesia	1 11 3	1 13 0		
Tanganyika, Congo and Rhodesia	2 1 3	2 2 6		
Tharsis (£2), Spain	4 13 9	5 1 3		
LEAD-ZINC:				
Amalgamated Zinc (8s.), N.S.W.	13 0	10 9		
Broken Hill Proprietary, N.S.W.	1 4 6	1 4 3		
Broken Hill North, N.S.W.	5 1 3	4 12 6		
Broken Hill South, N.S.W.	2 2 6	3 1 3		
Burma Corporation (10 rupees)	16 6	14 6		
Electrolytic Zinc Pref., Tasmania	1 12 6	1 10 0		
Mount Isa, Queensland	1 6 3	1 7 6		
Rhodesia Broken Hill (5s.)	1 7 6	1 6 0		
San Francisco (10s.), Mexico	19 0	18 9		
Sulphide Corporation (15s.), N.S.W.	1 6 0	1 5 9		
ditto, Pref.	2 1 3	1 16 3		
Zinc Corporation (10s.), N.S.W.	4 2 6	3 15 0		
ditto, Pref.				
TIN:				
Aramayo Mines (25 fr.), Bolivia	2 3 6	1 16 3		
Associated Tin (5s.), Nigeria	6 3	6 6		
Ayer Hitam	—	14 9		
Baugrin, Siam	1 6 9	1 6 3		
Bisichi (10s.), Nigeria	7 6	8 0		
Chenderiang, Malay	9 0	9 0		
Consolidated Tin Mines of Burma	8 0	6 9		
East Pool (5s.), Cornwall	1 3	1 0		
Ex-Lands Nigeria (2s.), Nigeria	1 9	2 3		
Geevor (10s.), Cornwall	6 0	5 9		
Gopeng, Malaya	2 2 6	2 2 6		
Hongkong	—	1 0		
Idris (5s.), Malaya	10 6	10 9		
Ipoh Dredging (16s.), Malaya	1 4 0	1 2 0		
Kaduna Prospectors (5s.), Nigeria	7 6	8 9		
Kaduna Syndicate (5s.), Nigeria	12 6	15 0		
Kamunting (5s.), Malay	11 9	10 3		
Kepong, Malaya	1 0 0	18 9		
Kinta, Malay	12 6	12 6		
Kinta Kellas, Malay	8 6	8 6		
Kramat Pulai, Malay	1 8 0	2 1 3		
Lahat, Malay	13 6	10 3		
Malayan Tin Dredging (5s.)	1 3 6	1 5 3		
Mongu (10s.), Nigeria	4 3	6 0		
Naraguta, Nigeria	12 6	11 3		
Nigerian Base Metals (5s.)	1 6	1 9		
Pahang Consolidated (5s.), Malaya	9 3	9 9		
Penawat (\$1), Malaya	2 0	2 0		
Pengkalan (5s.), Malaya	18 6	19 0		
Petaling (2s. 4d.), Malaya	12 3	12 3		
Rambutan, Malaya	14 9	13 9		
Renong Dredging, Malaya	1 6 0	1 6 3		
Siamese Tin (5s.), Siam	11 9	12 3		
South Crofty (5s.), Cornwall	3 3	3 6		
Southern Malayan	15 6	16 3		
Southern Perak, Malaya	2 3 0	2 5 0		
Southern Tronoh (5s.), Malaya	10 3	11 6		
Sungei Besi (5s.), Malaya	11 3	11 6		
Sungei Kinta, Malaya	1 0 6	1 1 0		
Tanjong (5s.), Malaya	14 0	14 6		
Tavoy (5s.), Burma	6 9	6 3		
Tekka, Malaya	1 0 9	1 1 0		
Tekka Taiping, Malaya	1 1 6	1 2 6		
Temengor, Malaya	1 3 9	1 5 0		
Toyo (10s.), Japan	7 9	7 9		
Tronoh (5s.), Malaya	19 6	1 0 6		
DIAMONDS:				
Consol. African Selection Trust (5s.)	1 3 9	1 5 0		
Consolidated of S.W.A.	11 3	12 6		
De Beers Deferred (£2 10s.)	9 15 0	10 1 3		
Jagersfontein	2 0 0	2 1 3		
Premier Preferred (5s.)	5 7 6	5 0 0		
FINANCE, Etc.:				
Anglo-American Corporation	1 8 9	1 12 6		
Anglo-French Exploration	1 0 0	1 1 3		
Anglo-Continental (10s.)	10 3	10 9		
Anglo-Oriental (Ord., 5s.)	6 6	6 6		
ditto, Pref.	14 9	13 3		
British South Africa (15s.)	1 18 3	2 1 0		
Central Mining (£8)	16 15 0	18 15 0		
Consolidated Gold Fields	2 3 9	2 6 3		
Consolidated Mines Selection (10s.)	17 6	18 3		
Fanti Consols (8s.)	13 3	14 9		
General Mining and Finance	13 9	17 6		
Gold Fields Rhodesian (10s.)	2 9 9	10 0		
Johannesburg Consolidated	2 1 6	2 6 3		
London Malayan	9 9	11 6		
London Tin Syndicate	1 19 6	1 16 3		
Minerals Separation	4 2 6	4 13 9		
National Mining (8s.)	2 6	1 9		
Rand Mines (5s.)	2 18 9	3 4 6		
Rand Selection (5s.)	14 6	15 0		
Rhodesian Anglo-American (10s.)	1 11 3	1 13 9		
Rhodesian Congo Border	6 17 6	7 17 6		
Rhodesian Selection Trust (5s.)	2 5 0	2 11 3		
South African Gold Trust	1 6 3	1 7 6		
Southern Rhodesia Base Metals	8 9	12 6		
Tigon (5s.)	1 5 0	1 8 9		
Tin Selection Trust	15 3	14 0		
Union Corporation (12s. 6d.)	3 8 9	3 14 6		
Venture Tru				

THE MINING DIGEST

A RECORD OF PROGRESS IN MINING, METALLURGY, AND GEOLOGY

In this section we give abstracts of important articles and papers appearing in technical journals and proceedings of societies, together with brief records of other articles and papers; also notices of new books and pamphlets, lists of patents on mining and metallurgical subjects, and abstracts of the yearly reports of mining companies.

THE GEOLOGY OF NORTHERN RHODESIA

(Continued from the December issue, p. 369.)

ZINC, LEAD AND VANADIUM DEPOSITS OF BROKEN HILL.—Broken Hill is situated in a distinctive series of Precambrian rocks to which it has given its name and which underlie a considerable portion of the central and south-eastern areas of Northern Rhodesia. Dolomites and shales, or phyllites, constitute the rocks underlying the concession, which is six miles square and at the centre of which the ore-bodies are situated. In addition, there are minor amounts of quartz schist, an exposure of conglomerate, and local silicifications of the dolomites.

The deposits occur in a N.W.-S.E. band of dolomites enclosed on either side by shales. The strike of the dolomites progressively changes in the neighbourhood of the ore-bodies from N.W.-S.E. to E.-W. and finally to 10° or 15° N. of E. by S. of W. The dolomites themselves are dense, fine-grained, light-coloured rocks, and it is only exceptionally that faint greyish lines betray the bedding on a fresh surface. It is almost impossible to recognize bedding within the mine workings, except occasionally in the ore-bodies themselves, where the banded character of the original sediment has been emphasized during the process of its replacement to ore.

Oxidized zinc ore is well exposed at Broken Hill, where it has given rise to several kopjes which are conspicuous features, being the only elevations in the immediate vicinity, and soon attracted the attention of the early explorers. They are locally referred to as No. 1 Kopje, now completely mined out, a large open-cast having taken its place; No. 2 Kopje, the largest of them all, which is 100 ft. high; Nos. 3, 4, 5, and 6 Kopjes, as well as numerous smaller exposures on which work has not yet been done.

The ore-bodies have originated by the replacement of susceptible beds in the dolomite by cross-cutting mineralizing fissures. They take the form of successive lenses bearing slightly south of west by north or east and dipping steeply to the north conformably to the strike and dip of the enclosing dolomite and, in addition, with a pitch to the east-north-east. Some of the more important ore-bodies are localized at points of sharp but minor crumples in the dolomite.

The mode of occurrence of the oxidized and primary ores is characteristic. The more important

ore-bodies always consist of two parts: (1) a central portion or core of massive sulphide ore, zinc-blende and galena, enclosed within (2) an envelope or shell of oxidized ore principally "zinc silicate." In the case of the larger ore-bodies the zinc silicate shell is usually about 15 ft. thick, but within 100 ft. of the surface or in the smaller ore-bodies zinc silicate ore may predominate entirely. "Zinc silicate" is the local designation for the bulk of the oxidized ore and consists of quartz, iron oxides, and zinc silicates (hemimorphite) with lesser amounts of zinc carbonates, lead carbonate, and vanadium minerals. It is very rich, assaying from 30 to 55% of zinc and lead combined. The ore minerals are diffused through fine-grained silica giving a jasperoidal appearance to the material which resembles a fine-grained cherty ironstone in surface exposures. The process of oxidation has been greatly enhanced by the extremely jointed and cavernous nature of the dolomite accentuated during the process of oxidation itself by the shrinkage of the ore-body and subsequent collapse of the adjacent dolomite on its creating additional fractures and new channels for the oxidizing solutions to penetrate. In consequence, the sulphide ore-bodies do not always increase in size with depth, but may diminish and actually rest on oxidized ore or terminate abruptly against a fractured zone through which oxidizing solutions have penetrated to resume beyond.

The occurrence of vanadium in the oxidized ores is of special interest. The rich vanadium ores have a well-defined marginal relation to the oxidized ores, being developed on the margins of the latter and largely in the broken ground between the massive oxidized ores and the dolomite as well as in open fissures and cavities. The whole of the oxidized ores also average a small percentage of it. Descloizite with lesser amounts of vanadinite constitute the vanadium-bearing minerals.

An unusual feature is the absence of cadmium in the ore; the silver content is very low, only averaging from 1 to 1½ oz. per ton of ore.

No. 1 Kopje.—Looking down on the open-cast that now occupies the site of what was formerly No. 1 Kopje a good idea of the relation of sulphide and oxidized ores may be obtained. It is only within the last year that the treatment of oxidized (zinc silicate) ores has been made possible by the

erection of the new zinc plant. Previous to this all mining operations consisted in removing the rich sulphide ores from the central portion of the ore-bodies, leaving the oxidized marginal ores in place. The glory-hole, 190 ft. deep, occupying the western end of the open-cast and directly beneath the former kopje, represents a former sulphide ore-body with its capping of oxidized ore, and in this case with large amounts of cerussite which has been mined out. The walls and bottom of the glory-hole consist of massive zinc silicate ore which has been left in place.

On the upper walls of the open-cast, on its eastern and northern sides, synclinal structures may be observed in the overburden due to collapse consequent upon the oxidation of the ore-bodies. Circular pits are to be seen in the eastern part of the open-cast; they are the topmost portions of two other ore-bodies, K26 and K19. The latter is a large ore-body increasing with depth and extending well below the 225 ft. level, which is the deepest level of the mine at present.

It is mainly from No. 1 Kopje that most of the beautiful mineralogical specimens for which Broken Hill is renowned have been found. In former years when the upper portions of the kopje were being removed large open fissures and caves lined with beautiful crystals of pyromorphite and cerussite were disclosed, and good specimens of descloizite and vanadinite were also common. Tarbutite, hopeite, and parahopeite, rare zinc phosphate minerals, tarbutite being found only at Broken Hill, were also obtained here. It was also in No. 1 Kopje that in 1907 a pre-historic cave was disclosed in which the skull of "Homo Rhodesiensis" was unearthed in 1921. The cave has since been mined out, but its approximate position close to the western wall of the glory-hole 50 ft. below the surface can be pointed out. The cave contained numerous animal remains, mostly bones of small rodents and birds, which may still be found in the ore dumps nearby.

Nos. 3 and 4 Kopjes.—These ore-bodies are on the direct line of strike of No. 1 Kopje. Nos. 3 and 4 Kopjes, No. 1. Kopje, K19 and K26 ore-bodies all succeed each other from west to east along the line of strike of the enclosing dolomite, and thus seemingly belong to one and the same horizon within the dolomite which has proved favourable to the formation of ore-bodies by replacement in the neighbourhood of intersecting mineralizing fissures. Nos. 5 and 6 Kopjes belong to a different but parallel horizon slightly to the north, and to the south the suggestion of a third is indicated by "E" and "F" outcrops.

Nos. 5 and 6 Kopjes.—These two small outcrops have expanded in depth to an ore-body of considerable size. The sulphide ore has been removed down to the 225 ft. level. It occurred as two parallel lenses enclosed in, and separated by, oxidized ores. Fractures were instrumental in permitting the easy access of the oxidizing solutions into the heart of the original sulphide core, dividing it into two parts.

No. 2 Kopje.—From the top of the kopje a very good view of the plant and of the surrounding country is obtained. The flat typical peneplain topography of the region may be fully appreciated. The isolated kopjes and ridges on the skyline to the south and south-east are composed of massive quartzites better qualified to withstand the agents of erosion than the softer shales or sandstone with which they are associated. The deviation

of strike of the dolomites from south-east to north of east may be observed within the kopje itself.

GEOLOGY OF THE N'KANA MINE.—Situated about 40 miles north-westward from N'Dola and embracing a rectangular area (12.5 miles by 5 miles) of 62.5 square miles, the N'Kana mine is owned by the Bwana M'Kubwa Copper Mining Co., Ltd. With an average elevation of about 4,100 ft. above sea-level, this area is flat to very gently rolling. From its southern and eastern borders there is a gradual descent of about 275 ft. within a few miles to the Kafue River.

The Basement Schists.—The oldest rocks within the area are rusty-weathering mica schists with a few intercalated beds of quartzite. The mica schists vary much both as regards their degree of schistosity and the relative proportions of their component minerals (chiefly muscovite, quartz, feldspar, scattered grains and crystals of magnetite and occasionally biotite, minute crystals of zircon and some needle-like crystals of tourmaline). In major part, these rocks have been tightly folded and in many places the schists are very much crumpled. In following along the strike of the series, it is possible now and then to observe the gradual transition of mica schists into light to dark quartzites within which the original bedding has been preserved. This series of mica schists with occasional beds of quartzites have resulted from the metamorphism of a very ancient series of sandstones and shales.

Older Granites.—Either contemporaneous with or following their folding and metamorphism the Basement Schists were invaded in numerous places within the area by small stocks of a grey, granitoid gneiss. Locally, this granite exhibits every transitional stage from a strongly foliated biotite-gneiss to a massive grey granite.

The Bwana M'Kubwa Series.—The area of 62.5 square miles under review includes two synclinal basins of the Bwana M'Kubwa copper-bearing series of sedimentary rocks which rest unconformably on the Basement Schists and the older granites. The more important of these synclinal basins occupies about three-fifths of the total area. With its nose in the south-eastern corner, this syncline plunges north-westward and rapidly increases in width. Its northern limb extends lengthwise (12.5 miles) through the area while its southern limb diverges to such a degree that it leaves the area in the vicinity of the midway point on the western boundary. Opposite No. 1 Shaft this syncline has a width of about 2.25 miles with a probable depth of over 5,000 ft., while approximately two miles further northward it is over four miles wide. Near the northern boundary of the area outcrops of sandstones and shales with strikes transverse to the trend of the syncline strongly suggest that the basin is shallowing in this vicinity. With a maximum width of about 1.5 miles, the less important of the synclinal basins crosses the south-western corner of the area for a length of about 4.25 miles.

Prospecting and mining operations and diamond-drilling have been confined to certain stretches within a length of about four miles along the easterly limb of the larger syncline. To date, the most intensive work has been done within a stretch of 8,000 ft. along the strike, the southern end of which is approximately three miles northward from the nose of the syncline. Within this latter

area, the stratigraphic sequence (in descending order) thus far established is as follows:—

	ft.
Dolomitic shales (in part schistose) and with a few intercalated beds of massive impure dolomities	1,300
Light grey felspathic sandstones and quartzites with some shales, all more or less dolomitic	150
Hanging wall argillaceous sandstones with some banded shales	40—50
Argillaceous sandstones (or argillites) with some banded shales all more or less dolomitic and copper-bearing	25—35
Micaceous shale, more or less schistose, and usually copper-bearing	2—8
Foot-wall conglomerate	0—8
Felspathic sandstones	50
Second conglomerate	0—12
Basal felspathic sandstones	200—1,000 ±
Great Unconformity.	

Basement Schists intruded by older granites.

The ore-bearing horizon rests upon the foot-wall conglomerate and includes the more or less schistose micaceous shales and the overlying somewhat dolomitic argillaceous sandstones (or argillites) with some banded shales. Toward the southern end of the syncline the ore-bearing horizon gradually passes into black carbonaceous shales. The beds of conglomerate contain pebbles of quartzite, mica schist, and of the older and usually gneissoid biotite granite.

Younger Granite.—When traversing those portions of the area underlain by the Basement Schists invaded by the older granites, it was obvious that in some places these rocks were intruded by stocks, dykes, and small irregular bodies of a younger granite. Grey to pink and occasionally reddish in colour, this younger granite seldom displays any well developed foliation; it locally contains muscovite to the exclusion of biotite and in places exhibits pegmatitic tendencies. Moreover, the ore-bearing horizon at N'Kana is traversed by a few narrow pegmatite dykes. Hence when Shaft No. 1. at a depth of 225 ft. passed from the basal felspathic sandstones of the Bwana M'Kubwa series into a body of the younger granite, it was not surprising to find that an intrusive contact was exposed.

Gabbro and Allied Rocks.—At several points outcrops of comparatively fresh gabbro, diabase, etc., are present. Although the contact relations of these rocks have not been exposed within this area, knowledge of regional geology leads to the conclusion that, probably in the form of sheets, dykes, and irregular bodies, these basic igneous rocks are intrusive into the Basement Schists, the older granite, the Bwana M'Kubwa series, and the younger granite.

All of the rocks described above as underlying the N'Kana area are regarded as being of Precambrian age.

The Ore-bodies.—Mineralization of the now ore-bearing horizon within the Bwana M'Kubwa series took place after these rocks had been folded. In some places along the limbs of the synclines, more or less prominent drag folds were developed which appear to have played a part in locally permitting relatively more ready circulation of mineralizing solutions within beds susceptible to the development of the higher grade ore-bodies. It is remarkable, however, the extent to which

commercial copper values persist within a definite stratigraphic horizon over large areas where little or no drag-folding is in evidence.

On the easterly limb of the main syncline for the length of 8,000 ft. along the strike, previously referred to, and involving an important drag-fold, an ore-body, averaging 31 ft. in true width and carrying 4.2% copper has been proved by diamond-drilling to a maximum depth of 2,270 ft. At the southern end of the stretch, the result of one bore-hole suggests that there is a definite break in the continuity of the mineralization within the ore-bearing horizon, but about 2,500 ft. further southward work done shows that the beds are again mineralized to commercial grade. To the northward the termination of this ore-body has yet to be located.

Within this stretch, leaching of copper values has taken place within the ore-bearing beds to vertical depths that vary from a few feet to a probable 125 ft. Beneath this leached capping there follows an oxidized zone containing copper values that average from 4% to 9.5%. Within this zone, which is known to extend universally to a depth of 100 ft. (and may in places be 150 ft. deep) copper values are chiefly in the form of malachite, chrysocolla, cuprite, tenorite, and small amounts of azurite and libethenite. Hydrated oxides of manganese and iron are also present.

The zone of "copper oxide" ores passes down into one of mixed oxides and sulphides which is known in places to descend to a depth in excess of 300 ft., the oxide copper minerals extending to the greatest depth within the hanging wall portion of the ore-body. Malachite staining has been noted to a depth of 700 ft. In order of abundance, the sulphides present in this mixed zone are bornite, chalcocite, covellite, linnaeite, chalcopyrite, and pyrite, the last two minerals mentioned being confined to the denser or the ore-bearing beds. In places, a little native copper is also in evidence. The mineralization of the beds with sulphides has been attended with variable degrees of silicification.

Beneath the zone of mixed oxides and sulphides, the ore consists of the more or less silicified dolomitic argillaceous sandstones and shales with disseminated bornite, chalcopyrite, chalcocite, covellite, linnaeite, occasionally a little pyrite, and rarely some native copper. Because of the presence of linnaeite, the sulphide ores carry from 0.02% to 0.46% of cobalt.

Within the southern part of the ore-body at a depth of 500 ft., high-grade ore containing bornite, chalcopyrite, a little chalcocite, and linnaeite are present, while directly down-dip, at a depth of 1,500 ft., the ore is of much lower grade, containing only chalcopyrite, linnaeite, and a little pyrite.

In the more central portion of the ore-body in the vicinity of the downward extension of the drag fold high-grade (5 to 6%) ore contains practically no chalcopyrite to a depth of at least 1,150 ft. Here also at a depth of 2,200 ft., bornite, chalcocite, and chalcopyrite with some linnaeite and native copper are present in the more porous beds, while denser beds are of much lower grade and contain only chalcopyrite and pyrite. These porous beds are sufficiently open to have permitted the ready circulation of waters from the surface and some of the drusy cavities contain hydrous oxides of iron.

Moreover, where grains of either bornite or chalcocite are in contact with those of chalcopyrite it is plain that the chalcopyrite was deposited first and in some instances the contacts are such as to suggest strongly that the bornite and chalcocite have been developed through processes of secondary sulphide enrichment.

It is believed that during the advance and cooling down of the younger granites and their associated pegmatites, mineralizing solutions emanated which through processes of replacement were responsible for the primary mineralization of the ore-bearing beds at N'Kana. It seems impossible at present to do otherwise than conjecture why these solutions sought out the particular beds which they mineralized. It is obvious that the ore-bearing beds are in general quite porous and even in places drusy, and this condition together with the presence of numerous bedding planes and joints permitted the easy circulation of solutions. At least in the area where mineralization has been most intense, the ore-bearing beds are more or less dolomitic, while to the southward they grade into dark shales which are not so dolomitic, but contain much carbonaceous matter. Theoretical considerations might lead to the belief that the solutions which led to the primary mineralization gained access

to these beds through tension cracks which developed at depths within the deeper portions of the syncline and which penetrated the massive yet relatively easily fractured basal felspathic sandstones and conglomerates, but died out quickly within the immediately overlying cushion, like layers of argillaceous sandstones and shales.

The data already submitted concerning the relative distribution and relationship of the bornite and chalcocite to the chalcopyrite do not readily permit an escape from the conclusion that the primary ore consists of disseminated chalcopyrite, linnaeite, and pyrite and that the bornite and chalcocite have been developed through processes of secondary sulphide enrichment. A comparative study of the copper deposits of N'Kana, Bwana M'Kubwa, and N'Changa leads towards corroboration of this view. The unusual depth to which these processes have been active would appear to depend chiefly on (a) the relative ease with which surface waters can circulate within the ore-bearing beds and (b) on the much lower ground-water level that prevailed in this country during that recent period of its history when its climate was more arid than now.

(To be continued.)

THE SUCTION-CUTTER DREDGE

At the December meeting of the Institution a discussion took place on a paper by G. W. More entitled "Suction-Cutter Dredging for Tin in Malaya." We have given elsewhere the main points which arose in the discussion, and here we give a summary of the new dredge design embodied in Mr. More's paper. Detailed descriptions of the results obtained by the Kinta and the Semeniyh suction-cutter dredges were given and the alterations found necessary in the working details were outlined. As the result of this experience, the author had come to the conclusion that in certain types of ground, notably ground over an uneven or very hard bed-rock, a suction-cutter dredge could be designed to give better results than could be obtained in such a location by a bucket-dredge. The new dredge is expressly stated to be for operation in the irregular limestone-bottom ground of the Kinta Valley.

The depth of the particular ground averages about 47 ft., but the limestone bottom is very irregular, varying rapidly and frequently from 20 ft. to 70 ft. in depth. Occasional boreholes are unbottomed at over 80 ft. The material to be dredged includes 25 ft. to 30 ft. of clayey silt, containing fine tin oxide in negligible quantity and overlying the tin-bearing wash proper. The latter consists of sands and sandy gravels, with varying amounts of clay as admixture or in bands. The ground runs to the cutter, or subsides readily on being undercut, and the clay puddles readily enough in course of digging and delivery by a suction-cutter dredge, though it is more apt to be a robber of tin in the treatment system of a bucket dredge. Tin-bearing clay which does not puddle effectively is sometimes met with, but generally the occasional banks, or bars, of clay which are slow to cut are also very poor in tin. Buried timber, when occurring, lies about the 45 ft. horizon and logs up to 80 ft. in length and 5 ft. in butt diameter are met with. In zones of

scour, mats of logs are encountered and present a very difficult if not an impracticable problem to ordinary dredging methods.

A feature of the occurrence of values is that about 15% of the boreholes average about 1.5 kattis per cub. yd., while the remaining 85% average about 0.5 katti. This feature appears to be characteristic of the irregular limestone-bottom ground of the Kinta Valley.

Messrs. Lobnitz & Co., of Renfrew, Scotland, have been supplied by the writer with the particulars governing the design of a suction-cutter dredge for operation in the above ground.

The design which has resulted provides for a normal capacity of 150,000 cub. yd. per month, with the expectation of achieving 200,000 cub. yd. per month under favourable conditions. The dredge will be much of the same size as a sluice-box bucket dredge of similar capacity, but it will be a cheaper dredge, by some 14%, by reason of a lighter ladder, lighter excavating gear, and lighter superstructure.

The features of the design are outlined as follows:

Tailings Discharge.—A sump is arranged at the stern of the pontoon to receive all tailings from the sluice-boxes. From this sump an auxiliary 14-in. gravel pump will draw and deliver through a suspended pipe-line to 200 ft. astern. The pipe-line is carried on the under-side of a light girder suspended from a high stern gantry so far overhung as to avoid any back thrust of the girder on the stern trunnion. Side-staying against side swing is a feature, and the arrangement is such that the delivery end of the pipeline can be raised to 15 ft. or depressed to 6 ft. above water-level. Should it be required to bench valueless overburden the tailings-delivery pipe line can be readily connected straight through to the delivery of the main gravel pump, thereby allowing the overburden to be cut and by-passed at maximum speed to the tailings

dump. In course of such benching the dredge can advance any distance up to 100 ft. ahead of the dredging face and then retreat to deal with the uncovered ground in the normal way, without any risk of being jammed by encroachment of tailings.

Treatment System.—The strong puddling and washing which the material receives in course of cutting, pumping, and delivery fits it well for service by fixed screens and grizzlies, but it is perhaps advisable to fit high-speed puddlers to deal with the stiffer tin-bearing clay. The delivery from the main gravel pump is thrown aft into a dead-end whence it flows forward over diverging aprons graded at 1 in 24, to port and starboard grizzlies formed of straight-run round bars set at 25° from the horizontal. The aprons contain fixed screens with under-flows.

The oversize from the grizzlies is carried by thwartship stone-chutes to outboard stone-chutes delivering aft. The undersize will find the under-aprons delivering aft to thwartship distribution launders. The latter, which also act as dewatering launders, feed the head boxes of the sluice-boxes.

The lower sluice-boxes deliver almost at deck-level to the stern tailings sump, and the top sluices, no more than fair coolie-head room above, deliver by downpipes to the sump. The total width of sluices will be at least 96 ft. and may be 104 ft. The length is 100 ft.

Pontoon.—The length of pontoon will be about 182 ft., the depth 12 ft., and the greatest width 56 ft. relating to the portion aft of the well-head.

The Ladder.—The heel of the ladder is trunnioned at deck-level at the head of the well. The ladder carries within its body, the line of 18 in. suction piping in a readily accessible position, and on its back (or top) the line of cutter shafting, suitably protected. The head of the ladder is a one-piece casting containing a special bearing for the end of the cutter shafting and the suction inlet. In the heel of the ladder is a water-sealed cast-steel ball joint connecting to the suction pipe of the gravel pump.

The ladder and well are designed for ample bearing and resistance against side strain, and the ladder, which tapers to the cutter, is adapted for sliding over limestone pinnacles and ridges and for probing cavities and depressions. The digging depth is 70 ft. below water-level at 50°.

The Cutter is 6 ft. in diameter at the base and of the 8-armed type, and is full shouldered to give a good cutting effect at the maximum digging depth.

The Cutter-drive.—The gears and motor are arranged on the heel of the ladder. The motor is a variable speed D.C. motor and will be provided with a suitable circuit-breaker at the winch-control platform. In addition, a friction clutch is provided on the first motion shaft.

The Main Gravel Pump is a 16-in. pump of Lobnitz design and is direct-coupled to a D.C. variable-speed motor, the set being on the centre line at the bottom of the pontoon, aft of the well-head. This method of positioning aims to make the best use of the available suction head, the suction inlet of the pump being below water-level, and represents Messrs. Lobnitz & Co.'s usual practice.

The Auxiliary-water Pump.—This centrifugal pump is direct-coupled to a variable-speed D.C. motor, the set being placed on the centre line at the bottom of the pontoon aft of the gravel pump set. The pump supplies water to the treatment system and for other purposes.

The Winches.—The manœuvring winch operates

one head line, one stern line, and four side lines, and is positioned on the starboard side of the well. The winch-control platform is overhead in such position that the winchmen have a full view of the flow over the top aprons and grizzlies, and of the portion of the dredging paddock above the cutter. All circuit-breakers, vacuum gauges, and meters necessary for the attention of the winchmen will be in a handy position.

Timber-grab.—A timber-grab on the starboard bow operated by a crane arm and a winch will have a lifting capacity of 10 tons.

Accessory Plant.—A suitable bilge pump, sealing-water pump, and service pump will be provided.

Power.—An electrical service of continuous current at 440 volts pressure will be used throughout. The current will come from a rotary-converter set if alternating current is purchased, or else it will be produced on board by Diesel-electric, or similar heavy-oil engine method of electric generation. The latter arrangement has much to commend it, as it allows the cutting out of transformers, the rotary-converter set, and a shore-to-dredge high-tension power cable.

The foregoing description is intended to give a fair idea of the general arrangement. The dredge will be called hereinafter the Lobnitz Dredge. The dredge's effectiveness is a matter of good class equipment and construction, and involves no experimenting.

The Operation of the Lobnitz Dredge.—The dredge will use one head line, one stern line, and four side lines. The dead lines to which the head and stern lines attach will be very liberal in length and number. The side lines will be long enough to allow the working of a 12-chain face and will be set at right angles to the direction of advance.

The general scheme of working a suction-cutter dredge is to develop a stopping lift, as one might call it, in the dredging face. This lift may be any length up to 20 ft. The cutter is advanced into the lift by means of the head line, but the advance in deep ground is more intermittent than continuous. Except where the ground is so stiff as to require benching the cutter will be always at bottom. At the conclusion of the advance the dredge retreats rapidly on the stern line, the ladder being first slightly raised, and is brought over about half the width of the cutter base for the next cut, when the ladder is again lowered. When the dredging face has been traversed and the port corner dealt with, the dredge is transferred rapidly by the starboard side lines to the starboard corner, when the next lift is entered upon.

This procedure is varied according to circumstances. A clockwise cutter will do its best work on a side advance from starboard to port, but it will also do effective work on the opposite direction of advance; a phase of working which has its uses. If it is desired to obtain depth rapidly the dredge, without advancing beyond a fixed distance, can advance and retreat as above described on a plunging cut, each retreat being longer than the preceding one, until the full depth is attained. But there must be no encroachment of tailings. In ground that runs, or subsides fairly readily towards the cutter, this procedure is very rapid and the cutter can be left with a slack ladder line to sink of its own accord.

In all cutting work the variations of the vacuum gauge give direct information of cutting effect and saturation of flow, while the wide expanse of

the flow on the aprons and grizzlies supplies similar information and, particularly, enables absolute bottom to be identified. Obstructions to the cutter are at once signalled audibly by the gears driving the shaft, and any undue strain is relieved by the friction clutch or circuit-breaker. This means that an experienced winchman is able to feel over buried timber or uneven bottom with extraordinary facility and without risk of damage to the cutter shaft or gears.

In good conditions of ground the proportion of solids in the flow will range about 10% by volume. In unfavourable conditions the proportion can fall to an uneconomical percentage. A usual speed of rotation of the cutter is 12 rev. per min., giving an eight-armed cutter 96 scooping cuts per minute, but it will be capable of variation from 7 rev. per min. to 14 rev. per min.

Failure of Suction-cutter dredges in Malay and Siam.—Ten self-contained suction-cutter dredges for tin dredging were supplied to Malaya and Siam in the proportion of seven and three respectively. The reasons for the scrapping of nine of these dredges can be set down as follows: (1) Unsuitability of ground, (2) faulty design, (3) faulty equipment, (4) wrong method of working, (5) excessive working expenditures. Some or all of the first four reasons apply in every case, and excessive working expenditure is a natural corollary.

Of the nine dredges which were scrapped, four were equipped with a novel treatment system. The system consisted of pointed boxes covered by fixed screens to give a stepped flow, and pulsator jigs fed by spigots from the pointed boxes. Only one dredge fully completed construction and tried the system out, to find that the ground was unsuitable to its digging ability. It was also found that the treatment system was unsuitable. This dredge was scrapped and two of the other dredges were scrapped without trial. The fourth dredge, with a pontoon no longer than 116 ft., was burdened with a 16-in. gravel pump and was put to work, but without the pulsator jigs. There was not space enough on the pontoon to make much of treatment, but instead of the jigs an attempt was made to use close-riffled sluices. Losses of tin, however, were so great that the dredge was shut down after excavating a liberal paddock to receive the bucket-dredge which the owning company had ordered.

Of the remaining five dredges two were sister ships of the Kinta dredge. One dredge, however, in Siam, achieved close upon 100% of close-bore values from shallow ground overlying a much-pinnacled limestone bottom, but its running time was so poor and the working cost so high that it was scrapped. This dredge was managed by Mr. C. J. Rowe, the present manager of Semenyih dredge. The bucket-dredge which replaced it has failed to make good in the conditions of ground. The third dredge had perhaps as good a chance of surviving as the Kinta dredge, but the owning company decided to scrap it; in any case it could not have been made an economical dredge without rearrangement and re-equipment.

Of the remaining three dredges one has been re-established as the Semenyih dredge. Of the other two, one was put to work in very suitable ground, but its treatment capacity was inadequate to deal with the full capacity of the 16-in. gravel pump with which it was equipped, being no more than suitable for the delivery of a 12-in. gravel pump. Moreover, the dredge is reported to have been worked for the most part without a stern line,

and more or less after the manner of the method of working a bucket dredge. The dredge's monthly yardage averaged far below what a 16-in. gravel pump should do in such ground; the conditions being perhaps ideal. Working expenditures were excessive.

The remaining dredge was an adaptation of a sluice-box bucket-dredge as a suction-cutter, and included suspended shaking screens. The gravel pump was 14 in. Shortness of tailings discharge was a gross fault. The dredge was put to work in clayey ground having a high bank with a very insufficient supply of water and without a stern-line. The encroachment of tailings rapidly became such that the dredge could not bottom.

Of all the dredges described only three—the three of the Kinta type—were originally so well designed as regards type and capacity of treatment plant and as regards control—the winchmen working with open view from overhead platforms—as to have a reasonable chance of success, and it is probable that all three would have survived if they had been able to run with the economy of the Semenyih dredge. Bucket-dredging methods do not apply, and to deny the use of a stern line was bad practice.

The time of cutting-in on a 15 ft. lift in subsiding ground depends entirely on the depth of the ground. In 60 ft. ground the Lobnitz dredge would take about one-half hour to do the cut and about 95 hours to traverse a 10-chain face once. A bucket-dredge of the same capacity might traverse the face about forty times in the same period for the same 15 ft. of advance. The whole movement of a bucket-dredge is by its side lines, the head line serving to hold the buckets to the face, while the stern lines, splayed to give a resultant rearward pull, are used for retreating when necessary. More than 90% of the movement of a suction-cutter dredge is by its head and stern lines, and the retreat by the stern line must be quick and sure, the dredge being held on the line of cut by the side lines.

A suction-cutter can be used on side advance, either port of starboard, when it is a question of picking up material from an excavated bottom, but generally rapid advancing and retreating would be employed. In advancing into a cut in deep ground the movement of the cutter is not continuous. The cutter may be stationary for many minutes at a time, depending upon the winchman's judgment of the degree of saturation of flow from the information afforded by the vacuum gauge and the flow over the aprons and grizzlies. In shallow ground the advance is necessarily more rapid and less intermittent, but in such ground deeper lifts or cuts can be taken into the dredging face. The personal equation counts for a good deal in suction-cutter work and the winchman has to be on top of his job, both literally and metaphorically.

The failure and the discarding of suction-cutter dredges during 1925 was on such a wholesale scale that popular prejudice against this method of dredging rose to an almost insuperable height and has not subsided since. However, it must be evident that there are very good reasons why a method of dredging which finds expression in plants of up to 3,000 h.p. and more, for marine, harbour, and river dredging, and is largely used for the excavation of canals, has not been successful in application to dredging for tin, when the conditions of the ground are such that an economic degree of saturation of flow with solids can be obtained.

DEEP MINING METHOD AT CITY DEEP

The September *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa contains a paper by A. V. Lange entitled "Resuing System of Mining at City Deep." The word "resuing" is perhaps not quite descriptive of the method, which is really a waste-filling method that has the advantages of resuing, and it is particularly applicable at very great depths.

In the shallow depths of the outcrop mines on the Rand, support of the hanging-wall was the least expensive of mining operations, and presented no difficulties. Timber props, with here and there a solid reef pillar, were all that was necessary. The most costly operation at that time was stoping, there being no hanging-wall pressure to help the breaking of the ground. As the depth increased, the ground broke more easily, but support of the hanging-wall needed more attention, and the filled pigsty was introduced. These provided an excellent support, but in most cases, owing to insufficient waste at the stope face, they were filled with reef, and had to be reclaimed during the necessary operation of sweeping down high-grade fines, which is carried out at some distance back from the face. To minimize the loss of fines and to provide good support for the hanging-wall without the extensive use of timber in pigstyes built still closer together as greater depth was reached, the shrinkage system of mining was introduced. This proved to be a most efficient system of mining down to depths of about 5,000 ft. vertical. At greater depths the reclaiming of the shrinkage ore became a more difficult and costly operation owing to the quick settlement of the hanging-wall, and there is the possible difficulty in getting sufficient waste for the increased pack supports required in the stoped-out areas after the shrinkage has been reclaimed.

There are three controlling factors to be considered when mining at depths below 5,000 ft. :—

(1) Support of the hanging-wall becomes a most important and most costly operation, not only for the sake of providing a good hanging-wall at each individual stope face, but also to provide a good general support in worked-out areas, in order to reduce the concentrated pressure in the newer and lower workings as the depth of mining operations is increased.

(2) In working places stoped at less than 48 in. wide, reclamation of ore left behind becomes most difficult and expensive if not carried out within 60 ft. from the face.

(3) Owing to increased rock temperature, more air is required for ventilation of the stope faces.

The modified resuing system carried out on the City Deep overcomes most of the difficulties encountered in deep level mining, for the following reasons :—

(1) The excavated area is filled nearly 100% with waste rock to within 20 ft. of the face before excessive sag of the hanging-wall has taken place. This condition is analogous to current sand filling, which has proved so successful where it has been practicable. One of the most striking features in the resuing stopes is the remarkably good condition of the hanging-wall at the working face, even in the case of those stopes which are now in the remnant stage.

(2) All the gold is drawn out at the face in the one operation, and there are therefore no old workings to reclaim.

(3) All air circulating from level to level passes along the stope faces where the workers are concentrated. There has been vast improvement in the ventilation of the working faces on the City Deep, especially in the Eastern Section of the mine, where conditions were not too satisfactory in many instances prior to the introduction of the resuing system.

(4) Owing to all the workers being within 20 ft. of the face, supervision is more efficient.

Underground officials now have an undoubted preference for this system of mining. They find it easier to measure the labour requirements, supervision of working areas is done with less exertion, and the conditions at the working face give a greater sense of security.

Other advantages are :—

(1) Improvement in grade of ore mined owing to a reduced milling width.

(2) Less high-grade fines and thus less loss of gold, owing to the reef being foot-walled.

(3) Less maintenance required in reef drives.

(4) Saving in amount and transport of timber.

(5) The system allows for the efficient use of mechanical scrapers.

(6) Less chance of the spread of hookworm.

The main reasons for its introduction on the City Deep were the urgent necessity for a system by means of which all the gold could be recovered within close proximity to the face, and which would provide a quicker, cheaper, and more substantial support for the hanging wall. The fact that a smaller milling width would result, was of less importance.

To preserve a comparatively safe and good hanging-wall at the working face, the hanging-wall must, as far as possible, be continuous and unbroken, and therefore the resuing system adopted was to alternately over-cut the payable reef channel and then foot-wall it. The over-cut is established by stoping waste or unpayable hanging-wall bands of reef, and the advance is about 8 to 10 ft. The waste or unpayable reef is packed in the foot-wall excavation behind, the amount of labour required for this being very small, owing to the assistance received from the blast, the dip of the foot-wall, and the slope of the face. It is not practicable, if a continuous hanging-wall is required, to mine the over-cut to the exact width to provide at each cycle just sufficient filling for the overall width which is being mined, and therefore the instructions are that, in the mining of the reef foot-wall, the ground must be broken, within limits, between partings in the formation, so as to get the easiest breaking possible.

If the reef is very narrow and can be foot-walled, say, 6 in. wide, the waste must be stoped at least 36 in. in order to get a sufficiently wide excavation for working in. In a case such as this, the excess waste over that required for the fill, must be shovelled out and trammed either as reef or waste. If a stope immediately below has insufficient waste for its fill owing to a wide reef channel, this excess waste can be dumped there, or if there is a waste box at the shaft, it can be hoisted and dumped on the surface. If, however, this waste is hoisted as reef, the milling width even then of this stope, with an overall width of 42 in., could not be much more than 17 in. if the excavation behind is filled with waste. In all cases where there is a solid waste

fill behind and all the broken rock trammed from the face is hoisted as reef, theoretically the milling width will not be more than two-fifths of the total width. In the opening up stages, owing to the continually increasing length of the face, the foot-walled width will be approximately half the total width if the excavated area is filled solidly. A certain amount of waste is always shovelled out and trammed as reef after the foot-walling is completed, in order to prevent any possible loss of fines.

The angle of the stope face, which is carried perfectly straight, varies according to the dip. In order to get good waste filling with little labour, the angle the face makes with the strike line should be small, but if this is too small, the dip along the face is too flat for efficient shovelling during the foot-walling period. Mechanical scrapers are now being introduced for cleaning out during the reef foot-walling period, and where these are being used it is possible to work the face at a flatter angle and thus get the best conditions for good filling.

In starting off from the rise, the stope is opened up by ordinary full width stoping to a distance of 50 ft. on each side of the rise along the drive, and a distance of 70 ft. up. The face is then ready to start resuing. The bottom 12 to 15 ft. of the face above the track is always carried full width and kept at least 20 ft. ahead of the resuing face. Pigstyes are built ahead of the resue face along the north side of the track, and spaced 4 ft. apart to provide outlets for the broken reef during the foot-walling period. Where there is no reef drive developed, the bottom 25 to 30 ft. is stoped full width, at least 20 ft. in advance. Foot-wall is excavated for the track, and excess waste packed in on the south side, as shown in Sketch H. K is a sketch plan of a stope.

Before resuing is started a row of 7 in. sticks, 7 ft. apart, is put in along the face about 2 ft. from the reef face. These sticks must be in a straight line, as successful working of the whole system depends largely on this. A barricade of lagging is built up on the inside of these sticks, up to the height of the waste foot-wall. A line of chutes is then placed on the reef foot-wall along the face between the barricade and the face, to facilitate the shovelling of reef when foot-walling takes place. The trough thus formed is filled up with loose rock to prevent the breaking away of the reef when the waste stoping is started. As soon as the installation of the barricade is completed, waste stoping is started, and as the face advances, it must be kept parallel to the line of sticks supporting the barricade. During the advance of the waste stoping face, the hanging-wall is supported by 7 in. sticks, which are provided in various lengths from 18 in. upwards. The broken waste is shovelled in behind the barricade, and when the fill reaches the barricade, waste stoping is stopped and foot-walling of the reef is started. Foot-walling is done by popholing and by barring with machines weighing 50 to 65 lb., and designed as concrete breakers. The foot-walling is carried to a distance of 1 or 2 ft. from the waste face, so as to have a ledge when restarting the waste over-cut. The short sticks supporting the hanging-wall during the waste cut drop out as foot-walling progresses, and are replaced by longer lengths. Most of the latter are withdrawn as the waste fill reaches them, and are used again. As the reef foot-walling progresses, a new line of sticks is put up in a straight

line along the reef face, and when the foot-walling is completed and the fines have been washed down and shovelled out, the barricade and chutes are transferred over to the new line, and waste stoping is restarted.

Sketches, A, B, C, D, E, F, G show the whole cycle of operations in approximately half-weekly periods. In A the chute line and barricade are in position for starting the waste over-cut. B, C, D, and E show the advance of the waste over-cut and the waste fill. F shows the foot-walling half completed. G shows the completion of the foot-walling and the chute line and barricade transferred over, and the face ready for the waste over-cut again.

Timber props are not essential for the supporting of the barricade. Three-foot lengths of steel made by welding discarded drill steel and placing them in 12 in. holes drilled 7 ft. apart are perfectly satisfactory, and save the use of timber where the hanging-wall is exceptionally good.

150 to 180 ft. of face is considered sufficiently long to be worked as one unit, so that where the backs between levels have a face length of 300 to 360 ft. at the angle at which these faces are stoped, an intermediate track is worked in about half-way up and the face is stoped in two portions. The ore from the intermediate track is tipped either down an ore-pass lined by pigstyes and built up the middle of the stope from the drive below, or down an ore pass raised from the foot-wall drive. Sketch K shows an ore-pass built up the centre, and shows in dotted lines the working in of the intermediate track. The lower face is carried about 15 ft. ahead of the upper face.

For the successful working of the system it is most essential that the following points are carefully observed:—

- (1) The dip along the face must be sufficiently flat to allow the waste to pack itself behind, and not gravitate down the face.
- (2) The bottom 12 to 15 ft. of the stope face above the track must be carried full width, at least 20 ft. ahead of the resue face, and the north side pigstyes installed in advance.
- (3) The resue face must be perfectly straight.
- (4) The barricade holding up the reef foot-wall must be properly installed.

It is the straight face and the fact that all the foot-wall tonnage for each advance of 30 to 40 fathoms can be broken in about four days which makes the mechanical scraper a suitable adjunct to the system. In the stopes where these appliances are used, the chute line is dispensed with and the lagging barricade is built right up against the reef foot-wall. The scraper winch is placed either in the drive above or the drive below, and the scraper pathway is the top of the waste fill. As long as the pathway is kept full of reef and the scraper operates over the whole length of the face, none of the waste fill is gouged out. When all the broken reef is eventually brushed off the foot-wall between the fill and the face, then the scraper starts at the top of the face and is allowed to gouge a certain amount into the waste fill all the way down the pathway, the length of the stroke of the scraper shortening each trip until the last portion of reef is scraped down to the boxhole.

Close investigation has been made after foot-walling of the value and amount of gold reef and fines left behind, both with and without the use of scrapers. It has been found that the loss of

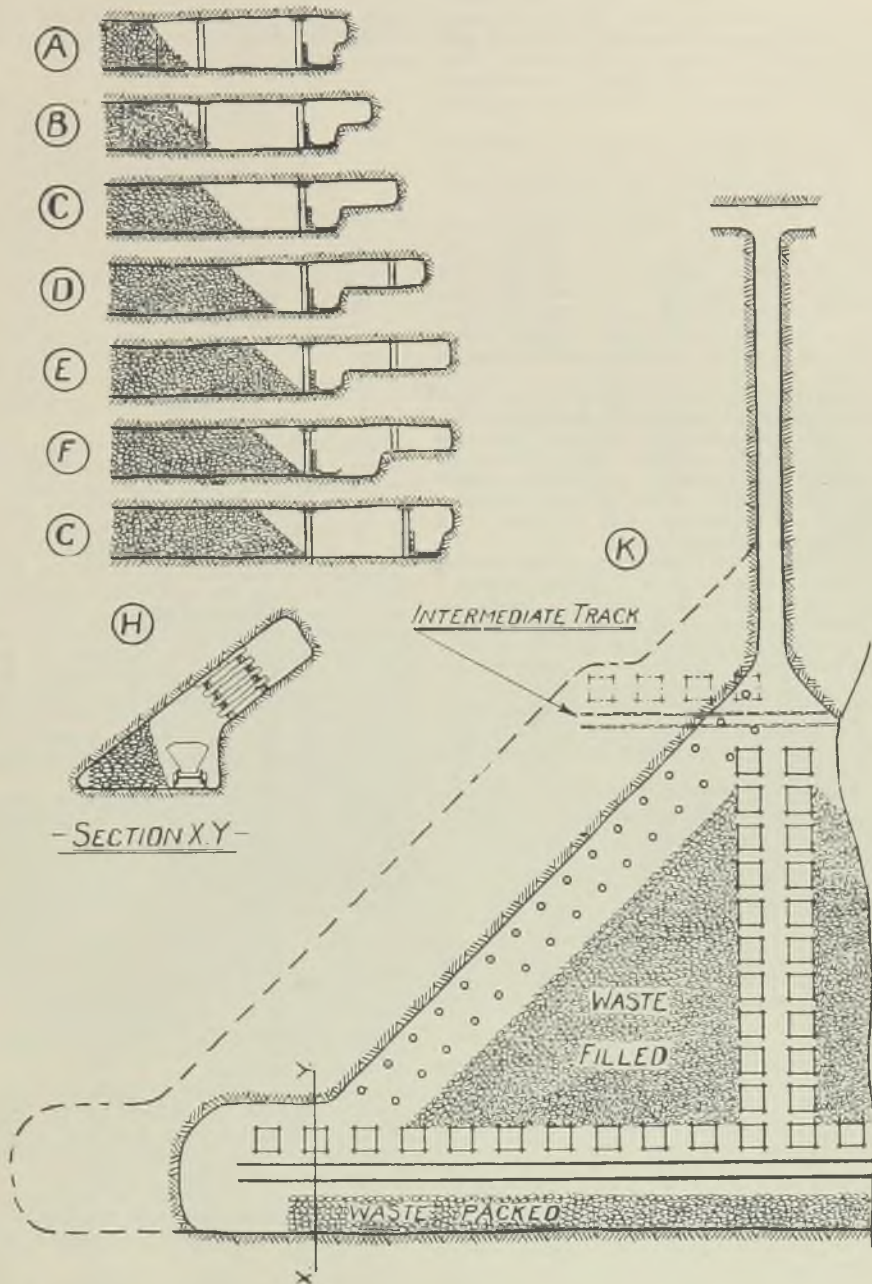


DIAGRAM ILLUSTRATING THE METHOD OF MINING AT CITY DEEP.

gold is probably less than 3%. The average value of the gold fines is not more than the average value of the reef channel being foot-walled. This, of

course, is due to the fact that holes are not drilled in the reef, but through or under it, and the ground is shattered and broken in coarse lumps.

THE ALLENBY CONCENTRATOR, BRITISH COLUMBIA

At the annual meeting of the British Columbia Division of the Canadian Institute of Mining and Metallurgy, held at Vancouver in November, 1929, H. R. Taylor described the Allenby Concentrator of the Granby Consolidated Mining, Smelting and Power Co.

The plant at Allenby was completed in 1920 and worked intermittently until 1927 when it was brought up to its present capacity of 2,500 tons per day. The following is a description of the plant.

PRIMARY CRUSHING.—The primary-crushing department, which is located at the mine, is near the portal of the lower tunnel, from which all of the ore is hauled and dumped into two receiving bins. The ore which requires sorting is put into No. 1 bin, which has a capacity of 1,650 tons, and the higher grade ore is dumped into No. 2 bin, with a capacity of 450 tons.

The plant is equipped with two 30 in. by 42 in. jaw crushers and two 10 in. fine reduction gyratories, together with the necessary conveyor belts for sorting and waste disposal, and has a capacity of 2,500 to 3,500 tons operating about sixteen hours per day. The product of the gyratory crushers, which was 2 in. in size, was conveyed to a 2,500-ton storage and shipping bin.

Early in 1929, a new 7-foot Symons cone crusher was installed to take the place of the two gyratory crushers. This machine is driven by a direct-connected 250 h.p. motor having a speed of 450 r.p.m., and has a capacity of 200 tons per hour when set to deliver a product of $\frac{3}{4}$ in. in size. This crusher is fed by a short feeder conveyor, over which is suspended a large magnet which removes any scrap steel. The gyratory crushers have not been used since the installation of the new cone crusher, but are kept as spares.

The crushed ore is hauled in 60-ton steel-bottom dump cars to the concentrator at Allenby, where it is weighed and then dumped into the coarse-ore storage bins, which have a capacity of 2,500 tons.

SECONDARY CRUSHING.—The flow-sheet of the secondary crushing department is simple, but with an ore which is extremely hard and tough it presents an interesting grinding problem.

There is less than 2% moisture in the ore, which made it necessary to install an efficient dust-control system in this department, and it has proved to be very satisfactory.

Only one of eleven belt feeders under the coarse-ore bins is operated at a time. These belts discharge on to the first 30 in. conveyor, which is equipped with a magnetic head pulley that takes out scrap steel before the ore drops on to the first stationary screen. The oversize from this screen is sent to the primary grinding circuit, consisting of one set of 72 in. by 20 in. rolls in closed circuit with a 30 in. elevator and stationary screen. During the first two years of operation, impact screens were used on this circuit, but it was found that a stationary screen was as efficient, owing to the dryness of the ore. The undersize from these stationary screens is the feed to the second set of 72 in. by 20 in. rolls, the product of which is elevated and conveyed to hammer and impact screens. The oversize from two of these screens is the feed to the 54 in. by 20 in. rolls, which are in closed circuit with 24 in. elevators and hammer and impact screens. The undersize from these vibrating screens is the product of this department, and is

conveyed to the 2,700-ton fine-ore bins. It is automatically sampled, and the following is a typical screen analysis and assay:

Mesh	Weight %	Copper %
+ 8	6.10	1.26
+ 10	12.46	1.31
+ 14	16.90	1.33
+ 28	25.30	1.35
+ 35	9.40	1.36
+ 48	5.80	1.45
+ 65	3.76	1.53
+ 100	4.84	1.69
+ 150	2.36	1.69
+ 200	2.00	2.02
+ 270	1.60	2.05
+ 325	1.46	2.40
— 325	8.02	2.34
Average		1.492

Each of the rolls is belt-driven from a line shaft, which is in turn driven through a flexible coupling by a 150 h.p., 300 r.p.m., induction motor.

The first set of 72 in. by 20 in. rolls runs at 67 r.p.m. and the second set at 118 r.p.m., while both sets of 54 in. by 20 in. rolls run at 130 r.p.m.

Forged chrome-steel roll shells are being used, and the average life of the 72 in. shells is 57 days and of the 54 in. shells 50 days. The average consumption of roll steel is 0.35 pounds per ton of ore. Manganese-steel elevator buckets are used in all elevators, as their life is three times that of malleable iron on this ore. All conveyors in this department have recently been equipped with roller-bearing idlers, which has cut down the power consumption somewhat and made a considerable saving in grease and labour.

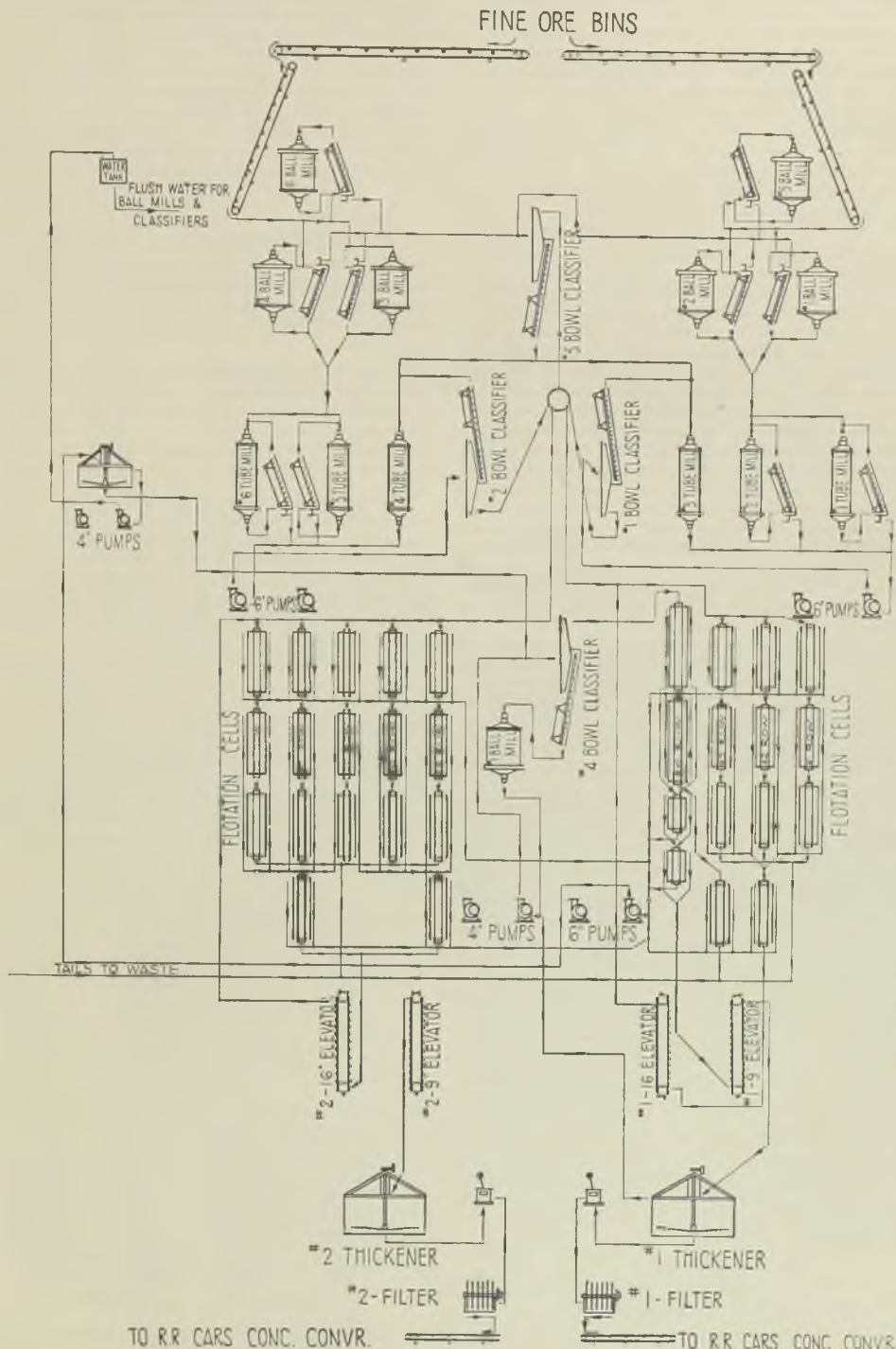
FINE GRINDING.—The fine grinding department, shown on the accompanying flow-sheet requires little explanation. There are six 7 ft. by 10 ft. P. and M. ball mills, which run at 21 r.p.m. and are driven by 200 h.p. motors through Texrope drives. The Allenby plant is credited with the pioneer work for this type of drive for ball mills. Each of these mills is in closed circuit with a heavy-duty Model D Dorr classifier. The overflows from these classifiers flow through two inverted syphons to an 18 ft. bowl classifier, which is in open circuit, the overflow going to flotation and the sands to two 5 ft. by 20 ft. ball tube mills, which are in closed circuit with two 20 ft. bowl classifiers.

There are also four 5 ft. by 20 ft. ball tube mills in this department, driven by 150 h.p. motors through Texrope drives, which are in closed circuit with Model C Dorr Classifiers the overflows of which also go to the 20 ft. bowl classifiers.

The combined overflow of the bowl classifiers is the feed to the flotation department, and the following is a typical screen analysis and assay:

Mesh	Weight %	Copper %
+ 100	9.17	0.79
+ 150	9.57	0.93
+ 200	8.93	1.03
— 200	72.33	1.92

The principal minerals in the ore are chalcopyrite and bornite, with very little chalcocite present, and the grain is extremely fine, irrespective of the grade



FLOW-SHEET OF THE ALLENBY CONCENTRATOR.

of ore. These copper sulphides are intimately associated and are finely disseminated throughout the gangue, which is very hard. Other metallic minerals present are hematite, limonite, and a small amount of pyrite, but these are for the most part associated with the gangue and are usually well separated from the copper minerals.

In order to make a satisfactory recovery, it is necessary to grind this ore so that at least 70 % will pass a 200-mesh screen.

Forged-steel balls are used as the grinding media and the average consumption is 1.95 pounds per ton of ore. The liners used in the mills are made of white-iron, and the average consumed per ton of ore is 0.35 pounds.

FLOTATION.—The flotation department originally consisted of seven strings of mat-type pneumatic machines, but as these machines were more or less obsolete, a considerable amount of experimental work was conducted during 1927 and 1928 with matless cells, in order to find a more efficient flotation machine for the ore. After a suitable flotation machine of this type had been developed, it was adopted, and during the early part of 1929 a complete installation, consisting of twenty-eight rougher cells each 18 ft. long, two cleaner cells each 24 ft. long, and two re-cleaner cells each 12 ft. long, was installed. These machines have proved to be very satisfactory, and the extraction has increased since this new installation was completed, which is due in part to the steady operating conditions maintained with this type of cell, and also in part to floating of coarser mineral.

The air for the cells is produced at a pressure of 1.6 pounds by a 400 cu. ft. per revolution Connorsville blower, which was installed at the same time as the matless cells. This blower, which requires about 375 h.p. is driven by an induction motor through a Texrope drive, which is reported to be the largest of its kind in the world, having twenty-six $\frac{1}{2}$ in Texropes.

The feed for the flotation cells is equally distributed to eight rows of rougher cells, each row consisting of three 18 ft. cells. The concentrates from the rougher cells contain a large percentage of copper sulphides that are still attached to gangue and have to be liberated by re-grinding in order to produce a high-grade concentrate, which is necessary on account of the high freight rate.

The rougher concentrates from the second and third cells of each row are re-cleaned and then combined with the first cell concentrates and pumped to the thickener of the re-grinding plant.

This re-grinding plant consists of a 40 ft. Dorr thickener, a 16 ft. diameter Dorr bowl classifier, one 7 ft. by 10 ft. ball mill, and Wilfley pumps for returning the re-ground and original concentrates.

The overflow from the 40 ft. Dorr thickener is used as return water on the ball and tube mills, and the thickener underflow, which averages about 33% solids and 9% copper, is the feed for the 16 ft. bowl classifier. The bowl sands are re-ground in the 7 ft. by 10 ft. ball mill and then returned to the bowl classifier.

The overflow from the bowl classifier, which is 98%—200-mesh and 20% solids, is re-treated in two 24 ft. and one 18 ft. matless cells. The concentrates from the first 24 ft. cell are double re-cleaned in two 12 ft. cells, which produce a final concentrate of about 33% copper. The tails from the first 12 ft. cell and the concentrates from the second 24 ft. and the 18 ft. cells are returned to the

thickener, and the tails from the last 12 ft. cell are sent back to the bowl classifiers. The tails from the 18 ft. cell are cut to waste.

The final concentrates are de-watered in a 40 ft. thickener and filtered in a 6 ft. six-disc American filter to about 11.5% moisture, and then conveyed to railway cars for shipment to the smelter.

GENERAL.—All the ore contains small values in gold and silver. The average assays, in ounces per ton, for the heads and concentrates are as follows :

	Gold	Silver
Head assay	0.01	0.24
Concentrate assay	0.18	5.00

The performance of the concentrator for 1928, and for a more recent representative period, is tabulated below.

	1928	Recent Operations
Dry-tons milled per day	2,449	2,528
Head Assay, total copper	1.48	1.508
Concentrate assay, total copper 32.99		32.38
Tails assay, total copper	0.271	0.223
Extraction % of total copper 83.34		85.77
Ratio of concentration	27.06	25.06

The reagents used in this plant are lime, pine oil, and xanthate or aërofloat. The ore is slightly alkaline and only a small amount of lime, which is fed as milk of lime to the ball mills, is necessary to maintain the correct alkalinity. Xanthate or aërofloat and pine oil are added to the bowl classifier overflows. The average consumption of these reagents is as follows :

	lb. per Ton of Ore Milled
Lime	0.17
Pine Oil	0.11
Xanthate or Aërofloat	0.06

The flotation cells use about 70 cu. ft. of air at $\frac{1}{2}$ lbs pressure per lineal foot of cell.

The following are representative screens and assays of the general tailings and final concentrates :

TAILINGS

Mesh	Additive		
	% Weight	% Weight	% Copper
+ 100	10.70	10.70	.316
+ 150	9.30	20.00	.264
+ 200	10.76	30.76	.250
+ 270	6.70	37.46	.238
+ 325	7.00	44.46	.226
— 325	55.54	100.00	.186

Average % Copper—0.212

CONCENTRATES

Mesh	Additive		
	% Weight	% Weight	% Copper
+ 100	0.50	0.50	17.37
+ 150	1.10	1.60	20.45
+ 200	2.84	4.44	19.93
+ 270	5.00	9.44	19.63
+ 325	9.00	18.44	21.33
— 325	81.56	100.00	35.43

Average % Copper—32.54

The water supply for the plant is pumped from the Similkameen river by 6 in. four-stage 800 gallon-per-minute Worthington-Janesville centrifugal pumps, through a 15 in. all-steel Victaulic joint

pipe about 1 mile in length, with a rise of 525 ft., to three 100,000 gallon-capacity storage tanks.

The following is the amount of water used in the concentrator:

	Gallons
Initial water per ton of ore concentrated	780
" " " minute	1,410
Return water per ton of ore concentrated	490
" " " minute	700
Total " " " ton of ore concentrated	1,180

This is equivalent to 2.75 tons of water per ton of ore.

On account of the extreme hardness and toughness of the ore, and the fine grinding which is necessary to free the mineral, the total power consumed per ton of ore is high, when compared with other concentrators of this type. It is consumed as follows:

	K.w. hrs.
Coarse crushing and sorting	1.5
Secondary crushing	6.1
Fine grinding	15.7
Flotation	4.0
Initial water and miscellaneous	3.5
Total	30.8

SHORT NOTICES

Tin in Malaya.—In the *Proceedings* of the Australian Institute of Mining and Metallurgy for September 30, B. A. Hadley gives a short account of the methods of boring alluvial tin properties in Malaya and also outlines the methods of concentration by means of jigs.

Shaft Widening.—The *Colliery Guardian* for November 22 gave a digest of an article appearing in *Glückauf* written by Bergassessor W. Bellmann and Obering H. Krischel, on the cementation method of shaft widening. This means was employed to widen the main shaft at the Hanover Colliery, Ruhr.

Hydraulomats.—At the meeting of the Royal Society of Arts held on November 13, J. O. Boving read a paper on "New developments in Hydraulic Pneumatic Engineering." The various systems the author refers to as "Hydraulomats" serve a diversity of ends, as, for example, the preparation of compressed air for working pneumatic apparatus.

Rabble Corrosion.—The corrosion of rabbles in zinc-concentrate roasting furnaces has been investigated by Dr. J. N. Greenwood and A. J. Roennfeldt and their results are embodied in a paper appearing in the *Proceedings* of the Australian Institute of Mining and Metallurgy for September 30.

Removal of Solutions from Leached Ore.—Technical Paper 453 of the Bureau of Mines, Washington, gives the results of research by J. D. Sullivan and A. J. Sweet on the factors governing the removal of soluble copper from leached ore.

Cold Working of Metals.—The results of an investigation into the effects of cold-working on the physical properties of metals are given by R. L. Templin in Technical Publication No. 238 of the American Institute of Mining and Metallurgical Engineers.

Reclamation of Foundry Sands.—In Technical Publication No. 261 of the American Institute of Mining and Metallurgical Engineers, A. H. Dierker describes the composition, deterioration, and reclamation of moulding sands in a steel-foundry.

X-rays and Coal.—The *Journal* of the Royal Society of Arts for December 13 contains a paper by C. Norman Kemp on the examination of coal and coke by X-rays.

Colombian Emeralds.—The Chivor-Somondoco emerald mines in Colombia are described by P. W. Rainier in Technical Publication No. 258 of the American Institute of Mining and Metallurgical Engineers.

Gold in Venezuela.—The gold-deposits of the Guayana Highlands in Venezuela are described by W. H. Newhouse and G. Zuloaga in *Economic Geology* for December.

Mineral Wealth of Australia.—In his presidential address to the Australian Institute of Mining and Metallurgy Mr. E. C. Andrews drew attention to the importance of the mining industry in Australia and to the need for co-operative research. The address appears in the *Proceedings* of the Australian Institute for September 30.

The Custer Expedition.—The November issue of the *Black Hills Engineer* is devoted to an account of the Custer Expedition in 1874 to the Black Hills of Dakota. The account has been written by C. C. O'Harra.

RECENT PATENTS PUBLISHED

A copy of the specification of any of the patents mentioned in this column can be obtained by sending 1s. to the Patent Office, Southampton Buildings, Chancery Lane, London, W. C. 2, with a note of the number and year of the patent.

15,679 of 1928 (321,394). I. G. FARBENINDUSTRIE A.-G., Frankfurt-on-Main, Germany. Compact masses of metallic oxides, for use as filter plates, diaphragms, electrodes, etc., are prepared by heating the oxide, which has been mixed with finely divided metal and pressed in moulds, at about 500° C. in a current of CO₂.

20,824 of 1928 (294,179). SOC. ANONYME DES MANUFACTURES DES GLACES ET PRODUITS CHIMIQUES DE ST. GOBAIN, CHAUNY ET CIREY, Paris. Refractory materials are made by mixing bauxite and refractory clay in various proportions with previously calcined and ground bauxite, moulding, and then firing. The alumina of the bauxite is said to remain in an amorphous state.

21,780 of 1928 (321,390). NATIONAL PROCESSES, LTD., London, and T. B. GYLES, Bristol. Sulphur-bearing gases from roasting furnaces are passed through sintered sulphide ore which absorbs the SO₂ content. The absorbing material may be mixed with fresh ore and returned to the roast or may be leached.

22,426 of 1928 (321,213). H. LAVERS and B. TAELIN, London. Sulphide ores of copper are ground and mixed with carbonaceous matter and heated at a red heat in a halogen atmosphere. The sulphides are modified in such a way that they are readily worked by flotation processes.

22,620 of 1928 (295,051). SOC. LORRAINE DES ACIERIES DE ROMBAS, France. Briquettes made from blast-furnace mouth dust, fuel ash, and carbon are calcined for use as iron-ore.

23,549 of 1928 (321,685). F. L. DUFFIELD, London. Copper concentrates are mixed with lime and carbon, or similar materials, in such proportions that heat-treatment produces carbon monoxide and leaves the copper and iron in the metallic form, ready for further separation. The process is carried out in a furnace of special design.

28,860 of 1928 (321,524). A. WOLFSHOLZ, Varese, Italy. Means for testing the resistance to pressure of underground strata.

32,202 of 1928 (300,129). I. G. FARBENINDUSTRIE A.-G., Frankfort-on-Main, Germany. Alloys of lead with alkaline or alkaline earth metals, such as sodium and barium, may be made into shaped pieces by forcing the hot, molten or granulated alloy through an extrusion press at a temperature of 260° C. to 330° C., and annealing.

34,246 of 1928 (307,904). H. A. BRASSERT AND Co., Chicago. Blast-furnaces gases are cleaned by passing through a system comprising a vortex gas-cleaner, a washing unit, a disintegrator, and a moisture eliminator.

38,482 of 1928 (320,818). L. ST. C. BROUGHALL, Barnet. The electrolysis of ammoniacal solutions of metallic salts, other than salts of the alkali metals, for the preparation or purification of the particular metal.

5,145 of 1929 (306,151). E. KELSEN, Vienna. An improved process for the electrolytic manufacture of iron.

5,429 of 1929 (307,061). METALS PROTECTION CORPORATION, Indianapolis. The preparation of pure chromic acid.

27,061 of 1929 (319,309). THE BRADLEY-FITCH COMPANY, Minneapolis. Low-grade iron-ores are heated in a reducing atmosphere in order to render them susceptible to magnetic concentration.

NEW BOOKS, PAMPHLETS, Etc.

Copies of the books, etc., mentioned below can be obtained through the Technical Bookshop of *The Mining Magazine*, 724, Salisbury House, London, E.C. 2.

Geology and Minerals of Ontario. By Dr. W. L. GOODWIN. Cloth, pocket size, 505 pages, illustrated, with map. Quebec: The Gardenvale Press.

Geochemische Migration der Elemente. Teil I. By Professor A. FERSMANN. Paper backs, 116 pages, illustrated. Price 10-20 marks. Halle (Saale): Wilhelm Knapp.

Textbook of Geology. Part I. Physical Geology. By LOUIS V. PIRSSON. Third edition, revised. Cloth, octavo, 488 pages, illustrated. London: Chapman and Hall.

The Trend of Flotation. By A. J. WEING and I. A. PALMER. 3rd Edition. Paper backs, 152 pages, illustrated. Price 25 cents. Colorado: School of Mines Quarterly, Vol. XXIV, No. 4.

Safety in Coal Mines: Some Problems of Research. Quarto, paper backs, 56 pages, illustrated. Price 6d. London: H.M. Stationery Office.

Gas and Flame. Quarto, paper backs, 23 pages, illustrated. Price 3d. London: H.M. Stationery Office.

The Mineral Industry of the British Empire and Foreign Countries. Statistical Summary (Production, Imports, and Exports), 1926-28. Paper backs, 365 pages. Price 7s. 6d. London: H.M. Stationery Office.

Abrasives. Imperial Institute Reports on the Mineral Industry of the British Empire and Foreign Countries. Paper covers, 67 pages. Price 2s. 6d. London: H.M. Stationery Office.

Railways in Tanganyika. Report on the Preliminary Survey for a Railway Line to open up the South-West of Tanganyika Territory. By

C. GILLMAN. Folio, 65 pages, with sections and a map. Price 5s. London: The Crown Agents for the Colonies.

Somaliland. Report of the Somaliland Agricultural and Geological Department for the years 1927 and 1928. Paper boards, 48 pages, illustrated with map. Price 5s. London: The Crown Agents for the Colonies.

Quebec. Report on Mining Operations in the Province of Quebec during the year 1928. Paper backs, 189 pages, illustrated, with maps. Quebec: The King's Printer.

Investigations in Ceramics and Road Materials, 1927. Paper backs, 80 pages. Ottawa: Department of Mines.

Bear River and Stewart Map-areas, Cassiar District, B.C. By G. HANSON. Paper backs, 73 pages, illustrated, with map. Price 20 cents. Memoir 159, Geological Survey of Canada. Ottawa: Department of Mines.

Preliminary Report on the Woman River and Ridout Map-Areas, Sudbury District, Ontario. By R. C. EMMONS and E. THOMSON. Paper backs, 30 pages, with map. Price 10 cents. Memoir 157, Geological Survey of Canada. Ottawa: Department of Mines.

Britannia Beach Map-area, B.C. By H. T. JAMES. Paper backs, 139 pages, illustrated, with maps. Price 25 cents. Memoir 158, Geological Survey of Canada. Ottawa: Department of Mines.

Geological Survey of Canada; Summary Report, 1928. Part A, 210 pages, illustrated, with maps. Part B, 132 pages, illustrated, with maps. Ottawa: Department of Mines.

Canada. Investigations in Ore Dressing and Metallurgy, 1927. Paper backs, 186 pages, illustrated. Ottawa: Department of Mines.

Canada. Investigations of Fuels and Fuel Testing, 1927. Paper backs, 107 pages, illustrated. Ottawa: Department of Mines.

Core Drilling Bituminous Sands of Northern Alberta. By S. C. ELLS. Paper backs, 26 pages, illustrated. Ottawa: Department of Mines.

British Columbia Minerals and Metals: Their Chief Uses. Paper backs, 19 pages. Brochure published by the B.C. Chamber of Mines, Vancouver.

Wyoming. Geology and Coal and Oil Resources of the Hanna and Carbon Basins, Carbon County, Wyoming. By C. E. DOBBIN, C. F. BOWEN, and H. W. HOORS. Paper backs, 88 pages, illustrated, with maps and sections. Price 60 cents. Bulletin 804, United States Geological Survey, Washington.

Alaska. Geology and Mineral Deposits of South-eastern Alaska. By A. F. BUDDINGTON and T. CHAPIN. Paper backs, 398 pages, illustrated, with maps. Price 85 cents. Bulletin 800, United States Geological Survey, Washington.

The Forsyth Coal Field; Rosebud, Treasure, and Big Horn Countries, Montana. By C. E. DOBBIN. Paper backs, 55 pages, illustrated, with map. Price 20 cents. Bulletin 812-A, United States Geological Survey, Washington.

Fuel-Efficiency Tests on Batch Oil Stills. By H. KREISINGER, W. R. ARGYLE, and W. E. RICE. Paper backs, 94 pages, illustrated. Price 20 cents. Bulletin 302, Washington: Bureau of Mines.

Geophysical Investigations at Caribou, Colorado. By C. A. HEILAND, C. W. HENDERSON,

and J. A. MALKOVSKY. Paper backs, 45 pages, illustrated. Price 10 cents. Technical Paper 439, Washington: Bureau of Mines.

Summarized Data of Gold Production. By R. H. RIDGWAY. Paper backs, 63 pages, illustrated. Price 20 cents. Economic Paper 6, Washington: Bureau of Mines.

Rock Bursts in the Lake Superior Copper Mines, Keeweenaw Point, Michigan. By W. R. CRANE. Paper backs, 43 pages, illustrated. Price 20 cents. Bulletin 309, Washington: Bureau of Mines.

Metal-Mine Accidents in the United States, 1927. By W. W. ADAMS. Paper backs, 96 pages. Price 15 cents. Bulletin 310, Washington: Bureau of Mines.

Flotation Mills. Illustrated brochure of 52 pages. Denver, Colorado: The Ruth Company.

COMPANY REPORTS

Sulphide Corporation.—This company was formed in 1895 to work the central lead-zinc-silver mine at Broken Hill, New South Wales. It also operates the Cockle Creek works in New South Wales, a zinc works at Seaton Carew, and has a controlling interest in the Nantymwyn lead-zinc mine in Wales. The report for the year ended June 30 last shows that operations at the Central mine have been continuous throughout the year. 134,086 tons of ore was raised of which 133,835 tons was treated at the concentrator. In addition 887 tons of Junction mine ore, 11,252 tons of Block 10 slimes, and 8,113 tons of Central mine slimes were treated. The total 154,087 tons fed to the mill averaged 14.4% lead, 14.9% zinc, 2.5% oxidized lead, and 12 oz. silver per ton. The output was 24,839 tons of lead concentrates averaging 65.7% lead, 8.6% zinc, and 53.7 oz. silver per ton, together with 37,188 tons of zinc concentrates averaging 50.1% zinc, 4.2% lead, and 7.3 oz. silver per ton. There were also produced 2,392 tons of special slimes averaging 12.7% lead, 5.7% zinc, and 8.6 oz. silver per ton. At the Cockle Creek works 43,954 tons of superphosphate, 22,997 tons of sulphuric acid, 205 tons of hydrochloric acid, and 52,985 tons of cement clinker were produced. At the zinc roasting plant 19,130 tons of concentrates was treated, and the sulphur used in acid manufacture. At Seaton Carew 17,880 tons of zinc concentrates, and other zinc-containing material, was roasted, producing 7,990 tons of spelter, and 80 tons of lead. 12,731 tons of retort residues gave 1,685 tons of concentrates on retreatment. The output of sulphuric acid at this works was 14,698 tons. The total profit for the year was £213,227, out of which £157,500 was distributed as dividends equal to 15% on the ordinary and preference shares.

Lake View and Star.—This company was formed in 1910 to work gold mines in the Kalgoorlie district of Western Australia. In March last the Golden Horse Shoe mine was purchased. The report for the year ended June 30 last shows that 207,095 tons of ore was sent to the mill, of which 70,575 tons was purchased from tributaries. The yield from this ore was £503,600. In addition 306,634 tons of residues from the Ivanhoe dumps was retreated, yielding gold worth £2,081. The ore reserves at the end of the year were 1,040,919 tons

averaging 31.51 shillings per ton. The working profit for the year was £7,939. Development at the mine is being forwarded, the intention being to open up sufficient ore reserves to warrant increasing the mill capacity to 40,000 tons per month. An experimental flotation plant will be installed in the near future.

Associated Gold Mines of Western Australia (New).—Formed in 1925, this company took over gold-mining leases in the Coolgardie field, Western Australia. The report for the year ended March 31 last shows that 59,276 tons of ore was milled, giving a yield of 33s. 4d. per ton. The year's working resulted in a net profit of £7,568.

Mexican Corporation.—This company was formed in 1919. As shareholders in the Mexican Corporation, S.A., the company is interested in the Teziutlan copper-zinc property in Puebla, and also in the Fresnillo silver mine, Zacatecas, Mexico. In May last the Mexican Corporation, S.A., and the Fresnillo company merged their respective interests in the Fresnillo mine, the former surrendering its lease on the property and receiving in exchange 500,000 shares in the Fresnillo company, or 50% of the capital of the latter company. In accordance with a capital reorganization scheme in July last the issued capital was reduced by £500,000 to £500,000, the unissued 400,000 £1 shares were divided into 10s. shares, and the capital was increased by the creation of a new 1,000,000 shares of 10s. each. Thus the capital now consists of 2,800,000 shares of 10s. each, of which 1,000,000 are issued. The report for the year ended June 30 last shows that at Fresnillo 846,583 dry tons of oxidized ore, averaging 0.12 dwt. gold and 5.9 oz. silver per ton, was treated by cyanide extracting 3,897 oz. gold and 3,717,313 oz. silver. The selective flotation plant treated 207,193 tons of sulphide ore, averaging 9.6% lead, 10.3% zinc, and 0.64% copper, and 0.58 dwt. gold and 1.5 oz. silver per ton, the yields being 32,796 tons of lead concentrate averaging 57.1% lead, 8.2% zinc, 2.9% copper, and 2.1 dwt. gold and 54.8 oz. silver per ton; 32,996 tons of zinc concentrates averaging 50.6% zinc, and 0.5 dwt. gold and 9.2 oz. silver per ton; and 8,141 tons of iron concentrate averaging 40.2% iron, and 1.4 dwt. gold and 13.6 oz. silver per ton. The reserves of direct-cyaniding oxidized ore are estimated at 1,636,916 tons averaging 0.13 dwt. gold and 6.06 oz. silver per ton. In addition, there are 436,511 tons of manganese-silver oxide ore, averaging 0.13 dwt. gold and 6.36 oz. silver per ton, which require treatment by the McGluskey process before cyaniding. The reserve of sulphide ore, positive and probable, is estimated at 807,006 tons averaging 9.7% lead, 9.1% zinc, 0.5% copper, and 0.6 dwt. gold and 11.1 oz. silver per ton. Further large additions to ore reserves are expected. The amount of ore treated at the Teziutlan mine was 67,372 dry tons of sulphide ore averaging 1.03% lead, 10.99% zinc, 2.91% copper, and 0.6 dwt. gold and 2.46 oz. silver per ton, and the products were: 7,635 tons of copper concentrate, averaging 22.15% copper, 13.04% zinc, 7.64% lead, and 2.47 dwt. gold and 11.85 oz. silver per ton; and 10,123 tons of zinc concentrate averaging 57.06% zinc, 1.28% copper, and 1.16 dwt. gold and 3.0 oz. silver per ton. The ore reserves are estimated at 128,389 tons averaging 3.1% copper, 11.2% zinc, 1.0% lead, and 0.5 dwt. gold, and 2.3 oz. silver per ton. Remittances from Mexico

amounted to £96,005. During the year £75,000 of the five-year notes were redeemed and during the current year notes to the value of £20,000 have been purchased, leaving a balance outstanding of £20,000. As a result of the reorganization of the company it has been possible to pay an interim dividend of 1s. per share in the current year.

Frontino and Bolivia (S.A.) Gold Mining.—Formed in 1911, this company is a reconstruction of a company of the same name which works the Silencio gold-mine in Colombia. The report for the year ended June 30 last shows that 21,290 tons of ore was sent to the mill, yielding 15,939 oz. of gold and 12,068 oz. silver, against 21,600 tons yielding 24,937 oz. gold and 18,073 oz. silver in the previous year. The ore reserves are estimated at 50,300 tons averaging 15.5 dwt. per ton. There was a working loss of £6,736. The Dona Teresa power plant is nearing completion when it is anticipated results will be more favourable. The half-interest in Marmajito mines has again been most profitable to the company.

Santa Gertrudis.—This company was formed in 1909, as a subsidiary of Camp Bird, Ltd., to operate a silver mine in Pachuca, Mexico. Work on the Santa Gertrudis property ceased in 1925 on the exhaustion of the mine but interests in neighbouring mines had been acquired, of which the Dos Carlos and Ohio groups are the most important. The report for the year ended June 30 last shows that in the El Bordo group of mines the El Cristo is worked out, and the El Bordo and Malinche mines have a very short life before them. During the year 633,657 tons of ore averaging \$11.21 per ton was milled, 175,431 tons coming from the El Bordo, 64,360 tons from the Malinche, 24,516 tons from the El Cristo, and 369,350 tons from the Dos Carlos. The yield was 9,655,056 oz. silver and 40,255 oz. gold, and the remittance to this country by the local operating company was £332,568, out of which £233,010 was distributed as dividends equal to 15%.

Camp Bird.—Originally formed in 1900 to work a gold mine in Colorado, this company has since acquired many other interests, notably the acquisition of the Santa Gertrudis silver-mine in Mexico, and more recently the development of the Lake George mine in N.S.W. Recently, as announced in the *MAGAZINE* for August, a close working agreement has been established with Consolidated Gold Fields and directors of the latter company have joined the board of Camp Bird. The report for the year ended June 30 last shows that the lessees of the Camp Bird mine have paid £10,626 in royalties on ore produced during the year. The Santa Gertrudis mine has also been profitably operated and the company has substantially profited thereby. The important interests of the company in the Mexican Corporation, whose rights in the Fresnillo mine have been merged with those of the Fresnillo company, have also been profitable during the year. The other interests of the company are in the Durango Timber Co., the Creole Petroleum Corporation, the Chemical and Metallurgical Corporation, Nyasaland Minerals, Wheel Buller, Venezuelan Consolidated Oilfields, and the Lake George mine. Development of the last-named property has proceeded very satisfactorily, and the reserves are said to be approximately 2,000,000 tons averaging 7.54% lead, 12.86% zinc, 0.76% copper, 1.27 dwt. gold, and 2.37 oz. silver to the ton. The company's

profit for the year was £249,172 out of which £51,970 was paid out as preference dividend equal to 8%, and the amount carried forward was £149,993. Development of the undertakings in which the company is interested has necessitated the issue of £250,000 in 7% debentures.

Malayan Tin Dredging.—This company was formed in 1911 to work alluvial tin property in the Kinta Valley, Perak, F.M.S. The report for the year ended June 30 last shows that 6,049,750 cubic yards of ground was treated, and 1,803.6 tons of tin concentrates recovered, as compared with 5,458,940 cubic yards and 1,607 tons in the previous year. During the year the area dredged amounted to 68.99 acres, bringing the worked area up to 817 acres; 52.7 acres were acquired during the year, the total area owned by the company being 2,177 acres. The electric power station is working satisfactorily. The amount realized for the sale of tin concentrates was £238,826 and the profit for the year £153,046, of which £100,000 was distributed as dividends equal to 50%.

Rambutan.—This company was formed in 1905 to work alluvial tin properties in the Kinta District, F.M.S. The report for the year ended June 30 last shows that 161.84 tons of tin concentrates was won by the treatment of 745,500 cu. yd. of ground, as compared with 170.17 tons from 638,500 cu. yd. in the previous year. In addition 72.83 tons of concentrates were recovered in the Toh Kiri section from 277,540 cu. yd. of treated ground as compared with 91.43 tons from 247,100 cu. yd. the year before. The working profit was £9,183, a decrease of £362 on the previous year's total, and the net profit was £8,180 of which £7,500 was distributed as dividends equal to 7½%.

Hongkong Tin.—This company was formed in 1927 to acquire alluvial tin property in the State of Selangor, F.M.S. The report covering the period from the incorporation to August 31, 1929, has just been issued. Production of tin concentrates commenced on August 1 last on completion of the dredge and dredge paddock, and the output until the end of the month was 42.3 tons. The company is now a regular producer.

Kamunting.—This company was formed in 1913 to acquire alluvial tin property in the State of Perak, F.M.S. The report for the year ended June 30 last shows that the output of tin ore was 1,113 tons obtained from the treatment of 3,843,200 cu. yd. of ground. Of the 2,524 acres held by the company 476 acres have been worked out, 56 being dredged in the year under review. The net profit for the year was £47,378 and £30,000 was distributed as dividends.

Meru Tin.—This company was formed in 1928 to work four adjoining alluvial tin properties in the State of Perak, F.M.S. The report for the year ended June 30 last shows that 812,378 cu. yd. of ground was treated, recovering 231.25 tons of tin concentrates. The Tong Fah Kongsia area is still worked on tribute. The total area of ground held by the company is 1,272 acres. Approximately 11 acres have been worked out during the period under review, and the acquisition of a further 10 acres is almost completed. The sale of tin concentrates realized £28,093 and with sundry receipts the gross revenue totalled £32,400. There still remains a loss, to date, of £1,722, but continued improvement is anticipated.

Ayer Hitam Tin Dredging.—This company, formed in 1926, works an alluvial tin property in

the State of Selangor, F.M.S. The report for the year ended June 30 last shows that the dredge has been completed and is working well, and is gradually working its way to the selected area.

Anglo-Burma Tin.—This company was formed in 1926 to take over alluvial tin properties in the Tavoy and Mergui districts of Burma. The report for the year ended June 30 last shows that on the Heinda area 112½ tons of tin concentrates was obtained from the treatment of 219,550 cu. yd. of ground, most of which was treated during the six months of rain. At Thabawleik 36 tons of tin ore was won, but this section was worked at a loss and has since been let out on tribute. The accounts for the year show a loss of £9,956 of which £7,764 is due to the operations at Thabawleik.

Consolidated Tin Mines of Burma.—This company, formed in 1928, took over tin properties and separation plant in the Tavoy district of Burma from the Burma Finance and Mining Company of Rangoon. The report for the period ended June 30 last shows that 700 tons of mixed tin and wolfram concentrates was won and this realized an average price of £109 per ton. There was a working profit of £8,757, but income tax, depreciation, and other expenses resulted in a net loss of £680. The company's revenue was adversely affected by the price of tin, but during the current year this has been largely offset by the rise in the price of wolfram.

Naraguta (Nigeria) Tin Mines.—This company was formed in 1910 to acquire an alluvial tin property in the Bauchi province of Northern Nigeria. Further areas were taken over in 1928, but portions of the original property are now worked by subsidiary companies. The report for the year ended March 31 last shows that 468 tons of tin concentrates were won, of which 116½ tons came from the Durumi areas acquired in March, 1928, and which, in January last, were sold to a subsidiary company. The production from the Naraguta areas was 351½ tons, as compared with 281 tons for the previous year. Tin concentrates realized £64,828 and the profit for the year was £10,583 which was carried forward.

Naraguta Korot Areas.—This company was formed in 1925 to take over alluvial tin properties in the Korot district of the Bauchi province, Northern Nigeria. Additional areas have been acquired from time to time. The report for the year ended December 31, 1928, shows that 135 tons of tin concentrates were won during the year, as compared with 80 tons the year before. The year's working resulted in a loss of £4,685.

Ex-Lands Nigeria.—This company was formed in 1912 and works alluvial tin property in Northern Nigeria. The report for the year ended December 31, 1928, shows that 650 tons of tin concentrates was recovered as against 705 tons in the previous year. The ore reserves at the end of 1928 were estimated to be 7,696 tons of tin concentrates. The year's working resulted in a net profit of £30,547, from which £7,687 was distributed as dividends equal to 5%. A contract has been entered into with Nigerian Electricity Supply Corporation for the supply of electric power.

Batura Monguna Tin.—This company was formed in 1923 to work alluvial tin properties in Northern Nigeria. The report for the year ended December 31, 1928 shows that 461 tons of tin concentrates was recovered during the year and realized £122 13s. 11d. per ton. The operations for

the year show a loss of £1,904. It has been decided to let the property on tribute for the time being.

Nigerian Consolidated Mines.—This company was formed in 1920 to work alluvial tin property in Northern Nigeria. The report for the year ended March 31 last shows that 264 tons of tin ore was won as compared with 336 tons the year before. The accounts show a net profit for the year of £1,135.

Lena Goldfields.—This company was formed in 1908 to operate alluvial gold properties in Siberia. In 1925 an agreement was made with the Soviet Government whereby the company was permitted to reopen these mines and also to take over other properties. The report for the year ended December 31, 1928, shows that at the Lenskoie mines 281,346 cu. yd. of gravel was washed yielding 175,080 oz. gold. A new dredge has been installed and is expected to commence work early in 1930. The production from the Ural Iron Works and Plevsky Copper Smelter shows an increase of 50% over that of 1927. Work is proceeding on a new iron works at Seversky which is expected to start production in 1930. 50,521 tons of pyrite was mined during the year and profitably sold. Work is still proceeding on construction in the Altai concession, and on the equipment of the Zevianovsk and Zmeinogorsk mining district, which is proving to be a rich property. Operating results in Russia show a profit of £292,860.

Apex (Trinidad) Oilfields.—This company was formed in 1919 by the Anglo-French Exploration Co. and the British Borneo Petroleum Syndicate to operate oil-lands in the Fyzabad district, Trinidad. The report for the year ended September 30 last shows that the production of crude oil was 414,328 tons as compared with 294,775 tons the year before. The net profit for the year was £313,208 out of which £262,500 has been distributed as dividends equal to 52½%. A year ago the net profit was £246,429 and the dividend at the rate of 35%.

DIVIDENDS DECLARED

Anglo-American Corporation.—Pref. 3%, less tax, payable February 5.

Angola Diamond.—1s., payable January 6.

Apex Mines.—7½d., less tax, payable February 7.

Ashanti Goldfields.—40 per cent., payable Jan. 31.

Burma Corporation.—7 annas, less tax, payable February 15.

Cam and Motor.—2s., less tax, payable

Charterland and General Exploration.—Pref. 6%, Ord. 5%, less tax, payable January 14.

Clydesdale (Transvaal) Collieries.—1s., less tax.

Consolidated African Selection Trust.—1s. 3d. less tax, payable February 4.

Consolidated Diamond Mines of S.W. Africa.—Pref. 4½d., Ord. 1s. 3d., less tax, payable February.

De Beers.—Deferred 5s., less tax.

Eastern Smelting.—Pref. and Ord., 1s. 6d., less tax, payable January 1.

Electrolytic Zinc.—6 per cent., payable March 6.

Gopeng Consolidated.—1s. 9d., less tax, payable January 7.

Hongkong Tin.—3d., less tax, payable December 31.

Huelva Copper.—2s., less tax.
Idris Hydraulic Tin.—3d., less tax, payable December 30.
Jelapang Tin Dredging.—6d., less tax, payable December 21.
Kinta Tin.—3d., less tax, payable December 21.
Kramat Pulai.—1s. 6d., less tax, payable December 17.
Kundang Tin Dredging.—6d., less tax, payable December 21.
London Tin.—4s., less tax, payable January 10.
Malayan Tin Dredging.—6d., less tax, payable December 19.
Natal Navigation Collieries.—9d., less tax, payable February 14.
New Consort Gold Mines.—1s. 6d., less tax.
New Era.—3d., payable February.
Pari Tin.—3d., less tax, payable December 28.
Pengkalen.—Pref. and Ord., 1s., less tax, payable January 25.
Poderosa.—1s., less tax, payable January 9.
Pontgiband Silver-Lead Mining and Smelting.—11s. 5d., less tax, payable December 21.
Renong Tin.—Pref., 1s. 6d., less tax, payable December 31.
Rezende.—2s. 6d., less tax.
San Francisco Mines of Mexico.—2s. 3d., less tax, payable January 8.
Sherwood Starr.—6d., less tax.
Sinai Mining.—Pref. 1s. 5d., Ord. 9d., payable December 31.
South African Coal Estates (Witbank).—6d., less tax.
South Kalgurli Consolidated.—1s., less tax, payable January 22.
Southern Malayan Tin Dredging.—3d., less tax, payable December 19.
Southern Perak Dredging.—1s., less tax, payable December 18.
Star Exploration.—7½%, less tax, payable December 18.
Sungei Besi.—1½d., less tax, payable December 27.
Sungei Way.—1'39d., less tax, payable December 6.
Tanjong Tin Dredging.—3d., less tax, payable December 21.
Transvaal Consolidated Land and Exploration.—1s. 3d., less tax, payable February 4.
Tronoh Mines.—6d., less tax, payable December 31.
Zambesia Exploring.—1s., less tax, payable January 31.

NEW COMPANIES REGISTERED

Amalgamated Metal Corporation.—Nominal capital: £5,000,000 in £1 shares; 1,000,000 6% Cumulative Preference, 3,400,000 Ordinary and the balance unclassified. Objects: To acquire all or part of the share or loan capital or the assets or undertaking of the British Metal Corporation, Ltd., and Henry Gardner and Co., Ltd., to carry

on business as buyers, sellers and manufacturers of and dealers in ores, metals and minerals, etc. Directors: Rt. Hon. Sir Auckland C. Geddes, Sir Evelyn A. Wallers, Chas. Vincent Sale, Capt. Oliver Lyttelton, Wm. S. Robinson, Henry Gardner, Walter Gardner, and Arnold J. H. Smith. Office: Princes House, Gresham Street, London, E.C.

Anglo-Nigerian Corporation. Registered December 27. Nominal capital: £600,000 in 5s. shares. Objects: To acquire lands, mining rights, grants, concessions, claims, mineral properties and water and other rights in Nigeria and elsewhere, or shares or securities of any company owning or entitled to any of the above, to enter into agreements between Nigerian Base Metals Corporation, Ltd., Nigerian Power and Tin Fields, Ltd., and Anglo-Nigerian Tin Mines, Ltd., and this company; to carry on all kinds of mining and exploration business, etc. Office: Finsbury Pavement House, Moorgate, E.C. 2.

Consolidated Tin Smelters. Registered December 28. Nominal capital: £5,000,000 in £1 shares (2,000,000 7 per cent. Non-Cumulative Preference and 2,000,000 Ordinary). The remaining 1,000,000 shares may be issued as Non-Cumulative Preference or Ordinary shares as the directors shall determine. Objects: To acquire the whole or any portion of the share or loan capital, or the assets or undertaking of the Cornish Tin Smelting Co., Ltd., Eastern Smelting Co., Ltd., Penpoll Tin Smelting Co., Ltd., and Williams, Harvey and Co., Ltd.

Klorex Syndicate.—Registered December 19. Nominal capital: £25,000 in 5s. shares. Objects: To adopt an agreement with Mexco, Ltd., and Selection Trust, and to carry on the business of manufacturing and operating chemists, etc. Directors: A. S. Clift, F. L. Gibbs, E. W. Janson, and G. R. Nicolaus. Office: 18, St. Swithin's Lane, E.C. 4.

Lightning Mine Trust.—Registered as a private company on December 11. Nominal capital: £3,000 in 2,000 "A" shares of £1 each and 20,000 "B" shares of 1s. each. Objects: To search for, win, get, quarry, reduce, amalgamate, dress, refine, and prepare for market, gold and all other metals, minerals, and substances, etc. Office: Finsbury House, Blomfield Street, E.C. 2.

Mining Trust of Northern Rhodesia.—Registered as a public company. Capital: £100 in £1 shares. Objects: To acquire and hold shares, stocks, debentures, bonds and securities; to employ experts to investigate into the prospects and to acquire mining rights in any part of the world, etc. Office: Adelaide House, King William Street, E.C.

Non-Ferrous Metal Products.—Registered as a private company on December 18. Nominal capital: £10,000 in £1 shares. Objects: To promote the production and use of zinc, copper, lead and other non-ferrous metals. Office: 95, Gresham Street, E.C. 2.

Northern Rhodesia Power Corporation.—Registered as a private company. Capital: £330,000 in £1 shares. Objects: To carry on the business of an electric supply company and to adopt agreement with Bwana M'Kubwa Copper Mining Company. Office: 4, London Wall Buildings, E.C. 2.

BRITISH COLUMBIA

DEPARTMENT OF MINES

British Columbia, the Mineral Province of Canada, has produced approximately \$1,184,200,000 worth of mineral products.

<i>Mineral production year 1928</i>	- -	\$65,372,583
<i>Estimated production year 1929</i>	- -	70,030,976

THE PRELIMINARY REVIEW
AND SUMMARY OF MINING OPERATIONS
FOR THE YEAR 1929 is now available and may
be obtained, together with copies of the Annual Reports,
Bulletins, etc., upon application to :—

**THE HON. THE MINISTER OF MINES,
Victoria, B.C.,**

or

BRITISH COLUMBIA HOUSE,

REGENT STREET, LONDON, S.W.1.

COMPANY MEETINGS AND REPORTS SECTION

LONDON TIN SYNDICATE, LTD.

Directors: Lord Askwith (*Chairman*), Sir William Daniel Henry, W. H. Edwards, Lieut.-General Sir E. Locke-Elliott, J. H. C. E. Howeson. *Consulting Engineers*: Pawle and Brelick, Yuba Associated Engineers, Anglo-Oriental (Malaya), Ltd., and Foley, Boyes, Butler and Peek. *Managers*: Anglo-Oriental Mining Corporation, Ltd. *Secretaries and Office*: The Anglo-Oriental and General Investment Trust, Ltd., 31 and 33, Bishopsgate, London, E.C.2. *Formed* 1925. *Capital issued*: £694,000 in £1 shares.

Business: Finance of and investment in tin ventures in various parts of the world.

The fourth annual general meeting of London Tin Syndicate, Ltd., was held on December 30 at the Cannon Street Hotel, E.C., the Rt. Hon. Lord Askwith (*Chairman* of the company) presiding.

The representative of the Secretaries (The Anglo-Oriental and General Investment Trust, Ltd.) having read the notice convening the meeting and the report of the auditors,

The *Chairman* said: Ladies and gentlemen, with your permission I propose, as usual, to take the directors' report and the accounts for the past year as read. My association with the Syndicate dates back to its inception in September, 1925. I was the original *Chairman* of the Board, and throughout the intervening years it has been my privilege to continue in that office, so that this is, in fact, the fourth annual meeting at which I have presided. I say with real regret that it will also be the last. During my years of office I may claim that the Syndicate has made vast and rapid strides. In 1925 we had a capital of £50,000 only, and our energies were chiefly directed towards the reawakening of the ancient tin-mining industry in Cornwall, but by the middle of 1926 we already had one foot firmly planted in Nigeria, and early in 1927 we obtained a footing also in the F.M.S., whence we have since successfully deployed into the neighbouring territories of Siam and Burma. A few months after our acquisition in 1927 of the dredging area in the Kinta Valley, subsequently developed by Kampar Malaya Tin Dredging, Ltd., and at present one of the largest low-cost producers in Malaya, we had again advanced further afield, and our engineers were at work upon the Mitate mine in Japan, since transferred to Toyo Tin, Ltd., and now already contributing its not inconsiderable daily quota of tin oxide to the Eastern smelters.

By the end of 1927 the ever-increasing production that was coming under our control had impelled us to look more closely into the smelting side of the business, and so began our association with the Penpoll smelter, which in the meantime we have entirely rebuilt and re-equipped in accordance with the most modern practice. The enlargement of that plant pointed the way for our return to Nigeria—for adequate supplies of the high-grade Nigerian oxide are a primary requisite in the home smelting industry—and early in 1928 we were once more applying our energies and resources towards the broadening of our sphere of influence in the tinfields of that Colony. Our efforts in this direction were speedily rewarded with success, as in March, 1928, our premier Nigerian subsidiary,

Associated Tin Mines of Nigeria, completed arrangements of a far-reaching nature involving the absorption of some few of the larger and a very considerable number of the smaller producing units on the plateau, a consolidation which established the Associated Company as the largest individual producer of alluvial tin in the Empire, a distinction that it has since upheld.

Realizing the importance of co-ordination within the industry, particularly in relation to the plateau tinfields of Nigeria, and desiring also as smelters to extend still further our control over the Nigerian production, we refused to be discouraged by the disastrous fall in the price of the metal which then ensued. On the contrary, we redoubled our efforts towards rationalization in Nigeria, as a stepping stone in the direction of a much wider rationalization which, I dare to believe, is now in prospect.

The current year marks the definite attainment of our first big objective in Nigeria. Early in the year arrangements were concluded whereby the Associated Company became largely interested in the Kurra Falls hydro-electric concession. Water is scarce on the plateau, wood for fuel does not grow in any sufficient quantity, and coal has to be brought great distances and is very costly. The lowering of mining costs to the minimum, which is an essential of rationalization in any mining industry, can be achieved to some extent by technical consolidations and administrative fusions such as we have been able to implement, and by the consequential interchange of managerial skill and experience; the modernization of plant also plays its part in improving costs, but a lack of cheap and dependable power will heavily discount the most skilful devices of the engineers and set a brake upon the wheels of the finest machinery.

Ladies and gentlemen, we have consistently sought to improve the status of the industry in which we are primarily concerned; re-grouping into larger and larger units, as opportunity can be made, is an important factor, as those have found who have devoted themselves to the same cause in the case of other non-ferrous metal industries, but the reduction of costs—I say it again—must be an integral part of such a policy. It is particularly unfortunate that our work in that direction, which, I am happy to say, is meeting with increasing success, should be temporarily set at naught by the long-continued recession in the price of our metal. Yet the savings in costs that have already been affected have enabled us to face a price which only a year or two ago would have brought nearly all the mining operations in Nigeria to a

close and thrown the industry back five years or more. In due course, however, the reward of our labours will become more apparent.

The Kurra Falls concession became vested in due course in Nigerian Electricity Supply Corporation, in which the Associated Company is a principal shareholder, and with which the companies of the group have made long-term contracts for the supply of power on terms equally advantageous to all parties. The first service of current will begin within the course of the next few weeks and, as it is hoped to complete the main storage reservoir prior to the seasonal wet weather, continuous supplies on a fairly large scale should become available soon after this year's rains have set in.

With the conclusion of these arrangements, we resumed our survey of the tin areas on the plateau, and in July we completed negotiations for the acquisition by amalgamation of the well-known Ropp areas which, as you will recollect, were absorbed within the Syndicate as recently as last August. A few weeks later we concluded a similar agreement with the Bauchi Company, and, although the reserves on the Bauchi areas are not so extensive as those at Ropp, there are a few thousand tons of specially high-grade ore among the proved reserves which will, if necessary, enable output to be maintained while we are engaged in enlarging the power station at Kwall Falls, a course necessary to facilitate the working of the low grade deposits that now constitute the principal asset of these areas. Still more recently we have concluded provisional agreements with the Mongu and Anglo-Bauchi companies; the former because its ground interlocks at many points with our Ropp areas and very important economies, as well as greatly simplified working, must ensue from their consolidation; the latter on account of the contiguity to one of our best leases at Bauchi, and also because we need more ground in that district to justify the enlargement of our power station. These four absorptions are eminently sound, technically as well as financially; they will greatly improve the technical structure of the Plateau mining industry, reduce costs in each case, enable work to be undertaken which would otherwise have been economically impracticable, and, in short, they conform in every respect to the requirements of our policy of rationalization. Incidentally, our Nigerian mining operations will then be so comprehensive that we shall be able without difficulty to displace our affiliate, the Associated Company, from the leadership of the Empire's alluvial producers, but, as the Syndicate is the principal shareholder in that company, and we employ the same engineers, you may rest assured that in all these directions we are proceeding in close collaboration and with a common objective. Together we may now claim to constitute the vital factor in the Nigerian tin industry, and other negotiations are proceeding which are likely still further to strengthen our situation in that territory.

Reverting to Penpoll, you will perhaps remember that in my address a year ago I remarked that we considered the time signally opportune for definite steps forward towards consolidation on the part of both producers and smelters of tin oxide, and that such conformations could lead only to more stable conditions. We have fearlessly pursued that policy in both the directions named. I have told you something of what we have

attempted and accomplished in relation to the consolidation of primary production, and you have doubtless read of the similar conformation which has recently been achieved among smelters. It is with pride that we take our place with three of the four other leading tin smelters in the world in the establishment of a holding company that links the East with Nigeria and with Bolivia, and will include among its many clients the largest individual tin producer in the world. The amalgamation in question is indeed a very real step forward, and I am convinced that its significance will dominate the tin situation, to the advantage of consumers no less than producers, in the coming year.

Four years ago we had a capital of £50,000, and, looking back, I must admit that our effective contact with the tin industry at that time was meagre and somewhat precarious. But we clung on, and, as I think I have shown, our tenacity has not gone unrewarded. To-day the issued capital of the Syndicate is very little short of a million, and there are 6,500 individual shareholders on our register. Moreover, that capitalization is based no longer upon mere prospects, but on very large proved reserves of tin oxide that we own and are developing and mining. It also represents extensive shareholdings in other producing companies and, as important as any of our possessions, the smelter plant that we ourselves have built and equipped. To-day the Syndicate mines as much alluvial tin as any other producer in the Empire, while our output of metal, constituting an appreciable part of the world's supplies, has brought us together with the largest interests in the industry. Within a few weeks, if the agreements which have been provisionally concluded are duly confirmed—as I have no doubt they will be—the Syndicate will be definitely established in a predominant position in Nigeria, and that position will be reinforced, as it should be, by a situation in Malaya of even greater magnitude and no lesser potentialities. We have faced difficulties and dangers of no mean order in arriving at this point: we are marching in the van of progress, and other hazards will inevitably impede and interrupt our advances. This then, ladies and gentlemen, is the moment when I feel that I should make way for others better able to bear the brunt, when I may lay down my arms without any fear of betraying the generous measure of confidence you have given me in the past. You are the proprietors of an institution of international importance and with great power for good in the industry. But energetic and virile leadership was never more vitally necessary than it is at the present time and will be in the years to come; there must be no hesitancy at this stage, and such guidance as I might still be able to give is no longer of sufficient importance to justify my barring the way to younger men better able to bear the strain and better qualified to carry on where I feel that I should, and am entitled to, lay down my burden.

Conditions were vastly different in our early days to those which have prevailed during the past two years. In 1926 the world produced some 4,000 tons less than the tin delivered into consumption and the average price for the year was £291. This year, on the other hand, consumption will probably be a similar amount behind production, and the average price of the metal is at least £86 a ton lower. It is an old point, but one worth

making again, that the relatively small difference between the deficiency in 1926 and the current excess, say twice 4,000, or 8,000, tons, has cost the industry not less than £80 a ton, or more than 14 millions in hard cash on this year's output, while the only compensation for that appalling loss is the sum received for the unwanted 8,000 tons, certainly not appreciably more than a million and a half. Yet, during those four years the world's annual consumption increased by no less than 25%, stocks were at a minimum in 1926 so that production had to be brought into line with the requirements of consumers, and that meant an increase of 35,000 tons as between the output in 1926 and in 1929. An adjustment so fine as to obviate the accumulation of 6,000 tons, or, say, 4%, in any one year is clearly beyond human calculation. To aim at increasing your production by 35,000 tons and actually to do so by 41,000 tons cannot readily be condemned as bad shooting.

Very patently there is something radically wrong with an industry which depends for its legitimate profit upon the upholding of such slender margins, and very definitely, as I have urged upon previous occasions, it is the business of producers themselves to take such precautions as will obviate for all time the persistence and the recurrence of the chaotic conditions that now obtain. Happily, producers have of late awakened to a sense of their responsibility and are now seeking energetically in co-operation the only practical remedy for the present disorder. You will wish, and will be glad to know, that your directors have given their fullest support to the co-operative measures which it is sought to bring into practice. The Syndicate was among the earliest of the applicants to join the Tin Producers' Association, now a strong and determinedly progressive organization with a membership representing practically the entire body of Empire producers.

And now I come to the accounts. They are presented in the simple form with which you have become thoroughly familiar. The profit and loss and appropriation accounts are set forth on pages 14 and 15, and the balance-sheet occupies the two preceding pages. As the details of these accounts are reviewed very fully on pages 7, 8 and 9, and you have had the report in your hands for some time, it will suffice for me to add a brief commentary on the figures themselves. Adverting in the first instance to expenditure, you will observe that directors' fees remain constant at £1,700, but that the general expenses have increased by £9,600. This increase is very largely due to the number of meetings we were obliged to hold during the year in connection with expansions, absorptions, and the relative increases of capital. In all such cases it has been our aim to place before you fully and clearly all the appurtenant facts and, as a substantial proportion of the Syndicate's capital is now held on bearer warrants, it was doubly needful for us to make free use of the public Press in connection with these various meetings in order to maintain due contact with all shareholders. Notwithstanding the ever-widening scope of the business, general charges show but little increment and secretarial fees remain unchanged.

On the opposite side of the profit and loss account, net revenue shows some appreciable setback, as is indeed inevitable in such a year. You will recognize that the almost uninterrupted depression, while possibly facilitating to some extent our policy of expansion, of which the benefit is

necessarily deferred, affected dividends most adversely, deprived us of the opportunity to earn commissions and also curtailed profitable realizations. But after taking into account the increased expenditure to which I have referred and intermediate adjustments, the balance (of £192,872 1s. 2d.) transferred to balance-sheet compares not so very unfavourably with the sum similarly transferred in last year's appropriation account. I said last December that dividends received, although showing a distinct improvement, were out of proportion to the sums invested, because our resources are so largely employed in developing nascent enterprise. While this is still the case and, in addition, our revenue from dividends has suffered substantially by reason of the much lower price for the metal, I am glad to be able to tell you that we have actually received in dividends this year more than 2½ times the sum that accrued from that source during the preceding year.

For the reasons already stated, our revenue from other sources has inevitably proved reactionary, but while we may not be justified in counting for some time to come upon any great improvement in our profit derived from ventures or from the sale of investments, there is every reason to hope that revenue in the form of dividends will, as in the past, continue to show a steady expansion. The Syndicate is also now a producer on a large scale, and the regular income which is already accruing from the operation of our own mines will play an increasingly important part in your future profits.

Turning to the balance-sheet, the capital in issue at the end of the year was £694,000, compared with £500,000 at the last closing, and reserves—other than taxation reserve—had increased from £625,000 to £745,777, which we are proposing, by transfer from the appropriate balance, to increase still further to-day to the satisfactory round sum of £800,000. Creditors at £7,180 are about £1,000 lower, but whereas last year we had the sum of £188,000 on deposit with Tin Selection Trust, our account with the Trust at September 30, 1929, showed a balance in the Trust's favour of £397,500.

I said when addressing you last year that if we were to continue with our programme of active progression we must be ready to take advantage of good things whenever they offered, and that, for this reason, cash was with us in essence a fluctuating commodity. I also explained our financial relationship with Tin Selection Trust, pointing out that we were permanently in account with the Trust and in enjoyment of an open facility, as well as of a reciprocal arrangement which operated to our mutual benefit whenever our own cash balances tended to become unduly swollen, as at that time they happened to be. Since then our business has been so largely confined to one direction, the acquisitive, that there has been but little reciprocity in our financial relations with the Trust, and, although the adverse balance has been substantially reduced since the close of the year, we are still very much beholden to the Trust. You will, however, appreciate that our respective interests—particularly in the Nigerian field—are very much interwoven and that the Trust is our largest individual shareholder.

The total expansion of some £658,000 on this side of the balance-sheet is offset on the asset side by an increase of £446,000 in investments, calculated at or under cost, of £116,000 in properties and

ventures, and of £159,000 in loans and advances. Dealing first with the investment figure, you will have observed that some £501,000 has been invested in subsidiary companies. This includes the whole of the capital of the Penpoll Tin Smelting Company, more than 90% in each case of the issued capital of Polhigey Tin, Ltd., and Parkanchy Tin, Ltd., and a majority holding in London, Nigerian Tin Trust, Ltd. Penpoll, to which I have already referred, is also discussed in some detail on pages 3 and 4 of the report, while there is a concise reference to Parkanchy and Polhigey on pages 6 and 7, and I will content myself with adding that, although Cornish mining enterprise may be the first to feel the draught in time of stress, we have equipped our properties in that county with the best of plant and machinery, so that they may survive all the buffeting of fate, and that at Polhigey, in particular, we have a mine whose costs are probably the lowest in Cornwall and which will still be yielding appreciable quantities of tin ore when even the names of many of the present alluvial producers have long been forgotten. The London Nigerian Trust was formed, as you will remember, to assemble and define some of our group shareholdings in Nigeria and to facilitate the consolidation now in progress.

In addition to our investments in subsidiaries, we have funds invested in some 30 different companies, involving an aggregate sum of £804,024. You are already aware that by far our largest investment is in Associated Tin Mines of Nigeria, and that, for reasons which I have already expounded at length, we attach very special importance to that investment. Approximately £215,000 of the above sum is invested in Eastern dredging undertakings, several of which are detailed in the report, and some £70,000 in other Nigerian tin producing companies. In our report we have said that it is an invidious task to attempt any reliable valuation of so diffuse a schedule of investments under such abnormal conditions, both in relation to the Stock Exchange generally and to our industry in particular, as obtained at the close of our year and unhappily still prevail. Many shares have depreciated out of all proportion, particularly those in which there has been a fairly open market, while in other cases the price has remained static only because there have been no dealings of consequence. But it so happened that we were called upon to review and to revalue all our investments at the date of the balance-sheet, for the purpose of the circular which was posted to you on October 9, and, after consultation with the auditors, we took the current quotations in respect to quoted holdings and a conservative basis for all other investments. That valuation disclosed a depreciation of only just over £70,000. Since then, as you are aware, conditions have not improved, either in our industry or in the Stock Market, but, with your sanction, we are increasing investment reserve fund to £200,000, so that we may face without undue concern, if not with equanimity, any additional depreciation up to £130,000, and for the present we are certainly well below that figure.

Properties and ventures stand in our books at some £201,000. You are well acquainted with their nature and will be disposed to agree with me that they are modestly valued, even in the present situation, and that with ordinarily favourable conditions you may expect to derive therefrom profits many times exceeding the total sum at which they figure in our books.

Debtor balances, reduced from £31,709 to £11,732, call for no comment, but loans have increased by £159,000. It has always been our practice to assist in the finance of Penpoll and the increasing turnover of the smelter has naturally caused its requirements to expand. The rearrangement made last year, as between Tin Selection Trust and the Syndicate, of our Cornish situation has thrown upon us some of the burdens which were previously carried by the Trust and also involved us in finding the finance needed to complete the equipment of those mines. This happily has now been done, and under reasonable conditions we have at least reached the limit of our obligation in these directions and may even expect to begin to derive some benefit therefrom. Sundry loans account for £53,000 of the total increase, and that is explained by our interest in Central America, which we have sought to protect and where, after much disappointment, our engineers now hold out every prospect in due course of our making some substantial recovery.

Ladies and gentlemen, I have dwelt at considerable length upon these figures, because it is my desire that you should have the fullest information I can furnish. But I should point out that the situation has changed so drastically owing to our further acquisitions since the date of the accounts which I have been reviewing, that the present picture bears but little resemblance to that depicted in the report now before you. Moreover, neither picture is destined to survive very long if the comprehensive amalgamations that you are to consider in a fortnight's time meet with general approval.

I do not propose to discuss those recent developments to-day, indeed they are no part of our agenda, and they do not arise out of a consideration of last year's accounts; but as I myself shall be vacating the chair in a few minutes, I should like you to know that these developments represent months of arduous labour undertaken solely in your interest. It may be, it probably will be, that the scheme which has been so patiently and meticulously evolved does not find instant favour with every one of you. Even although it bears the hall-mark of two distinguished firms of accountants who have made the most exhaustive investigation into every figure, and indeed every circumstance bearing upon the situation, some of you may at first sight be disposed to question the equities involved. If that be so, I would ask you to take the broadest possible view. The present position in our industry is not a happy one and the prospects are still very obscure. We have our own difficulties and tribulations within the industry, but also we have to face in ever-increasing measure the concentrated competition of other rival metals, the volume of whose production—unlike the output of tin—does not rest upon any limitation of primary deposits. Outlets have to be found for the constantly expanding production of those metals, and we must look to it that markets are not captured at our expense through stronger and more vigorous organization. This is essentially the day of consolidations, and tin has lagged desperately far behind. It is not therefore a moment for captious criticism, and it is not the time to cast our minds back and inquire why this and that should have happened a year or two ago. We must be determined to focus all our attention upon the present and the immediate future. That, ladies and gentlemen, is what my colleagues and I have tried to do, it is also what the other associated Boards have done, and, recognizing the support you have

always given us, I feel that it is not too much to hope that everyone of you will be equally broad-minded in your outlook.

There are two other matters not directly arising out of to-day's agenda upon which, however, I think that I should briefly touch. Considerable publicity has of late been given to the various methods adopted in connection with the registration of shares of group companies, and recent unfortunate events in the City have served to expose the weaknesses and dangers of some of those methods. Some years ago our secretaries caused a thorough investigation to be made into the principles of group registration, and, as the result of that investigation, improvements and safeguards were introduced which have since remained in continuous operation, and are indeed an integral part of the comprehensive system that forms the basis of the transfer department which handles all the group registers. Among these safeguards there is, as a matter of course, a complete system of internal checking, but, in addition, all transfers and certificates, together with the registers of members of every company, are examined and audited by the chartered accountants, and a full report submitted to the directors concerned at each Board meeting prior to the signing and issuance of any share certificates. You may indeed very probably have observed that every certificate bears the auditor's stamp. We have therefore every reason to feel, and it is well that you should know, that our organization, as well as that of every constituent member of the group, is thoroughly efficient in this respect, and that the risks attendant upon this class of work have been reduced to the minimum.

I should also like to take this opportunity to assure you, if that be necessary, that neither the Syndicate nor any of the affiliated or associated undertakings have ever been in any way connected with the groups whose affairs have recently aroused so much controversy, nor have we at any time held shareholdings in any of those companies.

And now, before putting the resolution to you, I should like to make a few personal remarks. Although times are bad and there are many difficulties to be surmounted, I am completely confident that your future prospects are established on an even sounder basis than they have been during the past. I hope you will permit me to say that I am proud of our past achievements. Since September, 1925, when the London Tin Syndicate was founded, we have made uninterrupted and steady progress, and in the four years, during which we have been mainly occupied in building up the business, it has been possible to distribute no less than 150 per cent. in dividends. With any reasonable improvement in the situation, which is now surely overdue, the maintenance of satisfactory dividends, based upon actual production, should be assured. Our policy has been to make this company one of the most comprehensive tin-producing units in the world, and I would express to you my conviction that we have already gone a long way towards succeeding in that endeavour. The Syndicate has continuously extended its mining operations in Nigeria and its interests throughout the East, and in all those countries you have witnessed the amalgamation of interests with other companies which have led to improved economic management, to the introduction of larger and more modern plant and to substantial expansion of ore reserves. Further, our present strength is derived not only from our mining interests in the various countries,

but also from the fact that we were successful in becoming our own smelters, and thus in attaining the unique position of being able to mine, smelt and market our own metal.

We have also now been able to extend our policy of the economic working of larger units by the amalgamation of the Penpoll Tin Smelting Company with other important smelting companies in this country and in Malaya, an orientation that cannot fail to bring the East into closer union with the West and to facilitate co-operative distribution from all centres.

These achievements are records of which I am proud, and, although they have entailed hard work in the past, it has been constructive work which has been a pleasure to me and to my associates on the Board. The seeds have been planted and the trees have grown. The roots are now firmly embedded and the branches have spread in many directions. Having aided in laying out the orchard and constructing the design, I feel I may fairly leave the further cultivation and the gathering of the fruit to younger men. I do not like prophets, but I will for once prophesy that the time is very near when you will get a better price for your fruit, and, ladies and gentlemen, I wish you long and continued success.

I will now move: "That the report of the directors and the statement of accounts for the year ended September 30, 1929, now submitted, be received, approved and adopted, and that a dividend of 20%, less income-tax at 4s. in the £, for the year ended September 30, 1929, be paid on January 10, 1930, in respect of shares numbered 1 to 550,000 inclusive to the holders of such shares registered in the books of the company on January 9, 1930." I will ask Mr. John Howeson to second that resolution.

Mr. John Howeson said: Ladies and gentlemen, in rising to second the adoption of the accounts, I have but little to add to the eloquent and illuminating review of the Syndicate's activities to which we have just been privileged to listen. Only two or three weeks have elapsed since I was invited to join your Board, but, by reason of the comprehensive investigation so recently concluded, there has fortunately been no lack of data ready at hand to enable me to obtain forthwith a thorough insight into the affairs, not only of your Syndicate, but also of the several companies which it is proposed to merge therewith. Moreover, as chairman of the Anglo-Oriental Mining Corporation, I had, of course, already a fairly close working knowledge of the wide-flung interests comprised within the Syndicate and the affiliated enterprises. In responding, as I did very readily to your directors' invitation, I laboured under no delusion that the appointment was likely to prove a sinecure. I am conversant with the difficulties into which the industry has drifted, and, although the critical year that ends to-morrow has brought producers throughout the world very much closer together, I have no mind to minimize the dangers and the hazards which still beset our path.

Sir Walter Scott described necessity as the "best of peacemakers as well as surest promoter of invention," and the Tin Producers' Association bears impressive testimony to the wisdom that underlies those words.

Ladies and gentlemen, the spirit of co-operation, without which the industry could not hope to prevail against the disorganization that has brought us to our present pass, was born when the producers decided upon an association; it has thriven lustily, and will enter upon the New Year adolescent, full of vitality and ready to do battle for the cause of

tin. I have said that it would be idle to underrate the many difficulties that still tend to obstruct progress. Your support, individual and collective, was never more cogently needed than it is to-day. But I think I may say that there has been good and definite progress, and I say so with the greater conviction because the leaders of the industry to a man have rallied around the flag of co-operative effort. For, while my associates and I have done, and will, of course, continue to do, without fear or favour, whatever we can to help in improving its status, we make no claim to the leadership of this ancient industry.

There are others who have actively espoused the cause of tin much longer than we have whose success in that cause is written for all to read. In the case of Malaya, for example, there are three outstanding names which are household words wherever tin is mined, and it is no small satisfaction to know that Mr. C. V. Thomas, the chairman of the Tronoh group, and the doyen of the industry, has devoted himself wholeheartedly, first to the establishment of the association, and then to its vigorous development; that Mr. Frank Mair, so long associated with the illustrious firm of Osborne and Chappel, the fathers of the Malayan dredging industry, has since the foundation been a councillor and, despite the many calls upon his time, an active member of the executive committee, and, indeed, that he is the sponsor of the plan which Malaya has acclaimed as the best solution of its particular problems and which the council has adopted as the basis for a world-wide scheme; that Mr. Stephens, whose dredging companies are among the largest and most successful in the world, and therefore best able to withstand the least favourable conditions, should have publicly enunciated and will follow a policy of inhibition, which cannot fail to inspire all those similarly situated.

And beyond the confines of the Empire, in the forefront of production, are our neighbours in the Dutch East Indies, who already have shown us a lead in no uncertain manner. The enlightened administration of Banka, that immense consolidation of mines and alluvial tracts from which the Netherlands East Indian Government obtains its annual output of some 20,000 tons of metal, have always conducted their enterprise on the most conservative lines. In the boom year of 1927 the Banka production was computed at 21,600 tons; in the first year of depression, 1928, that figure was reduced by no less than 900 tons; and this year there has been a further and still more drastic abatement of the output.

Again, with regard to Bolivia, I feel that the association may claim all the leading producers as its friends, and that the spirit of co-operation has met with instant recognition on every hand.

So much for progress and for the hopes in general that we may legitimately entertain in respect to the year 1930. As far as your own company is concerned, I would say that you hold a good hand with many trump cards. That you have weathered so successfully the storms of the past year—mighty upheavals that have not merely disturbed our own industry, but rocked the money markets, and shaken the stock markets of the world—points to prudent management, and the exercise of prudence under such difficult conditions is no mean task. The success of any company must depend largely upon good management, but the prosperity of every tin mining company in the world will hang ultimately upon the price of the metal and the fundamental conditions in the industry; and if those

conditions are unsound, then you will agree that all the energies of your Board should be directed towards their betterment. Your Chairman has told you that the Board has not shirked its responsibilities in that direction, and I am very earnestly of the opinion that there must be no relaxation in the future.

Before sitting down, I should like to say a word regarding the changes on the Board which come before you for confirmation this afternoon. Lord Askwith has told you how reluctantly he is laying down the burden of office. I am sure that I am voicing the sentiments of all the directors when I say that the Board, too, views his retirement with very real regret. We are deeply indebted to Lord Askwith for his unremitting labours in the interests of the Syndicate, no less than for the unflinching courtesy which has endeared him to his colleagues and, indeed, to the whole staff. It is no small achievement to have piloted successfully an undertaking such as yours through the past four years—years fraught with difficulties and perplexities. But, however reluctantly, we must recognize that Lord Askwith is entitled, after years of strenuous labour, to take things more easily. We all know how determinedly he has worked for consolidation and co-ordination within the industry, and it is perhaps fitting that he should choose to lay down the mantle of his office at the moment when the various internal mergers, of which he has always been the staunchest advocate, are almost within sight. It only remains for us, ladies and gentlemen, to thank Lord Askwith for the great service that he has rendered to your company and to assure him that the work, started more than four years ago and continued until to-day with unabated vigour, will be carried on until complete success crowns our efforts.

Sir Edward Locke-Elliott, who is also retiring at this meeting, is equally entitled to our grateful recognition. Like the Chairman, he was an original member of the Board, his services have been given unstintingly, he is a Tin man at heart and will remain such for all the many years we hope he will be spared to enjoy his retirement.

Lord Brabourne and Mr. Oliver Hoare, whom the directors have nominated for the two vacancies on the Board, come to us with redoubtable reputations won on other fields, but both of them are tin men, too, with an intimate knowledge of the plateau industry in Nigeria. They bring with them a very wide experience of the Empire mining industries, and they represent one of the oldest and most powerful of the London mining houses, which has now turned its attention towards our metal. The association is one from which we stand to gain immeasurably, and I have no hesitation in acclaiming it with enthusiasm. As for myself, I can only say that, if you honour me by confirming my appointment, I will do my utmost to protect and further your interests in any and every direction. I have very much pleasure in seconding the resolution which has already been read to you.

The motion was put to the meeting and carried unanimously in the absence of question or comment.

The election of Mr. John Howeson to a seat on the Board was unanimously confirmed, and Lord Brabourne and Mr. Oliver Vaughan Gurney Hoare were unanimously elected directors.

The auditors, Messrs. Fitzpatrick Graham and Co., were reappointed, and a hearty vote of thanks to the Chairman, directors and staff, with a special tribute to Lord Askwith for his services to the company, closed the meeting.

RHODESIAN SELECTION TRUST, LTD.

Directors : A. Chester Beatty (*Chairman*), C. W. Boise, J. A. Dunn, T. F. Field, E. E. Marshall, G. R. Nicolaus, D. Richardson, W. Selkirk, A. D. Storke. *Manager in Northern Rhodesia* : R. J. Parker. *Secretary* : D. C. D'Eath. *Office* : Selection Trust Building, Mason's Avenue, Coleman Street, London, E.C. 2. *Formed* 1928. *Capital issued* : £755,317 15s. in 5s. shares.

Business : Exploration and development of copper properties in Northern Rhodesia.

The first ordinary general meeting of the Rhodesian Selection Trust, Ltd., was held on December 18 at River Plate House, Finsbury Circus, E.C. Mr. A. Chester Beatty (Chairman of the company) presided.

The Secretary (Mr. D. C. D'Eath, F.C.I.S.) having read the notice convening the meeting and the report of the auditors,

The Chairman said : Gentlemen,—In accordance with the customary practice, I propose, with your permission, that the directors' report and statement of accounts to June 30 last, which have been duly circulated to all shareholders, be taken as read. In order to comply with the provisions of the Companies Act, 1929, an income and expenditure account covering the period of the accounts has been prepared, and is here on the table for any shareholder who desires a copy.

The original capital of the company consisted of 2,000,000 5s. shares. Of these, 1,200,000 were issued fully paid to the vendors and the remaining 800,000 for subscription at par. In January last the capital was increased to 4,000,000 shares by the creation of 2,000,000 new shares of 5s. each. In February 1,000,000 of these were offered to and subscribed for by shareholders at par pro rata to their holdings, and in April a further 503,475 shares were offered to and subscribed for by shareholders pro rata to their holdings at a premium of 5s. per share. Out of the total of 50,000 shares reserved for issue to the staff, 20,850 have been issued at £1 per share. The total issued capital of the company at this date is thus 3,524,325 shares of 5s. each. In order to finance the development of your properties the capital was further increased on November 4 last to 5,000,000 shares of 5s. each. There are thus available for issue to shareholders 1,446,525 shares. From the balance-sheet you will note that the total amount expended on prospecting and development in the N'Kana Concession to June 30 last amounted to £302,682, of which, under the terms of the agreement with the Bwana M'Kubwa Copper Mining Company, Ltd., that company provided £76,349.

The expenditure on the Mufulira mine amounted to £143,165. Since the date of the balance-sheet construction and development work on this important property have proceeded rapidly, with a consequent large increase in this total.

The N'Kana Concession has an area of approximately 1,800 square miles and under our agreement with the Chartered Company and the Bwana M'Kubwa Copper Mining Company we had the right, up to November 30, 1929, to select and mark out in the concession a total of 150,000 acres, the Bwana Company retaining one-third interest in the areas so selected. Further, the Bwana Company has the right to furnish up to 30% and the Chartered Company up to 10% of the initial cash capital required for the development and

equipment of any mines in the areas selected before November 30, 1929. The concession has been extended after November 30, 1929, by an agreement with the Chartered Company and the Bwana Company until December 31, 1930, with an option of further extensions to April 30, 1935. By the terms of the agreement all areas marked out after November 30, 1929, will be divided in ownership as follows:—Bwana M'Kubwa Copper Mining Company, Ltd., 65% ; Chartered Company, 10% ; Rhodesian Selection Trust, Ltd., 25%.

Out of the 150,000 acres to which I have referred we have selected 22 areas covering approximately 149,700 acres, or about 234 square miles, and special mining grants covering the whole of these areas have been issued to us by the Chartered Company.

It is impossible, I think, for anyone not cognisant with the details of your company's activities to have any idea of the enormous amount of work which this has entailed on our staff, not only in Rhodesia, but also here in London. In the first place, a thorough geological study had to be made over the whole of the 1,800 square miles, and this in itself was a great task, especially in a country covered with trees, bush and soil, and where outcrops of rock are few and far between and where the outside work could only be carried on advantageously for six months in the year.

After a general geological map had been prepared detailed geological work had to be carried out, coupled with a large amount of surface trenching, pitting and shallow drilling in the areas which in our opinion were the most likely to contain copper. In this way we were eventually able to decide on the actual areas to be taken up. I feel that a special word of commendation is due to our field staff in Rhodesia for the expeditious and efficient manner in which they have carried out this important work.

The developments of outstanding importance in the concession during the year were those at Mufulira, where indications point to the existence of a very extensive mineralized area. The 12 boreholes already completed indicate the presence of 45,000,000 tons of ore, averaging 4.68% total copper, of which 92% is in the form of sulphide, and a further large amount of drilling will be required thoroughly to explore the possibilities of this remarkable ore occurrence. The important tonnage of highly profitable ore already disclosed amply warrants the equipment programme already under way for dealing with an initial output of 2,000,000 short tons of ore per annum, which should produce 75,000 short tons of copper. I am pleased to inform you that we have secured the services of Mr. E. E. Barker as general manager of the Mufulira mine in Rhodesia. Mr. Barker has had a long and varied experience in large tonnage copper mining, having held responsible positions with the Nevada Consolidated Copper

Company, Chile Copper Company, Cerro de Pasco Copper Company and for the past six years with the Utah Copper Company.

Early in 1929 a contract was let for the construction of a branch railway from Mokambo, on the Chemin de Fer du Haut Katanga, to connect with the Mufulira mine. Construction work was commenced in May, and the first train reached the mine on September 21, thereby placing the property in direct rail communication with Beira.

In order to provide sufficient power for the carrying on of underground work, two 1,250-kw. turbo generators have been ordered, together with boilers and the necessary accessories. A town site has been laid out and the grading of streets has already commenced. Plans are well in hand for the main power plant, warehouses, fitting-shops, etc. Four secondary incline shafts are being put down in the ore-body in order to prepare the mine rapidly for production. The site for a large vertical hoisting shaft has been selected and a test bore-hole is now being put down to prove the suitability of the ground. The great width of the ore bed at Mufulira makes the preparation of the mine for production a relatively easy matter since there will be 5,000,000 tons of ore above the first haulage level which will be placed at an incline depth of about 500 ft. Ore will be available from the underground workings very shortly and a portion of this will be transported to the Roan Antelope mine for testing purposes in the Roan Antelope pilot plant.

As soon as the progress of underground work permits, Mr. Lucien Eaton, the company's consulting engineer on underground mining work will proceed to Rhodesia, and, in consultation with the management and staff, a comprehensive scheme for mining the ore-bodies will be laid out. I can assure you that we are leaving no stone unturned to provide the best men available for the various work in hand, and we will spare no reasonable expense in ensuring that first-rate quarters are built for the staff, with proper sanitary arrangements and water supply.

In the Chambishi area, which lies about 17 miles south-west of Mufulira, drilling has been carried on for some time, and while this property has not yet reached a point to justify the construction of a plant, the drilling has been very satisfactory, and in due course this area should develop into a very profitable enterprise.

In the Baluba area geological work was carried on in order to trace the extension of the ore-bearing horizon from the adjoining Muliashi property, and, based upon this, drilling was commenced. Three holes over a strike length of 5,000 ft. have indicated a true thickness of 25.6 ft. of sulphide ore, averaging 3.2% copper. These results are very encouraging, and I feel sure that additional drilling will open up an ore body which will justify the cost of equipment.

In the North Mokambo area ore was encountered in a borehole, but owing to pressure of work in connection with the completion of the surveys before November 30 of this year no further drilling has been done. Further work will be done here at a later date.

During the coming year geological work, pitting, prospecting and drilling will be continued on the special grants. The Bwana M'Kubwa Company

expects to carry on general prospecting in the remaining portion of the N'Kana concession, in which your company will hold a 25% interest, together with the right to find 20% of the cash required for any mines which may be found.

In order to meet our requirements for timber in future years our forestry department is carrying on its research work as to how the land, particularly in the Mufulira district, can best be reafforested.

The labour supply so far has been satisfactory, and I see no difficulty in the future. It is our intention to use mechanical appliances so far as possible at our mines and so reduce to a minimum the native labour required.

The question of cheap power is one that will naturally affect the company and, indeed, the whole of the Northern Rhodesian copper industry, and it is desirable that a supply of cheap power should, if possible, be obtained. We have decided, therefore, to co-operate with other companies working in Northern Rhodesia in making full investigation into a probable source of hydro-electric power for the use of the whole field.

The health of the employees, both native and European, is one which has been and is being carefully considered. While the climate is undoubtedly a healthy one, there is a certain amount of malaria and other tropical disease which I am confident can be largely and in most cases entirely eliminated. I am pleased to tell you that our companies have arranged with the Ross Institute for a thorough survey of our properties, to be undertaken by eminent men of great experience in this special work. The expedition, under the direction of Sir William Simpson, its chief adviser on tropical diseases, is already on the spot.

We are now proceeding with the formation of the Mufulira Copper Mines, Ltd., in which your company will retain a 66 $\frac{2}{3}$ % interest in the Vendor's shares, and also the right to subscribe to 60% of the initial capital.

I am pleased to inform you that your company's arrangements for providing the initial funds required for carrying on prospecting, and the construction of plant at Mufulira have been completed. I consider that we were unusually fortunate in being able to conclude these arrangements during one of the worst periods of financial stress that the world has ever seen. It was not possible under the existing conditions to make an issue of shares at a price which your directors considered justified, and therefore the arrangement which I will explain a little later was entered into with the American Metal Company, Ltd., Cull and Co., and the Lehman Corporation. Mufulira is already undoubtedly a very valuable mine, and I look to its becoming one of the premier copper mines of the world. At Chambishi we have already found a very large tonnage of ore, and I have no doubt that when fully explored this will also prove to be an important mine. At Baluba the drilling so far has given promising results and the prospects of a large mine here are excellent.

The resolution for the adoption of the report and accounts was unanimously carried.

At the extra-ordinary general meeting which followed, the agreement for the sale of the Roan Antelope Extension Area to the Roan Antelope Copper Mines, Ltd., was approved.

RHODESIAN CONGO BORDER CONCESSION, LTD.

Directors : F. L. Gibbs (*Chairman*), W. Broadbridge, A. Chester Beatty, W. Selkirk, A. C. Howard, Carl R. Davis, Sir Edmund Davis, D. O. Malcolm, Sir Auckland C. Geddes, J. N. Buchanan, Sir Henry Strakosch, L. A. Pollak. *Consulting Mining Engineers in Africa* : Rhodesian Anglo American, Ltd. *Secretary* : H. C. Hankins. *Office* : 20, Copthall Avenue, London, E.C. 2. *Formed* 1923. *Capital issued* : £699,581 in ordinary shares of £1 each and £49,651 in "A" shares of £1 each.

Business : The development of large copper properties in Northern Rhodesia.

The seventh annual ordinary general meeting of the Rhodesian Congo Border Concession, Ltd., was held on December 16 at the Cannon Street Hotel, E.C. Mr. Francis L. Gibbs (Chairman of the company) presided.

The Secretary (Mr. H. C. Hankins) read the notice convening the meeting and the auditors' report.

The Chairman, after reviewing the accounts in detail, said: You will remember that at the extraordinary general meeting which was held in May last I told you that the British South Africa Company had agreed to make our company special grants of mining rights over any areas which we chose to select, but such areas should not exceed 10,000 acres each and should not amount in all to more than 150,000 acres: these grants would be made on the establishment of one discovery point for each area, and out of this total of 150,000 acres the British South Africa Company had agreed to allow us to locate 75,000 acres before December 31, 1929, on condition that they had the right to subscribe up to 10 per cent. of the capital issued for cash of any companies formed to work any areas marked out before that date.

The British South Africa Company had also agreed that the special grants could be located at the discretion of our company where beds of the ore-bearing horizon were in evidence and that, in respect of areas located prior to December 31, 1929, the British South Africa Company would accept the description and plans made by the Surveyors of the Rhodesian Congo Border Concession, Ltd., subject to confirmation by a licensed surveyor after that date. In respect of the remaining 75,000 acres, the British South Africa Company will be entitled to receive 10 per cent. of the vendor consideration paid by any companies formed to work the properties, and have the right to subscribe up to 20 per cent. of any capital issued for cash by such companies.

You will be pleased to learn that advice has been received by cable from the company's officials in Africa that 14 areas have been marked out under the above arrangement, covering approximately 74,000 acres in extent; four areas in the N'Changa district are shown on map 2 which accompanies the technical committee's memorandum. One additional area has been selected in the N'Changa district in the neighbourhood of Luano, and two further areas to the north-west of N'Changa. Two more areas have been marked out in the eastern portion of the concession, one of which is in the vicinity of Bwana M'Kubwa and the other in the Lunsemfwa district. One area has been located in the southern portion of the concession in the neighbourhood of Kasempa and four in the western portion of the concession.

You will appreciate the enormous amount of work which has been entailed in selecting and marking out these special grant areas, and our best thanks are due to Dr. Bancroft, the chief consulting geologist of Rhodesian Anglo American, Ltd., who superintended this work, and to the staff engaged thereon. I should like to take this opportunity of again thanking the British South Africa Company

for the way in which they have assisted our company in this most difficult task.

Another matter of vital importance to our company was that arrangements should be made for the extension of the branch railway line from N'Kana to N'Changa, in order that the N'Changa district should be placed in direct connection with the Rhodesia Railways system as soon as possible, and you will be glad to know that this arrangement has been made and that a satisfactory agreement has been come to between our company and N'Changa Copper Mines, Ltd., and the Mashonaland Railway Company, Ltd. The survey for the extension of the line has been completed and the construction has started. It is hoped that the line to N'Changa will be open for traffic by the end of next year.

Another equally important matter in connection with our company's operations and those of N'Changa Copper Mines, Ltd. is the provision of adequate power, and this matter is receiving the most careful consideration of our technical committee and the company's consulting engineers in Africa. Your Board have agreed to take a participation in a company which has been formed to investigate the possibility of developing a central power scheme for Northern Rhodesia, and in the meantime two 625 kw. turbo-generating sets have been ordered, and will be installed at N'Changa.

Another matter which is also receiving the careful consideration, not only of your Board, but also of all the other companies operating in Northern Rhodesia, is the provision of native labour. A central bureau is being formed for the recruiting of native labour, so that all companies operating in Northern Rhodesia shall be able to secure their labour through this bureau and thereby do away with competition in recruiting, which, without such central organization, cannot fail to exist. The available supply of native labour should be ample to meet the requirements of the companies operating in Northern Rhodesia, provided recruiting is properly organized and due care is taken to ensure that the well-being of the natives is effectively provided for. This is not a difficult matter, but it requires careful organization.

I would ask you now to turn your attention to the position of the N'Changa Copper Mines, Ltd., in which, as you are aware, our company holds a very large interest. At the end of 1928, the manager of N'Changa Copper Mines, Ltd., estimated that the indicated ore amounted to over thirty-one million tons, averaging 3.9 per cent. of copper. Of this amount of ore 1,693,900 tons are on the River lode to the 350 ft. level, 8,193,000 on the Dambo lode in that portion developed by drilling and underground work, and 21,551,000 tons on what is known as the New Discovery.

During the present year additional boreholes within the N'Changa area have increased this indicated tonnage of 31,000,000 tons by approximately 28,000,000 tons, averaging 3.9 per cent. copper. Thus there is a total indicated tonnage within the N'Changa Copper Mines area of over 59,000,000 tons, averaging 3.9 per cent. copper.

The ore, apart from the sulphide ore on the river lode, should be classified as mixed oxide-sulphide ore. I have used the word "indicated" in respect of the above tonnage, because that is the word we have always used up to the present in connection with our estimates of tonnage, but in the opinion of Dr. Bancroft, the eminent geologist, who is in charge of all the geological work of our companies, this tonnage can now be definitely taken as proved. I would emphasize that these estimated tonnages include only ore within triangles formed by completed boreholes, and there is reasonable expectation that further work during the coming year will greatly increase these tonnages.

From what I have told you it is evident that the N'Changa Copper Mines, Ltd., has within its area an enormous tonnage of good grade copper ore and cannot fail in the course of time to become a very important copper producer.

Leaving now the area of the N'Changa Copper Mines, Ltd., I will deal with the work which has been done within our concession to the west of this area. Immediately to the west drilling has been in progress, and a strike of high-grade ore between 4,000 and 5,000 ft. in length has been proved, but until further drilling has been carried out it is not possible to estimate the tonnage which may be obtained in depth on that strike, but, unquestionably, between boreholes N.E.5, N.E.6 and N.E.7, a distance of 4,000 ft., an ore-body of the highest importance both as regards tonnage and grade exists. These three boreholes gave extraordinary results—N.E.5 encountered 65 ft. of ore averaging 7.9 per cent. copper and a further 25 ft. of very high-grade ore—but owing to the low core recovery no definite figure as to the grade of this 25 ft. can be given. The average, however, of the content of the core which was recovered was 24.9 per cent of copper. N.E.6 cut 125 ft. of ore averaging 10 per cent. copper. N.E.7 cut 55 ft. of ore averaging 5.56 per cent. copper.

Further to the south-west along the strike of the mineral beds, at a distance of some two and one-eighth miles from the N'Changa boundary, there is what is called the Chingola area, and here borehole N.E.15 encountered 46 ft. of ore, and the manager's interpretation of this hole is that it averages 8.3 per cent. of copper over that vertical thickness. The surface indications at Chingola are favourable, and there is good reason to believe that a high-grade ore-body of great importance exists here.

Work during the past year has to a large extent been confined to the eastern portion of the concession, but Dr. Bancroft and Major Gilchrist, the company's assistant manager, visited the western section during the autumn and inspected several of the prospects with a view to submitting their recommendations for future work.

I have already told you that 14 special grants covering 74,000 acres in extent have been marked out. There have been many prospects reported within our concession, and it is possible that some of these may prove of sufficient importance to warrant our obtaining special grants to cover them at a later date. It must be borne in mind that the greater part of our concession has still to be systematically prospected.

During the coming five years the policy of your Board regarding the exploration of our concession is to continue an active prospecting and geological campaign with the object of attempting to cover in detail the exploration of the entire concession

within that period. In addition, an extensive drilling campaign will be carried out, in order to develop further the ore-bodies of importance to which I have drawn your attention, as well as any other ore-bodies which may be discovered.

The metallurgical treatment of our company's ores and those of N'Changa Copper Mines, Ltd., is receiving the careful consideration of the technical committees, and it has been decided to retain the whole-time services of a leading metallurgical expert to study this question and to supervise the carrying out of the necessary tests and to advise the Board as to the best method to be adopted for the treatment of these ores.

In this connection I may say that an important American group has carried out in its laboratory a large number of tests on the treatment of N'Changa ores by the Segregation Process of Minerals Separation, Ltd. These tests have proved eminently satisfactory, and this process, in which the Minerals Separation Company has the greatest confidence, will now be further tested in common with other possible processes under the supervision of the metallurgical expert whom we propose to employ.

You were advised in the directors' report that in July of this year a separate syndicate, known as the Kipushi Syndicate, Ltd., was formed, to prospect for minerals in an area of 10 square miles, to be selected from within an area of 15 miles long by 5 miles deep, in our concession adjoining the boundary between Northern Rhodesia and the Belgian Congo in the vicinity of the Prince Leopold Mine, at Kipushi. The capital of the Kipushi Syndicate, Ltd., is £60,000, divided into 240,000 shares of 5s. each. 48,000 shares were issued credited fully paid up to our company as vendor consideration and the balance of 192,000 shares has been subscribed for in cash, and our company has taken up 80,000 of the subscribers' shares, so our holding in the Kipushi Syndicate, Ltd., is 128,000 shares at 5s. each, out of an issued capital of 240,000 shares.

In conclusion, you will appreciate from what I have told you to-day that the ore deposits within the N'Changa area and the extension of those deposits into our concession to the west of the N'Changa area are both of outstanding importance. The size and grade of these ore-bodies have created a profound impression upon the leading copper experts of the world.

We have still an immense task before us in exploring our concession, which even to-day is, to a large extent, unexplored, but from what we have already accomplished we have every encouragement to proceed with that task.

I should like to express our thanks to our consulting engineers, the Rhodesian Anglo American, Ltd., our manager, Mr. W. Burns, our assistant manager, Mr. D. Gilchrist, and all other members of the staff for the painstaking way in which they have carried out their duties during the past year. I now beg to move: "That the directors' report and accounts for the year ended June 30, 1929, be and the same are hereby approved and adopted," and I will ask Sir Auckland Geddes to second the motion.

The Rt. Hon. Sir Auckland C. Geddes, G.C.M.G., K.C.B., seconded the motion, which was carried unanimously.

The retiring directors and the auditors were re-elected and the proceedings terminated.

NEW MODDERFONTEIN GOLD MINING CO., LTD.

Directors : A. W. Rogers (*Chairman*), Sir Abe Bailey, S. C. Black, D. Christopherson, R. W. Ffennell, Major C. S. Goldman, J. Martin, Sir Evelyn Walters. *Consulting Engineers* : Central Mining and Investment Corporation, Ltd. *Manager* : E. C. J. Meyer. *Secretaries* : Rand Mines, Ltd. *London Secretaries and Office* : A. Moir & Co., 1 London Wall Buildings, London, E.C. 2. *Formed* 1888. *Capital* : £1,400,000 in 10s. shares.

Business : Operates a gold mine in far East Rand.

The ordinary general meeting of the New Modderfontein Gold Mining Co., Ltd., was held in Johannesburg on Monday, November 25, Mr. A. W. Rogers (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts for the year ending June 30 last, said: The total profit for the period was £2,287,479, which, with the balance of £317,371 unappropriated at the beginning of the year and a small amount of £754 in respect of forfeited dividends, gave a total of £2,605,604 to the credit of Appropriation Account. As shown in the Directors' Report, this was disposed of as follows: Dividends Nos. 45 and 46, of 70% each, absorbed £1,960,000; Government and Provincial taxation amounted to £315,982; capital expenditure, chiefly in respect of the annuity payable for certain undermining rights leased from the Government, accounted for the net sum of £12,561; and a further amount of £15,000 was set aside towards meeting the Company's outstanding liability in respect of Miners' Phthisis compensation. The unappropriated balance at June 30, 1929, was £302,061, represented as to £161,749 by cash assets, mainly stores, materials and similar items, and as to £140,312 by net cash, after allowing for all current liabilities.

The Company's proportion of the outstanding liability of the scheduled mines on account of Miners' Phthisis compensation was calculated at £341,580 as at July 31, 1929, an increase of £41,283 compared with the estimate made twelve months earlier. The sums provided up to June 30 last towards meeting this obligation, with accrued interest, total £57,462.

The tonnage milled during the past financial year averaged 142,750 tons per month, an increase of 7,250 tons over the monthly average for the previous year. Although the yield decreased by 0.7 dwt. per ton milled, working costs showed a satisfactory reduction of 1s. 8d. per ton milled, and, owing to the larger tonnage crushed, the total working profit was increased to £2,252,433, an improvement of £10,670. With regard to working costs, the Consulting Engineer points out in his report that, although operations were conducted on a larger scale during the year under review, the total working expenditure recorded a decrease of £62,414, by comparison with the preceding year's figure. Continuous effort is being made to improve upon the already high standard of general efficiency at the mine. A further appreciable increase has been effected in the efficiency of the machine drills used in stoping and development, although, as I indicated at our last annual meeting, you will realize that the rate of improvement in any particular direction cannot be expected to be maintained indefinitely. Patient investigations into the economical use of native labour and the extended employment of mechanical appliances have led to an important additional increase in the output

per native employed in shovelling and tramping. The substantial improvement recorded during the past financial year is distinctly gratifying, and it is hoped that the efforts of the management in this direction will have further success.

Good progress continues to be made with the sand-filling programme, 638,000 tons of sand having been lowered into the mine during the period under review, as against 515,641 tons in the previous year and 170,465 tons in the year ended June 30, 1927.

The development footage was increased to 74,982 feet, as compared with 58,565 ft. during the previous twelve months and 47,300 ft. during the year ended June 30, 1927. The increase was chiefly due to the larger footages driven on the Upper Leaders and the South Reef, as the result of the acceleration of development on these reefs in view of the approaching completion of the major development programme on the Main Reef Leader. Out of 19,545 ft. sampled on the Main Reef Leader, 13,980 ft. disclosed payable reef averaging 680 inch-dwt.; of 7,730 ft. sampled on the Upper Leaders N.A. 1 and N.A. 2, 3,955 feet were classed as payable, with an average value of 384 inch-dwt.; of 12,554 ft. sampled on the Upper Leader N.A. 7, 7,384 ft. exposed payable reef averaging 373 inch-dwt.; and of 11,860 ft. sampled on the South Reef, 7,070 feet gave payable values averaging 374 inch-dwt. The payable ore developed during the year on the Main Reef Leader amounted to 815,200 tons, averaging 9.8 dwt. over 48.9 inches; on the N.A. 1 and 2 Leaders it was 218,900 tons, averaging 6.1 dwt. over 44.5 inches; on the N.A. 7 Leader it was 296,300 tons, averaging 6.5 dwt. over 41.1 inches; and on the South Reef it was 220,900 tons, averaging 7 dwt. over 42 inches. The total payable ore developed on all reefs was thus 1,551,300 tons, an increase of 190,200 tons on the previous year's figure, although the average value at 8.2 dwt. per ton was 1.0 dwt. less. The ore reserve as recalculated at June 30, 1929, totalled 9,097,600 tons of an average value of 8.6 dwt. per ton over an assumed average stoping width of 50.2 inches. This included 1,240,000 tons of ore averaging 6.7 dwt. per ton included in shaft pillars, etc., which is not immediately available for stoping, but which sooner or later can be expected to be mined. Full particulars of the ore in reserve on each of the different reefs are given in the Consulting Engineer's Report, and its location is shown on the plan accompanying this report.

The expenditure on equipment during the year was only £3,041, incurred in connection with the extension of the South reduction plant. As you know, the programme of major capital expenditure has been completed and no important fresh outlay of this nature is contemplated. We are, however, now considering, and will in all likelihood adopt, certain proposals for immediately effecting further refinements and additions to the reduction plants,

with the object of improving the efficiency of metallurgical operations and enabling the present rate of milling to be increased by between 4,000 tons and 5,000 tons per month. The expenditure involved is tentatively estimated at about £13,000. The benefit to be derived from operating on this larger scale will in a measure offset the effect of the drop in yield that will result from the milling of an increased proportion of lower grade ore from the Upper Leaders and South Reef.

I dealt fully at the last annual meeting with the development position and programme, and particularly the bearing which the development of the Upper Leaders and the South Reef might be expected to have on the life of the mine. An excellent beginning has been made in the last few years with the big undertaking which the development of these subsidiary reefs represents, and the results on the whole have so far been satisfactory. You will see from the plan accompanying the annual report the areas in which these Leaders and the South Reef have already been developed, while you will also be able to appreciate the large amount of work which remains to be done before an estimate can be made of the extent of the influence which ore derived from these sources may have on the future of the mine. With the exception of N.A. 1 and 2, there have been only a few exposures of these reefs outside of a limited area in the north-west section of the mine.

I mentioned last year that the grade of ore going to the mill would probably be reduced in value as the proportion of ore mined from the Leaders was increased. That has been the case during the period under review. This tendency will continue

to manifest itself. During the past year its effect was counterbalanced by the larger tonnage milled and the reduction of working costs. The further increased rate of milling that will follow the proposed increase of the reduction plant to which I have already referred will help to make up for the lower grade of ore that will, for the reason mentioned, be going to the mill, but the probability is that there will be some reduction in profits. While, however, the milling of a greater proportion of this lower grade ore will result in somewhat smaller profits than the recent high average, shareholders must not fail to take into account the influence which the opening up of additional tonnages of ore from the Leaders and South Reef will have in extending the profitable life of the mine.

As regards operations during the first four months of the current financial year, the tonnage crushed averaged 151,250 tons per month, an increase of 8,500 tons on the monthly average for the past year. The yield was slightly lower at 9.664 dwt. per ton milled, but working costs were reduced to 16s. 8d. per ton milled and the working profit totalled £742,432, or an average of £185,608 per month. Development was prosecuted at the again increased rate of 7,958 ft. per month. The major development programme on the Main Reef Leader is now practically completed, and the footage at present being accomplished on that reef consists largely of internal development. Altogether we hope to add something in the neighbourhood of 500,000 tons to the payable Main Reef Leader reserves.

Mr. A. Alexander seconded the motion, which was put to the meeting and carried *nem. con.*

FRONTINO AND BOLIVIA (SOUTH AMERICAN) GOLD MINING CO., LTD.

Directors : Rt. Hon. Sir Hugh O'Neill (*Chairman*), Sir Henry P. Harris, Lord William Percy, H. N. Stephens. *Consulting Engineers* : Pellew-Harvey and Co. *Superintendent* : J. Reed. *Secretary* : J. J. Truran. *Office* : 206, Gresham House, Old Broad Street, London, E.C. 2. *Formed* 1911. *Capital issued* : £23,390 in preference shares and £140,000 in ordinary shares ; debentures £33,653.

Business : Operates the Silencio gold mine, Colombia, S. America and holds a half interest in the Marmajito Mines, Ltd.

The ordinary general meeting of the Frontino and Bolivia (South American) Gold Mining Company, Ltd., was held on December 17 at Winchester House, E.C.

The Right Hon. Sir Hugh O'Neill, Bart., M.P. (Chairman of the company), said that the sales of gold amounted to £38,920 less than for the previous year, and expenses at the mine were £6,517 less. The result of these greatly reduced gold sales had been a working loss of £6,735, as compared with a profit of £24,744 in the previous year.

In spite of this very unfortunate result, they were maintaining the full dividend on the Preference shares, but naturally they were unable to recommend the payment of any dividend on the Ordinary shares. Although the tonnage treated was within 310 tons of what it was in the previous year, the grade of the ore milled fell from 23.09 dwt. to 14.97 dwt., and this difference accounted for the decrease in revenue. The ore produced from the stopes was nearly 5,000 tons less, but the deficiency here was made up by ore from the development operations, which, unfortunately, was mostly of a low grade.

The reduced yardage in the stopes was principally due to shortage of power, owing to the exceptionally dry season experienced during the year, particularly in the later months. With regard to the development work during the year, he said this amounted to no less than 3,993 ft. of advance, which was 1,573 ft. more than in the previous year. Although the grade of ore in the length of new vein developed was rather lower, the greatly increased width of the vein was a satisfactory and encouraging feature, which very largely offset the somewhat lower values.

With regard to the returns for the first five months of the current financial year, the tons milled had amounted to 9,300 of a total value of £30,288. This was, unfortunately, no better than during the corresponding period of the previous year, but in spite of it he really believed that they had now turned the corner, and that the two favourable factors of increased power and greatly improved developments would very shortly begin to tell their tale in the monthly production of the mine.

The report and accounts were unanimously adopted.

CAMP BIRD, LTD.

Directors : F. W. Baker (*Chairman*), J. A. Agnew, R. Annan, L. W. Harris, F. C. Heley, O. V. G. Hoare, H. C. Porter. *Secretary* : E. C. Leaman. *Office* : 49, Moorgate, London, E.C. 2. *Formed* 1900. *Capital issued* : £649,625 in preference shares of £1 each and £326,884 16s. in ordinary shares of 2s. each.

Business : Finance of and investment in mining and other ventures in various parts of the world.

The twenty-eighth ordinary general meeting of shareholders of Camp Bird, Ltd., was held at Riber Plate House, Finsbury Circus, E.C., on December 20, Mr. F. W. Baker (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts for the year ended June 30 last, said that the control of the company and its management had not passed over to the New Consolidated Gold Fields, although three directors of that company had been added to their directorate. The management of Camp Bird rested with its Board.

The authorized capital of the company—£2,100,000—showed no alteration from last year. The issued capital, the 8% Cumulative Preference shares also stood at the same figure as last year—namely, £649,625—while the Ordinary share capital stood at £326,884 16s., representing an increase of £18,900 during the year under review. Share premium account, which stood in last year's balance-sheet at £18,345, had been added to by the sum of £13,961, as a result of premiums realised on shares issued during the year, making under this heading a total of £32,306.

Before giving details as to the properties in which their company was interested he would like to draw a comparison of the position of the company at the date of the reorganization in 1926, and its position as at June 30 last, and to outline the policy which their Board had in mind to carry out; this policy lay in acquiring and building up a series of interests from which revenues would be secured, which would put the company on a permanent and definite dividend basis. If this policy was to be carried out, and he asked their approval of it, it could only be done by applying the profits earned to development purposes until such time as the numerous interests which they owned had been brought to the productive stage.

He then dealt with the arrangements made with the New Consolidated Gold Fields, and the reasons which induced their Board to issue, since the close of the period under review, £250,000 worth of 7% Debentures. When he suggested to the management of the New Consolidated Gold Fields a working arrangement between the two companies he felt that, having regard to our very largely increased activities the company would greatly benefit by the addition to its directorate of gentlemen with whom he had been associated for a long number of years, and whose experience and knowledge of the class of business that they were doing would be of material help to them. The proposal was sympathetically considered and the Gold Fields' management, after a close investigation of their interests and liabilities, expressed the view that if any agreement was to be brought about it would be on the condition that further capital was provided and that capital secured rather by the creation of a debenture issue to the extent of £250,000 than by

the sale of assets at considerable sacrifice. Their Board, after careful consideration of the Gold Fields' proposal, decided to create the number of debentures referred to in the report. They were influenced in agreeing to the creation of this debenture indebtedness by their desire to liquidate the bank overdraft, as pressure was being brought for reduction, influenced possibly by factors the undercurrent of which was then beginning to be felt, and which have since loomed large with disastrous results both here and in New York.

The arrangement embodied a change of offices for all the companies included in what was known as the "Camp Bird Group", which were now housed at 49, Moorgate. Their company was entitled to a participation in all new business undertaken by the Gold Fields.

He would now deal with the more important interests of the company. Camp Bird mine: The company had maintained the mining property in good order during the year. The lessees had held a lease of the mine extending from the surface to the third level since October, 1925. Ore production during the past year resulted in a net profit of £10,625 19s. 6d. accruing to the company by way of royalty, after providing for all costs of the mine office, including maintenance of the tunnel, plant, taxes, insurance and general expenses.

The Chairman then gave details of the results of the Santa Gertrudis Co., and the Mexican Corporation, which are dealt with elsewhere in the reports of the meetings of those two companies.

The Durango Timber Company's operations in Mexico had shown good progress during the year in organising operations, improving and increasing its equipment and remodelling one of its sawmills, resulting in a substantial increase of productive capacity. The management in Mexico estimated that the production of timber would shortly be at the rate of 60 million board feet per annum, and they were proposing to add additional drying kilns in order to enable the company to maintain normal supplies to customers throughout the rainy season.

During the period of four months, July to October of the present year, the operating results of the Durango properties in Mexico at the two milling plants showed that the production and profit equal an annual rate of £100,000 per annum. Mr. Rose further reported that the mills continued to work at full capacity. An important contract was now under consideration by the Durango Company of Mexico for furnishing railroad ties to one of the most important railroads up to a total of 800,000 ties, and a contract had been arranged to supply the railways with several million feet of lumber and poles during the current fiscal year. Important contracts had also been entered into with one of the largest of the oil companies in Tampico for furnishing box shooks which are manufactured at the Durango plant. They had

during the period under review increased their holding in the Durango Timber Company. Their investment in the company was taken up in the form of an 8% Redeemable Debenture, the redemption period to operate in two years' time. They held approximately one-third of the share capital of the company, and he looked for very substantial dividend returns on this shareholding when certain obligations entered into by the company through advances from the local banks have been partially liquidated.

Through its subsidiaries and in its own name the Creole Petroleum Corporation held, at January 1 this year, about 10,976,000 acres of oil leases in Venezuela, of which approximately 3,905,000 acres would be returned to the Venezuelan Government by virtue of the terms of exploration concessions. This corporation's share of gross production from properties operated by others was large, and was increasing rapidly. During the year 1928 it was reported to have averaged 15,666 barrels per day. During the year 1929 the Creole Petroleum Corporation had developed an important field in the middle of its extensive holdings in East Venezuela. This field was situated 20 miles from the San Juan River, at which point oil could be loaded into 30,000 barrel tankers.

A pipeline covering this short distance was under construction, and was expected to be completed early in the New Year. So far nine wells in this field had been brought in with a production ranging from 300 to 900 barrels daily. The drilling of these wells had already proved an area one and a half miles long by one mile wide. The corporation was planning for an average production of 10,000 barrels daily during 1930 from this field, in addition to its present production, and was now installing facilities for such production. Locations for ten additional wells had been made, with three actually drilling.

A further field being developed by the Creole Corporation was situated in the Buchivacoa district. In the eastern part of this concession a well, known as Las Palmas No. 1, was deepened and came in during August with a daily production of 2,500 barrels of high-grade oil. This well and others drilled in the same area were considered to have demonstrated that the Las Palmas area was of commercial importance, and arrangements were now being made which should lead to its further development.

Development of the Lake George property continued to give satisfactory results, and the ore reserves indicated by development and diamond drilling now amounted to nearly 2,000,000 tons. The pilot mill, with a capacity of 30 tons daily, had been put into operation, and the results to date indicated that the previous estimates of recoveries and grade of concentrates would be bettered in practice. The Public Works Commission of New South Wales had recommended the construction of the railway to connect the mine with the main line, and the necessary Bill would be introduced into the Assembly in the coming session. Estimates and designs were now in preparation for the equipment of the property for a production of 500 tons per day, with provision for increase in the future. This work had been entrusted to Mr. T. C. Baker, general manager of the Fresnillo mine, whose

experience in the successful treatment of a similar sulphide ore would be of the greatest value. The deposit consisted of three main ore shoots, of which Elliott's, accounting for 1,000,000 tons, had been developed by two shafts and six levels to a depth of 600 ft. and by diamond drilling to 900 ft. The Central and Keating's ore shoots, accounting for about 300,000 tons and 640,000 tons respectively, had been developed by diamond drilling, which the work in Elliott's section had proved to be entirely reliable. The last drill-hole put down in Central section showed 13½ ft. of ore, assaying 11% of lead and 19.6% zinc, which was much above the average of the mine, and development from Elliott's would be extended into this section. The Keating's ore shoot was of average grade, and showed widths up to 24 ft. Since the end of the financial year the Lake George Metal Corporation, Ltd., had been registered, with a capital of £1,000,000 in shares of £1 each. This corporation would acquire from Camp Bird for a consideration of 650,000 shares their interest in this property and provide the funds for its further development and equipment.

After unwatering Wheel Buller, operations had been confined to sinking the shaft to the 1,000 ft. level, and to making the necessary connections for haulage and ventilation. The 1,000 ft. was reached in August last, and, after completing the shaft station and installing the pumping and hoisting plant, development of the tin zone underlying the old copper workings had been commenced. A considerable amount of driving and cross-cutting would be necessary to prove the possibilities of the property.

Venezuelan Consolidated Oilfields reported that development work during the past year had been confined to its Trinidad properties, where 14 wells were now producing at Fyzabad and seven wells had been brought into production at the Palo Seco district since June 1, 1929. A contract had been entered into with the Creole Petroleum Corporation to drill this company's Delta Concessions on the eastern coast of Venezuela, which were considered to be of great potential value. The company reported a very important well having been brought in at its Palo Seco property on December 11, with a flow of 1,440 barrels per day.

He had to report that Mr. Leon Clerc had resigned his seat on the Board, and that Messrs. J. A. Agnew, O. V. G. Hoare, and H. C. Porter, directors of the New Consolidated Gold Fields, Ltd., had been appointed directors of the company. In accordance with the articles of association Messrs. J. A. Agnew, O. V. G. Hoare, H. C. Porter, L. W. Harris and R. Annan retired from the Board, and resolutions for their re-election would be put to the meeting in due course.

He would now propose the resolution which was before them—namely: "That the directors' report and statement of accounts for the year ended June 30, 1929, be and they are hereby received and adopted." I will ask Mr. Agnew to second the resolution, but before putting it to you shall be glad to deal with any questions which you may care to ask arising out of the report and accounts.

Mr. J. A. Agnew seconded the resolution, which, after some discussion, was carried unanimously.

SANTA GERTRUDIS CO., LTD.

Directors : F. W. Baker (*Chairman*), J. A. Agnew, R. Annan, L. W. Harris, O. V. G. Hoare. *Secretary* : E. C. Leaman. *Office* : 49 Moorgate, London, E.C.2. *Formed* 1909. *Capital issued* : £1,553,400 in £1 shares.

Business : Operates silver mines at Pachuca, Mexico.

The twenty-first ordinary general meeting of the Santa Gertrudis Company, Ltd., was held at River Plate House, Finsbury Circus, E.C., on December 20, Mr. F. W. Baker (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts for the year ended June 30 last said that interest and dividends on investments amounted to £10,553, and dividends declared by Cia. Beneficiadora de Pachuca amounted to £300,000. The balance remaining amounted to £285,074, and from this sum had been appropriated to general reserve £50,000, to reserve for income-tax £5,000, and the balance of £230,074 had been carried to the balance-sheet. After adding the balance brought forward from last year's account of £27,486, dividends amounting to £233,010 had been paid, leaving a balance to the credit of profit and loss of £24,550 11s. 7d., which it was proposed to carry forward to the current year. Since the date of the accounts before them, operations in Mexico had been thoroughly satisfactory, and in spite of the low price of silver remittances had been regularly maintained. As a consequence an interim dividend of 1s. 6d. per share in respect of the current year was declared on November 28, payable on January 9.

During the year the mill of the Cia. Beneficiadora treated 633,657 dry tons of ore, having a gross assay value of \$7,100,000. Of this ore 264,000 tons were produced by the Inversiones Company and 369,000 tons by the Dos Carlos Company. The bullion recovered contained 40,000 oz. of gold and 9,655,000 fine oz. of silver. A total of approximately 43,000 ft. of development was accomplished during the year, of which 30,500 ft. were driven in the Dos Carlos territory. In the El Bordo group, the El Cristo mine was worked out, and the El Bordo and Malinche mines, although still producing, apparently have a short life in sight. On the other hand, the Dos Carlos mine developments have continued to show good results during the past year.

A new level, the 22nd, was opened on the Dos Carlos vein, and the results to date of developments, both east and west, on this level have been uniformly good. The strong indications of the continuance of ore in depth have made it advisable to open up a new 23rd level, 165 ft. below the 22nd level, and sinking to this horizon is in progress. Since the end of the company's financial year developments on the 19th, 20th, 21st, and 22nd levels in the western section of the mine have disclosed a considerable amount of high-grade ore in large widths, the assay values of which are much higher than the average metal contents of the general ore reserves.

This development opened up the possibility of adding considerable future tonnage to their reserve, as they would have available large backs assuming that values persisted into the upper levels. The manager pointed out further that

geological surveys of the Dos Carlos property carried out during the past year had suggested some interesting possibilities of probable ore occurrences which were being investigated by driving and diamond drilling.

Generally, the intensive programme of development which had been proceeding for some time past would be continued throughout the current year, with the object of exploiting a considerable amount of virgin ground as well as the further opening up of present producing areas. It would be of interest to know that the heavy expenditures necessarily incurred in carrying out the large amount of development work had been, and were still being, charged to current operating costs, and the reserves of the operating companies as well as those of their company had not been drawn upon in any way, but had on the contrary been increased during the year under review.

The ore reserves estimated as at June 30, 1929, showed a reduction of less than 50,000 tons as compared with the previous year's estimates; in other words, the year's developments had put in sight over 585,000 tons of ore, and Mr. Rose stated in his report that substantial additions to the reserves might be expected; and having regard to the interesting developments which he had just reported in the western end of the Dos Carlos vein at the 19th, 20th, 21st, and 22nd levels, it would seem that the current year would show large additions to reserves, notwithstanding the heavy rate of ore extraction.

The reserves at the several mines at June 30, 1929, were estimated at 959,151 dry short tons, having a recoverable content of 55,546 oz. gold and 13,000,000 oz. silver. The milling plant was maintained in the usual first-class condition. Mr. Rose reported that earnings were expected to continue at a satisfactory rate during the current financial year, even with the present low price of silver.

During the period under review an arrangement was entered into with the Compania de Real del Monte y Pachuca to do jointly some development on the 500 metre level of their Santa Margarita mine, along the common boundary between the Realito and their Ohio claims. The proposed work, now well under way, included about 1,000 ft. of driving, to be followed by 2,300 ft. of diamond drilling to the east, along the line of the above-mentioned common boundary. This work had as its object the discovery of any veins which might enter either property from the other.

It would be gratifying to them to know that their large shareholding in the Mexican Corporation was now a revenue-earning interest, and should continue to remain so. The Mexican Corporation, on October 24 last, paid its first dividend of 1s. per share, and, subject to continuance of normal metal prices, he looked forward to the maintenance of regular dividend distributions in the future.

Mr. L. W. Harris seconded the resolution, and it was carried unanimously.

MEXICAN CORPORATION, LTD.

Directors : F. W. Baker (*Chairman*), J. A. Agnew, R. Annan, Lord Brabourne, H. Guedalla, O. V. G. Hoare, W. McDermott. *Managing Director of Mexican Company* : Hugh Rose. *Secretary* : E. C. Leaman. *Office* : 49 Moorgate, London, E.C. 2. *Formed* 1919. *Capital issued* : £500,000; *Notes* : £40,000.

Business : Owns a large interest in the Fresnillo silver mine and operates the Teziutlan copper-zinc mine, Mexico.

The eleventh ordinary general meeting of the Mexican Corporation, Ltd., was held on December 19 at River Plate House, Finsbury Circus, C.E., Mr. F. W. Baker (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts for the year ended June 30 last, said: With your permission, I will ask you to treat the directors' report and accounts as read.

Before dealing with the accounts I would like to go back to last year's annual meeting, when I referred to the negotiations which were then in hand for merging the Fresnillo Company's interest in the Fresnillo mine and our Mexican company's interest in the Fresnillo lease into one operating company, and I indicated that, if these negotiations were brought to a successful termination, the logical and proper course to be pursued would be to reduce our capital, secure the sanction of shareholders and the Court to this reduction, so that as a result the share of profits coming to us through our Fresnillo and Teziutlan interests would become available for distribution as dividends. The negotiations which I have referred to were brought to a successful conclusion, and in June of this year meetings were called when the necessary resolutions were passed by you authorising the reduction of capital, and subsequently the Court's sanction to the reduction was secured, the change in capitalisation being reflected in the balance-sheet which is now before you.

The Fresnillo mine during the year ended June 30, 1928, made a total profit of \$1,023,188, against a profit for the year 1929 of \$1,592,904. The Teziutlan mine's total profit for the former period was \$16,338 and for the latter \$177,509. These results show a total increase in 1929 for the two mines of over \$630,000. It will be of interest to you to know that the profit and loss account of the Mexican Corporation, S.A., as at June 30, 1929, showed a credit balance of \$1,373,926.

With regard to Fresnillo mine. From a study of the managing director's report it will be seen that the year's work at the Fresnillo mine has been productive of excellent results. A total of 44,350 ft. of development, as well as 3,287 ft. of diamond drill holes, was accomplished during the year. The results were very satisfactory, and put in sight a considerable tonnage of sulphide ore.

As has been the practice for some years, developments were largely concentrated on the sulphide ore bodies, and a comparatively small amount of work was done in the oxide ore section. In spite of the increased tonnage of sulphide ore treated during the year, Mr. Rose's ore reserve estimate, as at June 30 last, shows a considerable increase in this class of ore. After charging the whole of the development expenses to operating costs, the mining, milling and general expenses were reduced during the year, such reduction

amounting to 10 cents per ton on oxide ore and 56 cents per ton on sulphide ore.

Dealing with the ore reserves as at June 30, 1929, the oxide cyaniding ore shows a total tonnage of 2,073,427 tons, having a gold content of 13,477 oz. and 12,705,000 oz. of silver. These reserves show a reduction compared with the figures of last year of some 680,000 tons, against 846,000 tons milled during the year. The reduction in reserves is in consequence of development of this class of ore having been treated as a secondary consideration in favour of the development of the sulphide ore bodies, the latter being a more profitable ore for treatment with present metal prices. The sulphide ore reserves are given at 807,000 tons; despite the fact that during the period under review 207,000 tons of sulphide ore were treated, the existing reserves of this class of ore show an increase of 70% over the figures given you last year, approximating an increase of 330,000 tons, and Mr. Rose, in his report, states that further large additions to the ore reserves are expected. The concentrates produced from the sulphide ore and shipped were 32,796 tons of lead concentrate, 32,996 tons of zinc concentrate and 8,141 tons of iron concentrate.

It will be of interest for you to know that a contract was arranged for the sale of zinc concentrate production to the end of the year 1930.

Turning now to the Teziutlan mine. The diamond drilling programme at the Teziutlan mine, referred to in your directors' report for the year ended June 30, 1928, has been actively proceeded with during the year, and a total of 4,661 ft. of drilling has been accomplished, consisting of 2,020 ft. of surface holes and 2,641 ft. of holes drilled underground. This has had the satisfactory result of discovering a new ore body. In addition, there have been other favourable developments of ore, and, as a result, the reserves as at June 30, 1929, show a substantial improvement over those indicated in the previous year's report. Mr. Rose states that further additions are expected to the present ore reserves.

The profit return of this mine shows a considerable improvement over that for the previous year, and the life of this property has been considerably lengthened by the discoveries made.

The Teziutlan ore reserves at June 30 are estimated at 128,000 tons. This figure of reserves shows an increase during the period under review of 73,000 tons, after treating 67,372 tons. The average milling rate was 185 tons per day; the concentrates produced and shipped were 7,635 tons of copper concentrate and 10,123 tons of zinc concentrate. The total operating expenses work out at \$10.51, as against \$12.29 for last year. Mr. Rose states that, notwithstanding increased expenditure for development and diamond drilling, the costs show satisfactory reduction, taking into account the small size of the operation.

Mr. J. A. Agnew seconded the resolution, which was carried unanimously.

LAKE VIEW AND STAR, LTD.

Directors : J. A. Agnew (*Chairman*), David Anderson, A. H. Collier, J. H. Corder-James, G. G. Hay.
Consulting Engineers : James Brothers and H. E. Vail. *Mechanical Engineer* : W. R. Degenhardt.
General Manager : J. F. Thorn. *Secretary* : J. Comper. *Office* : Finsbury House, Blomfield Street,
 London, E.C. 2. *Formed* 1910. *Capital issued* : £520,000 in 4s. shares.

Business : Operates a group of gold mines at Kalgoorlie, Western Australia.

The nineteenth ordinary general meeting of Lake View and Star, Ltd., was held on December 30 at River Plate House, Finsbury Circus, E.C., Mr. John A. Agnew (Chairman of the company) presiding.

The Secretary (Mr. J. Comper) having read the notice convening the meeting and the report of the auditors,

The Chairman said : In dealing with the development work at the mine, I find it impossible to avoid some repetition of what I had to say last March. On that occasion I explained to you our policy of development respecting the opening up of the Chaffers section and the southern end of the Horse-Shoe property, and the work contemplated in our efforts to prove the views put forward by Dr. Maclaren regarding the continuation southward of a shoot of ore in the Horse-Shoe lease in an area hitherto entirely unprospected. This shoot of ore was estimated by Dr. Maclaren as probably existing over a length of about 700 ft. and at a depth of between 1,000 and 2,500 ft.; it represented the continuation of the very rich shoot of ore on the No. 4 lode worked by the Golden Horse-Shoe Company further north, its southern continuation having probably been missed at successive levels by the management of the latter company owing to faulting having occurred at the intersection of that lode with the Horse-Shoe No. 2 lode. Now, with the Horse-Shoe shaft down to something over 3,000 ft. in depth and levels driven at varying depths between 100 and 125 ft. apart, it would have seemed a simple matter to have repaired some of these levels between the critical depths to which I have above referred, and to have extended them at a minimum expenditure of time and money to test the soundness of Dr. Maclaren's views. We found, however, that the main levels were in such bad condition as to make it practically impossible to reopen them.

To those of you who are familiar with such problems as these and who have had an opportunity of studying the mine plans there may have occurred another line of attack, and that is from the Chaffers end. The Chaffers main shaft is being sunk as rapidly as circumstances will permit. The primary object of that shaft was to enable us to develop the southern continuation of the Horse-Shoe lodes, not only in the deeper ground in Horse-Shoe but in Chaffers also. The continuation of this programme would mean that a considerable time must elapse before we would be able to open out and drive north into the unprospected area in which Dr. Maclaren's report indicated possibilities. If we could have obtained any reasonable confirmation of the existence of what I may term for convenience the Maclaren shoot of ore at depths between 1,000 ft. and 2,500 ft. we could safely have postponed shaft sinking at, say, 2,600 ft. and have opened out levels from which driving north could be prosecuted with the utmost speed. Now within the last week or so we have had such

confirmation in the results met with in No. 8 bore-hole put out east on the 2,100 ft. level south drive on the Horse-Shoe. At a distance of 61 ft. east of the drive an ore-body was intersected, the first 2 ft. of which were low grade, and next 12 ft. in ore averaging 48s. 6d. per ton. This lode is found exactly where we expected the southern continuation of the No. 4 lode to exist, and there does not appear to be any doubt whatever about its providing us with a most striking confirmation of the accuracy of the views expressed by Dr. Maclaren.

In the meantime we are taking up with the management the possibility of an alteration in our plans, suggesting that we should temporarily suspend the sinking of Chaffers shaft at a depth of approximately 2,600 ft. and commence development work northwards in the Horse-Shoe ground, the shaft sinking to be resumed as soon as the levels in question are far enough removed to obviate any risk of accident.

In addressing you last March, I described very fully the development work which had been conducted in the Chaffers section from the Horse-Shoe workings on the 2,770, 2,900, and 3,030 ft. levels, which we now call the Chaffers deep levels. Though the results obtained properly come within any survey of the work carried out during the year ended June 30 last, I do not intend to repeat my remarks, highly satisfactory though such results appear. The only new work since carried out in that section is that of driving south on the No. 4 lode at the 3,140 ft. level for a distance south of the boundary of 67 ft. The first 51 ft. averaged 316s. per ton in value over a width of 73 in. At the end of that extension the drive encountered a slide, and the last 16 ft. driven are in very low values. No further work from the Horse-Shoe workings in this section in contemplated at the present time.

It was the original intention of the management to drive south from the main shaft on the Ivanhoe lease at the 3,600 ft. level in order to expedite the very great amount of development work that has ultimately to be undertaken in the deeper levels of the Horse-Shoe. After consultation with the management it was decided to connect the main workings on the Horse-Shoe section with those from the Ivanhoe shaft by driving at a depth of 3,260 ft., and this work is now being vigorously prosecuted from both ends.

When we were placed in possession of the Golden Horse-Shoe property one of the first points which attracted the attention of the management was the fact that little cross-cutting had been done in the walls of the main drives throughout the mine. Mr. Thorn, on assuming charge, put in hand work calculated to prove the possibility of discovering, adjacent to the main ore-bodies themselves, further important makes of ore. Just north of the main shaft on the 2,780 ft. level a diamond drill hole put out east from the old drive on the No. 4 lode

cut ore assaying £4 18s. per ton over a width of 26 ft. The diamond drill was removed to the 2,900 ft. level, and in a section immediately below that just referred to in boring east from the old drive ore has again been cut. Lying 1 ft. distant from the drive an ore-body 6 ft. in width and assaying £15 17s. per ton has been encountered.

So far, I have dealt mostly with our prospects in the Horse-Shoe and in the Chaffers leases. There are, however, important prospects of getting very large tonnages of ore of a very good grade from the No. 3 lode in the Horse-Shoe lease. Quite recently diamond drill-hole No. 7 put out from the 2,630 ft. level 500 ft. south of the Horse-Shoe main shaft towards No. 3 lode cut 3 ft. of ore worth 31s. per ton, this being in all probability the continuation of the body of ore exposed some time ago by a cross-cut 750 ft. south of the shaft, where a width of 15 ft. averaged 2 oz. per ton for a length of over 100 ft. The latter block of ore is still intact. Shareholders were advised recently through the Press of a find of very rich telluride ore in the 300 ft. level on the Lake View section. The actual discovery was made in a cross-cut put out by tributers and subsidized by the company.

I ought to refer briefly to another item of news, and that is the find of so-called alluvial, which was made at a point west of the Golden Horse-Shoe mill at a depth of about 60 ft. below the surface in a block of ground let to tributers. Present indications point to this extending for a distance of about 450 ft. east of the Horse-Shoe plant and for some distance west of the site of its first location. This deposit owes its origin to the denudation of the rich outcrop on the Great Boulder lease, and from its nature it would appear to be more correctly described as eluvial rather than alluvial.

We have been asked on several occasions if we can account for the low returns recorded from the treatment plant in the last few months. Two difficulties confront the management in the matter of maintaining a regular and satisfactory yield. The first of these is due to the shrinkage method of stoping, which has been practised over a great number of years in the Lake View section, from which the greater part of our ore supplies are at present being drawn. The other difficulty is that of transporting to the mill the higher grade ore which has been opened up recently, and shareholders would be well advised to regard the yields for some little time to come as being of a purely temporary character.

Our work during the last eighteen months has been very greatly hampered owing to an actual shortage of air compressor capacity, and owing to the bad condition in which a good deal of the equipment in and about the mine has fallen. We have had to renew almost entirely the rock drill equipment, instal new air lines in several sections of the mine and to replace a great deal of the transport equipment. A new air compressor has been purchased and is being erected as rapidly as possible.

The Lake View property as a whole is to-day an aggregation of several mines, whose scattered nature means the maintenance of a number of separate power plants. We are investigating at the present time the possibility of being able to establish on the mine a central power plant, using oil for fuel. As an alternative to this proposal we

are investigating the possibility of making a suitable arrangement with the Kalgoorlie Power Company for the supply of electric power, and this if completed would obviate capital expenditure on our own account.

After repeated tests we have decided to erect the first unit of a flotation plant, and those portions of the latter necessary to be procured from England are already on their way out to the mine. This unit will have a capacity of about 5,000 tons monthly, and, dependent upon the results obtained being confirmatory of the test work just referred to, we shall proceed immediately with the erection of further units so as to provide for a total treatment capacity of about 40,000 tons of ore per month. The first flotation unit is expected to be at work at the end of May next, and, assuming successful working results, it will take a further twelve months to erect and bring into operation the remaining units. The management assure us that well before the date of completion of the enlarged plant there will be developed on the Horse-Shoe property ample supplies of higher grade ore. Taking into consideration the capacity of the present plant—namely 16,000 tons per month—and allowing for portion of the roasting and cyaniding sections being utilized for treatment of concentrates from the new flotation unit, we should have by the middle of 1930 sufficient plant capacity to treat about 20,000 tons of ore monthly.

Since the date of the financial year we have decided that the magnitude and importance of the work we have in hand requires the attention of a man who can give his whole time to it and we have accordingly appointed Mr. J. F. Thorn general manager. Mr. H. E. Vail, who has been general manager of Lake View for a number of years, will continue to assist us in the capacity of consulting engineer.

I have now to move: "That the report and accounts as issued to the shareholders and submitted to this meeting be, and they are hereby adopted," and will ask Mr. Corder-James to second this. Before putting this to the meeting I shall be pleased to answer any questions you may care to put before me.

Mr. John H. Corder-James said: I am sure you have all listened with the greatest attention to the lucid and exhaustive address which has been delivered to you by our Chairman. The preparation of such an address could only have been undertaken by one having the possession of technical qualifications as well as a personal knowledge of our property and of the Kalgoorlie field generally such as is possessed by our Chairman. His address seems to me to practically answer beforehand every question that could have arisen in the minds of shareholders with regard to the present position and prospects of this important enterprise, as well as clearly defining the development policy adopted for their realization.

Mr. A. H. Collier, in seconding the motion, said: I would like to say a few words regarding my having vacated the chair in favour of my good friend, Mr. Agnew. Directly Mr. Agnew joined the Board it became obvious to me that he was the man best qualified to direct the company, and I hope shareholders will understand that I was studying their interest to the fullest extent when I resigned the chairmanship in favour of Mr. Agnew.

SULPHIDE CORPORATION, LTD.

Directors : The Earl of Kintore (*Chairman*), Hon. Vicary Gibbs, Andrew Williamson, Hon. G. C. Gibbs, C. F. Courtney (*Managing*). *General Manager* : J. C. Moulden. *Secretary* : C. R. Fisher. *Office* : Finsbury House, London, E.C. 2. *Formed* 1895. *Capital issued* : £600,000 in preference shares of £1 each and £450,000 in ordinary shares of 15s. each.

Business : Operates the Central lead-zinc-silver mine and Cockle Creek Works at Broken Hill, New South Wales, and a zinc and acid works at Seaton Carew.

The thirty-third annual ordinary general meeting of the Sulphide Corporation, Ltd., was held on December 19 at Winchester House, Old Broad Street, London, E.C. The Rt. Hon. the Earl of Kintore, (Chairman of the company), presided.

The Chairman, in moving the adoption of the report and accounts for the year ended June 30 last, said that the present had been deemed an appropriate time to deal with the large credit balance under accumulated profits used in the company's business, and £377,522 had been appropriated in reduction of the book value of the fixed assets—which now stood at £784,171—leaving £150,000 to be dealt with later. The total of the liquid and semi-liquid assets was this year £703,759, compared with £594,464 last year.

The final net profit was higher by £88,047 and amounted to £213,227. It was proposed to pay a dividend of 15% on both classes of shares. He was glad to have the opportunity of congratulating shareholders on the improved profit earned this year and the consequent increase in the dividend.

Dealing with the company's mines and works in Australia, the Chairman said that shareholders would have noticed from the reports that favourable progress had been made in both treatment and production. At the Central mine all re-opening work that had to be undertaken as a result of the disastrous fire had been completed, and although in certain parts of the mine the temperatures still continued unduly high the extraction of ore had not been interrupted. A complete ventilation of the mine had been successfully re-established, thus permitting an examination to be made of the ore existing below the 1,400 ft. level.

The Junction mine during the period had remained closed down in consequence of the fall in metal prices, and although the expenses of upkeep and the cost of labour conditions imposed in the lease were kept at a minimum, nevertheless, the total annual expenditure was such as to show that in a few years this increasing debit would amount to a sum in excess of the value of the ore reserves unless the prices of metals were abnormally high. Seeing that this mine was situated between the North and British mines, with railway connections through the Junction mine area, an offer had been made to the North Company to take over these leases, and it was agreed, after discussion by the parties interested, that the sum of £20,000 would be a reasonable value to place on the mine and surface plant, which sum had been accepted. This property had thus been acquired by the North Company, and was now incorporated with that company's leases.

From the summary of the milling operations at Broken Hill for the past year it would be seen that 154,087 tons of ore were passed through the mill, of which 19,365 tons were old dump slimes. This product, being free from mining charges, had favourably influenced their milling costs,

and had also been a source of considerable profit in the past, but it was now exhausted. In order to compensate for this, arrangements had been made with Broken Hill Proprietary and the Block 14 Company for blending their ore with that from the company's own mine for treatment in the company's mill. In order to accommodate the large increase this would entail to the input, it was found necessary to modify and enlarge the mill, and since October milling of the combined ore of the three companies had been under successful operation, with the result that the present weekly input had risen to between 5,000 and 6,000 tons, compared with an average of 3,000 tons last year.

From the 154,087 tons of ore treated, 24,839 tons of lead concentrates were produced of somewhat higher value than last year, together with 37,188 tons of zinc concentrates, which also showed a higher grade as well as improved segregation. The average price obtained for their lead in the lead concentrates was £23 2s. 5d. per ton, or £2 per ton better than for the previous year, while the price obtained for their spelter showed a reduction of 12s. 3d. per ton.

Last year he referred to the efforts on the part of zinc and lead smelters to formulate a scheme by which production would be regulated. Conferences had since been held and a more accurate knowledge of the lead position had been disclosed. Even if a rough balance could be secured between production and consumption, a general benefit must result to both producer and consumer, and in the meantime the co-operative action between the leading zinc smelters had proved successful in arranging for a general reduction in output, without which effective combination prices would have fallen further.

At their works at Cockle Creek, operations had been carried on without interruption. Acid production had amounted to 22,997 tons acid mono, being an increase of 2,457 tons over the previous year. In the Superphosphate department 43,954 tons of high-grade super were produced, an increase of 6,035 tons. The development of the limestone quarry at Attunga was assuming large dimensions, a face of over 500 ft. in length and 90 ft. in height of very high-class limestone having been opened up, the capacity to meet requirements being practically unlimited.

Great progress in treatment had been achieved at the zinc and chemical works at Seaton Carew. Notwithstanding the fall in the price of spelter, their profits from these works had been well maintained. Connected closely with the interests of the Seaton works was the Nantymwyn mine in South Wales. It was now anticipated that the completion of the plant would not be delayed beyond next month, when the whole would be tuned in for continuous operation.

The report and accounts were unanimously adopted.

CONSOLIDATED TIN MINES OF BURMA, LTD.

Directors : Sir Cyril Kendall Butler, C. F. Lochner, Ross Macartney, Sir Frank Cecil Meyer, Maj.-Gen. The Hon. Sir Newton Moore. *Consulting Engineers* : Pellew-Harvey and Co. *Secretary* : P. E. Day.
Offices : Alderman's House, Alderman's Walk, Bishopsgate, London, E.C.2. *Formed* 1928.
Capital issued : £809,534 17s. 6d. in £1 shares.

Business : Operates tin- and wolfram-properties in the Tavoy District, Burma.

The first annual meeting of the Consolidated Tin Mines of Burma, Ltd., was held at Cannon Street Hotel, E.C. 4, on December 30, Sir Cyril Kendall Butler (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts for the period ended June 30 last, said :—

You will, no doubt, have observed that approximately 20% of the company's assets are in the form of cash at bankers, debtors, and stocks. With these resources available, the funds necessary for the proper development of your properties are assured.

If you will now turn to the mining account and the profit and loss account, which immediately follows, you will see that these accounts cover periods of eight and twelve and a half months respectively. So far as the working costs are concerned, the reports which accompany the accounts deal with the exceptional circumstances which are associated with the period since the inauguration of the company. I particularly wish to emphasize that up to June 30, 1929, no benefits were derived from the preliminary development and equipment work which was in process of introduction during the eight months to that date. Moreover, the entire period was composed of "dry" months; this expression, of course, is not used in the prohibition sense, but implies the absence of rains. I think the most fitting method of substantiating my remarks on this subject is to give you particulars of the results obtained since the date of the accounts. Firstly, you will have seen from the report before you that the output for the five months since June amounts to 711 tons, which exceeds the output for the whole period embraced by the accounts before you to-day.

Despite the unfavourable price of tin, the results of the mining operations since June are equally gratifying, and a cable which was received by the Board from your company's technical adviser only last week (and which I propose to read to you) will enable you to form some idea of the greatly improved results: Total output July to November, 711 tons. Total output values July to November, inclusive, £81,324. Expenditure, £61,004. Profit, £20,320. Price tin taken for valuation of stocks at end of November, £180. Expenditure includes £3,140 carried forward at June 30, 1929. Recent inspection of mines shows first part of equipment programme to have been well carried out. July, 1929, was first month to get benefit from this work. An active policy of construction and development is being continued. Underground development during last year has been mainly directed towards opening up known veins at lower levels—evidence so far shows no diminution of size and values of veins at depth. Our intense campaign of prospecting has revealed valuable bodies of detrital not worked in the past. It is

expected following the completion of this season's equipment programme that from July next there will be a considerable increase in production. I am of opinion that the properties possess great potentialities and promise of long life.

But what will even more appeal to you, as it does to the Board, is the concluding paragraph of Mr. Ross Macartney's printed report, in which he states that with the further knowledge of the properties he confirms his previously expressed opinion that the company possesses large and valuable areas of tin-bearing detrital ground, profitable lode occurrences and a considerable area of alluvial flats.

A brief reference to metal prices is important on this occasion. It is generally admitted that, next to production and its cost, the most essential factor to the success of a mining company is the price at which its products can be sold in the markets of the world. To the tin producer it is somewhat disappointing that the market price of the metal is in no way governed, or, in fact, barely influenced, by the cost of its production, and so long as a commodity is allowed to be produced and marketed in excess of its demand for trade requirements, it is only logical that a decline in its market value will follow.

Probably most of you have followed the gradual and serious decline—during the past eighteen months—in the price of tin, and although I do not wish, for one moment, to minimize its adverse effect on the company's revenue and profits, I must at the same time refer to the other product of your properties—I allude, of course, to wolfram. It is most satisfactory to me to be able to report a very different position so far as this product is concerned. Compared with tin, the movements in the market value of wolfram are not so easily followed, but the significance of the advance in the market price which has taken place during the past nine months will, to some extent, be appreciated when I inform you that, for the current year (that is, since June 30 last) your company's wolfram concentrates have been marketed at a price of 100% in excess of their value at the date of the prospectus. Since June 30 until the end of this year our wolfram shipments have been sold to produce approximately £30,000.

I think you will expect me to refer to the scheme for restriction which has been put forward by the Tin Producers' Association. I can only say that we are wholeheartedly in favour of the schemes for research and propaganda initiated by the Association, and provided, as I feel certain will be the case, the majority of the producers of the world agree to a restriction of output, we shall, as far as our exceptional circumstances admit, also support the policy of restriction. I may add that we have already called for a report from our technical adviser on the subject.

Sir Frank Cecil Meyer seconded the resolution and it was carried.

KAMUNTING TIN DREDGING, LTD.

Directors : W. Arthur Addinsell, John I. Philips, E. J. Byrne. *General Manager* : C. S. Kneebone.
Secretary : A. Shelley. *Office* : King William Street House, Arthur Street, London, E.C. 4. *Formed* 1913.
Capital issued : £374,989 7s. 6d. in 5s. shares.

Business : Operates alluvial tin properties in the State of Perak, F.M.S.

The sixteenth annual general meeting of Kamunting Tin Dredging, Ltd., was held on December 19 at 7, Martin's Lane, Cannon Street, E.C. Mr. W. Arthur Addinsell presided.

The Chairman, before moving the adoption of the report and accounts for the year ended June 30 last, referred to the death of their Chairman, Sir Ernest Birch. He sketched Sir Ernest's career and said that the thoroughness of their late Chairman was well known. He held the manuscript of Sir Ernest's speech in his hand and would read it to them later.

After the Secretary (Mr. A. Shelley) had read the notice convening the meeting and the report of the auditors, the Chairman read Sir Ernest Birch's address :

Gentlemen, the report on working during the year ended June 30, 1929, is written by the new manager, Mr. C. S. Kneebone, and I propose to compare it with last year's report written by Mr. Stuart, the acting manager, who, after long service with the company, has now retired.

Four dredges operated continually throughout the year, whereas in the previous year No. 4 worked for nine months only. Consequently 3,843,000 cubic yards were cut, or 160,000 more, returning 1,113 tons of tin ore, which realized £141,215. The output in the previous year was 1,336 tons. The tin content of the ground dredged averaged '65 lb., as compared with '81 in the previous year. The price per ton was £22 less than in the year before and the sum realized by sales was £58,000 less. The working costs of the four dredges amounted to 15½ cents, or 4'43d. per cubic yard, and are lower. No. 4 dredge, electrically driven, shows lower costs than the other three, and when No. 1 is converted to an electric dredge, with jigs, it is anticipated that its costs will be much lower, because as our oldest dredge and one requiring a good deal of expenditure in upkeep, it shows much higher costs than the others. It was in operation until June 30 when it was taken into dock for rebuilding and conversion.

No. 4 dredge has now entered the area of 118 acres which was obtained from the Government under the road and railway deviation, and early in August No. 5 dredge, a new machine electrically driven, began operations. This has been paid for, the last payment of £12,500 to the builders being included in these accounts. It is running at a spot nearly four miles from the centre of the mine, and has entailed the erection of quarters for the native workmen.

Mr. Kneebone deals at some length with the power-house and with the water supply. The road and railway deviation about which I told you last year will have cost us approximately £50,000.

In the last financial year four dividends were distributed amounting to 40 per cent in all, free of income tax. This year only one dividend of 10 per cent, free of tax, has been paid, and while

your directors greatly regret that they are unable to recommend the payment of a final dividend, they think that it is not unreasonable to ask the shareholders to exercise a little patience.

The profit for the year is £47,377, or £69,063 less than last year, which is accounted for to the tune of £58,000 by the fall in the price of tin, and for the balance by the smaller output. The obscurity which surrounds the metal market compels your directors to exercise the greatest caution.

Your directors are in sympathy with the aims of the Tin Producers' Association to obtain a better price for the ore they produce. It is evident, too, that the Government of the F.M.S. is apprehensive of the way in which tin is taken out of the earth and sold at a price which is adverse to the interests of the Government, as well as the producers.

I will read to you a letter written by the Under-Secretary to the Government to the manager of two of the largest mines in Perak :—

" Kuala Lumpur,
 " 9th November, 1929.

" The Secretary,
 " The F.M.S. Chamber of Mines,
 " Ipoh.

" Dear Sir,—In continuation of my letter of even number dated the 16th September, 1929, concerning the issue of mining leases, I am directed to inform you that the Government of the Federated Malay States is of opinion that its potential tin assets are being depleted at a sufficiently rapid pace and that an acceleration of that pace would be to the advantage neither of Government nor of the industry. It has, therefore, decided to adopt the following policy :—

" (a) Government is not prepared for the present except in special cases to consider applications for mining land or for the conversion of agricultural to mining land outside existing mining areas.

" (b) Land within mining areas will not, as a general rule, be alienated or converted unless it is essential to the efficient development of existing undertakings."

Mr. Naish, our former general manager, is now on his way to the East on private business, and will take the opportunity of visiting Kamunting and of conversing with Mr. Kneebone on some matters of great importance. When he reports we shall have knowledge at first hand on points of which it is difficult to judge by correspondence.

It will, no doubt, be a pleasure to him to see the scheme completed which he negotiated with the Government for a deviation of the railway line and of the main road to Province Wellesley, obtaining for us thereby an area of valuable land which Mr. Kneebone is commencing to work.

Shareholders' questions having been answered, the resolution was adopted.

MALAYAN TIN DREDGING, LTD.

Directors : W. J. Payne, C. V. Stephens, H. A. Hope. *General Manager* : A. J. Kelman. *Secretary* : T. P. Patterson. *Office* : Portland House, 73, Basinghall Street, London, E.C. 2. *Formed* 1911. *Capital issued* : £200,000 in 5s. shares.

Business : Operates alluvial dredging property in Kinta Valley, Perak, Federated Malay States.

The eighteenth annual general meeting of the shareholders of the Malayan Tin Dredging, Ltd., was held on December 17 at Winchester House, Old Broad Street, E.C., Mr. C. V. Stephens presiding.

The Chairman, before moving the adoption of the report and accounts referred to the illness of Sir Ernest Birch. He then said:—The profit for the year was £122,686, as against £112,701 in the year before. The total yardage of ground treated was over 6 million cubic yards, or 590,810 cubic yards more than in the previous year, and the output of tin ore for the year was 1,803 tons, or 196 tons more, but the average price per ton received for the ore was £22 10s. 2d. less at £132 8s. 4d. The average tin content of the ground was .5 of a kati per cubic yard, as against .49 of a kati for the previous year.

The working costs again show an improvement, averaging 4½d. per cubic yard, as compared with 4¾d. for the previous year. The royalty paid to the Government amounted to £37,450. The value of the ore produced was about £10,000 less. Interest and dividends increased from £7,721 to £20,177, the increase being mainly due to our shareholding in Southern Malayan Tin Dredging, Ltd. The surplus on realization of investments was £30,359.

Turning to the balance-sheet, property account remains at £40,000 after adding expenditure during the year and writing off an equivalent sum from profit and loss account. A proportion of our electrical plant was sold to Southern Malayan Tin Dredging, Ltd., for fully-paid shares in that company, and after allowing for ordinary expenditure on the dredges during the year and deducting depreciation £12,622, the six dredges, power station and subsidiary plant stand in the balance-sheet at £60,000. Investments at June 30 last consisted of Treasury bonds, a holding in Kramat Pulai, Ltd., and 365,677 shares of 5s. each in Southern Malayan Tin Dredging, Ltd. £20,000 has been transferred from the profit and loss account to reserve account, which now stands at £80,000.

The balance of profit and loss account brought forward from last year was £87,125 4s. 11d., to which has been added the total profit for the year under review £153,046 6s. 1d. Five dividends of 10 per cent. each, totalling £100,000, were paid out of the year's profits. After deducting the £20,000 transferred to reserve account and £1,252 14s. 2d. written off property account, the balance remaining is £118,918 16s. 10d., out of which it is proposed to pay a final dividend of 10 per cent., making 60 per cent. for the year, leaving £98,918 16s. 10d. to be carried forward to the current year.

The general manager's report gives full particulars of the working of the dredges and the power station during the year. In the tables which he gives of the returns for each dredge you will see how much more ground was worked. A great point is the increased yardage cut at a lower working cost, and that, of course, is the object to be attained.

I wish to make a few remarks concerning the Board's policy in regard to the present position of the tin industry. In a few words, we are prepared to give full support to any plan based on thoroughly sound lines and designed for the true betterment of the industry. A proposal has now been put forward by the Tin Producers' Association for producing companies to cease mining operations between the hours of 10 p.m. on Saturdays and 6 a.m. on Mondays, and to shut down for a week in each of the months of January and February next, also of March if found necessary. It would, however, be a hasty and short-sighted policy for the Malayan producers to adopt the proposal unless and until absolutely assured that the Nigerian, Bolivian, and Dutch interests were prepared to co-operate loyally with the Malayan producers in carrying out the scheme.

Your directors have carefully considered the matter in its different aspects with our associate company, Southern Malayan Tin Dredging, Ltd., and we have decided as a common contribution from the two companies towards the amelioration of the present state of affairs to cease at a convenient date operations on Nos. 1 and 2 dredges belonging to our company, these being the oldest and most expensive units to run. These dredges will in due course be dismantled and sold, if and when possible. This action may entail a certain amount of sacrifice, but we are confident that it will ultimately work out to your great advantage, as in order to replace the two units, whose total capacity is approximately 150,000 yards, we intend to place an order for a dredge with a minimum capacity of 200,000 yards. The stoppage will represent a curtailment for a year of some 14 per cent. of the total of both companies' production.

At a Board meeting held this morning your directors declared on account of the profits for the current year an interim dividend of 10 per cent., less income-tax, payable to shareholders on the register at to-day's date. This dividend is in addition to the 10 per cent. final dividend recommended in the accounts before you. The two dividends, amounting to 20 per cent. in all, will be incorporated in one warrant which will be posted to you to-morrow.

Mr. W. J. Payne, who seconded, said: It is a great pleasure to me to second the resolution for the adoption of such an excellent and sound set of accounts. There is no doubt now that the installation of jigs on our dredges has proved a success. This is shown by the steady improvement in the amount of ore recovered, which has increased from .44 of a kati per cubic yard under the former table method to the present figure of .5 of a kati. Tin dredging is still a comparatively young industry and experience is enabling us to embody in modern dredges the beneficial knowledge gained from previous working.

The report and accounts were unanimously adopted.

NARAGUTA (NIGERIA) TIN MINES, LTD.

Directors : Sir Edwin A. Speed (*Chairman*), R. H. Benard, G. R. Matthews, the Hon. Sir Newton J. Moore, John Waddington. *General Manager in Nigeria* : J. E. Snelus. *Consulting Engineers* : James Brothers. *Secretary* : H. T. Skipp. *Office* : 341, Salisbury House, London, E.C. 2.
Formed 1910. *Capital issued* : £350,000 in £1 shares.

Business : Operates alluvial tin properties in Northern Nigeria.

The nineteenth ordinary general meeting of the Naraguta (Nigeria) Tin Mines, Limited, was held at Winchester House, Old Broad Street, London, E.C., on Tuesday, December 31, 1929, Sir Edwin A. Speed (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts for the year ended December 31, 1928, said that, as stated in the report, the production for the past year was 468 tons. Of this amount 116½ tons were won from the Durumi areas, which were acquired in March, 1928, the production from the Naraguta areas being 351½ tons, which compares with 281 tons for 1928. The increased production unfortunately synchronized with a period of unsatisfactory tin prices, the average price realized being some £18 per ton less than for the previous year, although, on the other hand, Nigerian expenses during the year show a reduction of some £17 per ton compared with 1928. After making provision for depreciation of plant and machinery, they would have seen that the profit for the year was £10,582, against £8,054 for 1928. They would remember that in the last balance-sheet there was an item, platinum prospecting £500 15s. 11d., in connection with which he had stated at the last general meeting that they had decided to abandon the areas. They had accordingly written off this particular item in the current profit and loss account.

The Naraguta Company now held very considerable interests in its subsidiaries, which were

shown in the balance-sheet at cost. At an extraordinary general meeting of the Karama Company in March, 1927, he had stated that their one object had been to float these subsidiaries as good, honest, tin-producing, dividend-paying concerns, and if they did that the rest did not matter. Since that date they had sustained very many disappointments, some in connexion with their anticipated production, some in respect of the selling price of tin, and all I think beyond their power to prevent or even to mitigate; but they had this consolation arising out of their initial aims, that to the best of their information and belief the issued capital of each of their subsidiaries was reasonably commensurate with the intrinsic value of the areas which they have severally acquired.

With regard to the Naraguta areas, the production for the current year—April to November—was 312 tons, and the output for August last had been a record one of 76 tons. With regard to the general position in the tin market, tin had always been subject to more or less violent price fluctuations. He mentioned that because the impression was given in certain quarters that they were in the presence of an unprecedented and unheard-of calamity, and he ventured to suggest they should attempt to visualize existing conditions in their correct perspective.

Mr. John Waddington, J.P. (deputy chairman), seconded the resolution, and it was carried unanimously.

NARAGUTA KOROT AREAS, LTD.

Directors : Sir Edwin A. Speed (*Chairman*), R. H. Benard, G. R. Matthews, the Hon. Sir Newton J. Moore, John Waddington. *General Manager in Nigeria* : F. O'Donnell Bourke. *Secretary* : H. T. Skipp. *Office* : 341, Salisbury House, London, E.C. 2. *Formed* 1925. *Capital issued* : £120,000 in 10s. shares.

Business : Operates alluvial tin properties in Northern Nigeria.

The third ordinary general meeting of the Naraguta Korot Areas, Limited, was held on Tuesday, December 31, 1929, at Winchester House, Old Broad Street, London, E.C., Sir Edwin A. Speed (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts for the year ended December 31, 1928, said that production during the year amounted to 135 tons of tin concentrate. This compared with 80 tons for 1927, but the increase was unfortunately offset by a fall of some £30 per ton in the price realized for the metal, and, as stated in the report, there was a loss on the year's working of £4,685, apart from loan interest which was shown on the balance-sheet.

He had reminded them that they produced 135 tons for 1928, but in the light of the directors' report he thought it was unnecessary for him to emphasize that they realized such a production—even if it were recovered at a profit—was altogether incommensurate either with the extent of the company's areas or with the large capital expenditure on plant, machinery, and mine development. Mr. Bourke, their general manager, had been recalled to England and had reaffirmed his faith in the value of the areas, and the directors had granted him a further seven months' control of

the areas. The production for the current year to date had continued to be disappointing, however, and altogether inadequate. Their experience of the past four years left the directors no alternative to the conviction that past methods must be held to be responsible for past results, that was assuming that reliance could still be placed on Mr. Bourke's original estimates and subsequent statements as to the values of tin concentrate in the ground.

In this connexion they had received from time to time from their returning employees confirmatory opinions as to the values of different sections of the areas, and they had just received one such report to the effect that the proved and payable reserves were in the neighbourhood of 8,000 tons. Therefore, he thought that their past failures pointed rather to defects on the working side than to lack of values. Values constituted the very heart of a mine, and in their own case, given assurance on that point, they could justifiably look for a satisfactory reversal of their fortunes. Mention had been made of a possible capital reorganization, and all he would say in that connexion was that it would be their aim to avoid any assessment on the shareholders in respect of the shares which they at present held.

Mr. John Waddington, J.P. (deputy chairman), seconded the resolution, and it was carried unanimously.

CHINESE ENGINEERING AND MINING CO., LTD.

Directors : W. F. Turner (*Chairman*), F. Cattier, Sir Edmund Davis, Chevalier E. de Wouters, E. Franqui, L. Jadot, Col. H. A. Micklem, Major W. S. Nathan, Lord Southborough. *Agent and General Manager in China* : P. C. Young. *Secretary* : A. W. Berry. *Office* : 3, London Wall Buildings, London, E.C. 2.
Formed 1912. *Capital issued* : £1,400,000 ; *debentures* £816,000.

Business : Operates coal mines in North China.

The seventeenth annual ordinary general meeting of the Chinese Engineering and Mining Company, Ltd., was held on December 16, at Winchester House, Old Broad Street, E.C. Mr. W. F. Turner (*Chairman* of the company) presided.

The *Secretary* (Mr. Alfred W. Berry) having read the notice convening the meeting and the auditors' report,

The *Chairman* said : *Gentlemen*,—The report and accounts for the year ended on June 30, 1929, which we are submitting to you to-day, show that there has been a reduction in the profits compared with those of the preceding year, which were exceptional. The result, however, must be regarded as satisfactory, seeing that we are able to recommend a balance dividend of 10 per cent., free of income-tax, making a total dividend for the year of 20 per cent., free of income-tax, which compares with 25 per cent., free of income-tax, for the year 1927–28.

The gross profit of the Kailan Mining Administration for the year amounted to £9,462,881. After providing for interest on the Six per Cent. Kailan bonds, £49,680, redemption of bonds for the year, £24,000, reserve for depreciation, \$1,419,432, the proportion of profit to which the Chihli Provincial Government is entitled, £298,689, and other items, there remains a net profit of \$5,813,374.

The proportion of this profit brought to credit of profit and loss account, together with interest in China, is £352,192, the conversion being at the rate of 1s. 10³/₄d. per dollar, compared with 1s. 10³/₄d. in the preceding year. Interest amounted to nearly £33,000, owing to the high rates which prevailed during the year, and minor items bring up the total credit of the account to £391,251. Administration and expense of all kinds in Europe amount to £20,749, which is about the same as before, exclusive of two items which I will mention. The directors' percentage of £7,204, under article 83 of the articles of association, which is introduced into this account for the first time, is about half the figure for 1927–28. A donation of £1,000 was made to the miners' relief fund opened by the Lord Mayor in December of last year to alleviate the acute distress which existed among the mining population throughout the country, and a donation of the same amount was made to a fund which was opened in Tientsin in support of the Lord Mayor's Fund.

The net profit for the year is £361,298. This compares with £478,384 for the preceding year 1927–28, and with £314,962 for the year 1926–27. The balance brought forward from the previous year's account was £309,556, making a total credit of £670,854. On the other side we have income-tax £83,416, against £59,375 in the preceding year, an increase of £24,041. The balance to be carried to the balance-sheet is £587,438, compared with £674,457 in the preceding year. The interim dividend of 10 per cent., free of tax, paid on May 8 last, amounted to £140,000, which leaves available the sum of £447,438.

The further dividend of 10 per cent., free of tax, to be declared to-day, takes £140,000, leaving a balance of £307,438, compared with a balance of £309,556 which was brought in. I shall come presently to the question of the disposal of this balance.

The balance-sheet is quite satisfactory, showing as it does a strong financial position. The liabilities, amounting to £61,550, consist mainly of dividends and interest outstanding. Reserve for income-tax is £26,020 and for the half-year's interest on debentures to June 30, 1929, £24,480. The six per cent. First Mortgage Debentures stood at £816,000 after providing for the annual reduction by drawing of £24,000. The account called "Redemption of debentures (Kailan bonds)—reserve account" now amounts to £396,000, nearly 50 per cent. of the total outstanding. I shall return to this item later. On the other side cash was £724,904, bills receivable were £22,379 and debtors £7,281, together £754,564. There is, therefore, a surplus of cash assets over liabilities of over £640,000.

We now come to the property account, described as "Property, rights and undertaking acquired under agreement dated June 28, 1912, including the Kaiping collieries and mining rights, buildings, plant and equipment; land, harbour works, and other property at the port of Chinwangtao; depots at various ports in China, and other assets, at cost, £1,836,163." Under the new Companies Act, Section 124, we have to give such particulars as are necessary to disclose the general nature of the liabilities and the assets of the company and to distinguish between the amounts respectively of the fixed assets and of the floating assets and to state how the values of the fixed assets have been arrived at. We also have to show the amounts of goodwill and of any patents and trade marks.

The Board have found it impossible, and the auditors agree, to make a literal compliance with the terms of the section. We have, therefore, added an explanatory note, which has been settled with the assistance of the solicitors and auditors. It reads as follows :—"Since the date of the above-mentioned agreement (that is June 28, 1912) the property, rights and undertaking of the company in China have been combined and worked as one business in conjunction with the adjacent mines, of the Lanchow Mining Company, Ltd. It is, therefore, not practicable to distinguish between the fixed assets and the floating assets, or to place a value on the fixed assets at June 30, 1929. The amount above stated does not include any goodwill, patents or trade marks." The difficulty is self-evident, so I need not pursue the subject.

The next three items in the balance-sheet consist of our accounts with the Kailan Mining Administration. The first is working capital account, £350,794. The loan account, £50,143, is unchanged. The item current accounts, £87,870, represents part of our share of the profit of the past year. The advances to the Chinese Dredger Company, Ltd., £23,472, have been repaid partly in Eight per Cent. Debentures and partly in cash. There are some minor changes in

the balance-sheet which do not require specific mention and there is a statement at the foot in accordance with the Companies Act, 1929, Section 126, which refers to a matter of no importance.

We now come to the question of the disposal of the balance which will remain at credit of the profit and loss account after providing for the final dividend and of dealing with the reserve account. I cannot do better than read the paragraph as it stands in the report.

"The Board of Directors have come to the conclusion that it is expedient in the interests of the company to capitalize the major part of the undistributed profits and reserve. They therefore propose to carry to a general reserve account the sum of £280,000 from the profit and loss account, and the sum of £280,000 from the existing reserve account, together £560,000. They propose that this sum be capitalized by the distribution among the members of 560,000 of the unissued shares of £1 each at the rate of two fully-paid shares in respect of every five shares held. The percentage to which the Board of Directors will be entitled in respect of profits so capitalized is £13,200." (That sum, I should mention, covers a period of eleven years.) "There will remain a balance of £27,438 5s. 6d. at credit of the profit and loss account and £102,800 at credit of the existing reserve account. The issued capital of the company will be £1,960,000, leaving 40,000 shares in reserve."

This capitalization is made for the purpose of adjusting the company's balance-sheet and of bringing the share capitalization of the company into accordance with the facts of the case. Some of you will remember that the original share capital of the company was £1,000,000. In the year 1920 it was increased to £1,400,000 by taking £400,000 of accumulated profits, crediting it to the capital account, and issuing 400,000 fully-paid shares to the shareholders in the proportion of two to five. After that transaction the balance at credit of the profit and loss account was £37,784 and at credit of the reserve account £180,000; while, as I have already mentioned, the position as disclosed in the balance-sheet at June 30 last was that after providing for the dividend there remained £307,438 at credit of profit and loss account and £396,000 at credit of the reserve account. Those sums are being used in the company's business as working capital, and if the resolution is passed to-day £560,000 will be transformed into permanent share capital, which will then stand at £1,960,000. There are other considerations into which we need not enter. It will take three or four months to prepare this new issue.

The next paragraph of the report states that this change will involve an amendment of Article 83 of the company's articles of association, so that the amount payable to the shareholders by way of dividend—namely, £140,000 per annum—before the directors' percentage becomes payable shall be maintained at that figure notwithstanding the increase of share capital. This means that the position as between the shareholders and the directors will remain precisely as it is to-day. A formal meeting for the purpose of passing the necessary resolution will be called for an early date in the New Year.

At the last general meeting, held on the same day

a year ago, we explained the position of affairs in North China so far as we were affected down to that time, and stated that we looked forward to a prosperous year. There was no further trouble in the neighbourhood of our mines. The sales of coal for the year to June 30 last amounted to 4,336,000 tons, which was only 175,066 tons short of the sales of the preceding year, but, as you have heard, there was a reduction in the profit.

As regards the current year, the sales for the period from July 1 to the present time show an increase of 163,965 tons over the same period of the preceding year. As you know, there has been a recurrence of military disturbances in Central and Southern China. This has affected the rate of exchange and business generally in Shanghai and on the Lower Yangtze, which is one of our important markets. But, as I said a year ago, our experience shows that business revives rapidly in China. The Kailan Mining Administration is pursuing a steadily progressive policy. A new wharf has been acquired at Shanghai and is being equipped with a large mechanical handling plant, the electrification of the railway at the depots at Chinwangtao is about to be undertaken, and the mines are developed to such an extent as will enable the Administration to meet promptly all the requirements of a largely increased trade whenever it may occur, so that we feel we have good reason for regarding the future with confidence.

I now beg to move: "That the directors' report and accounts to June 30, 1929, be and they are hereby received and adopted, and that a final dividend be declared of 10 per cent., free of income-tax, 20 per cent. for the year, free of income-tax, payable on December 17, 1929."

Col. H. A. Micklem, C.B., C.M.G., D.S.O., seconded the resolution, which was carried unanimously.

The Chairman next moved: "That the sum of £560,000, being part of the undistributed profits and reserve of the company, be capitalized by the distribution among the members (at the closing of the transfer books on such date as may be fixed by the Board of Directors) of 560,000 of the unissued shares of £1 each of the company, all of which 560,000 shares are to be issued as fully paid at the rate of two such fully-paid shares in respect of every five shares held, and that the said sum of £560,000 be applied in paying up in full at par the 560,000 shares of £1 each of the company to be distributed as aforesaid."

Sir Edmund Davis seconded the motion, which was unanimously approved.

On the proposition of the Chairman, seconded by the Rt. Hon. Lord Southborough, G.C.B., it was also resolved: "That such holders shall be entitled if they so desire to have issued to them free of charge duly stamped share warrants to bearer in respect of the shares to be allotted to them under the last preceding resolution such warrants to be issued in such denominations as the Board may determine provided that no share warrant will be issued in respect of a fraction of a share."

The retiring directors (Mr. Lambert Jadot, the Rt. Hon. Lord Southborough, G.C.B., and Mr. W. F. Turner) were re-elected, and Messrs. Annan Dexter and Co. having been reappointed auditors, the proceedings terminated.

EASTERN SMELTING CO., LTD.

Directors : Sir Cecil L. Budd, S. C. Ambrose, William Clark, Sir George Penny, Sir Arthur Adams, Hon. P. M. Robinson. *Local General Manager* : Hon. P. M. Robinson. *Secretary* : F. C. Bell. *Office* : Stafford House, King William Street, London, E.C. 4. *Formed* 1911. *Capital issued* : £50,000 in preference shares and £325,000 in ordinary shares.

Business : Operates tin-smelting works in Malaya.

The eighteenth ordinary general meeting of the shareholders of Eastern Smelting Company, Ltd., was held on December 17 at Stafford House, King William Street, E.C. 4, Sir Cecil L. Budd presiding.

The Chairman before moving the adoption of the report and accounts referred to the death of Sir Ernest Birch. He then continued by saying that he would assume that they would take the report and accounts as read.

The tin market situation had continued to be a matter of concern to all those engaged in the industry and that the situation was a serious one was demonstrated by the formation of a Tin Producers' Association. So far as the Eastern Smelting Company was concerned, he might say that they regarded the efforts of the association with every sympathy.

He had then two announcements to make of very particular interest to the shareholders. Firstly : Some time ago they gave an option to certain interests who were in a position to be of great assistance in the development of their business to purchase 60,000 of their unissued Ordinary shares at £2 per share. This offer was subject to conditions which have since been fulfilled and the option had been exercised. Secondly : They responded to overtures made that they should explore the possibilities of amalgamation with other smelting interests.

They agreed with the other smelting companies referred to, which were : Williams Harvey and Co., Ltd.; Cornish Tin Smelting Company, Ltd.; Penpoll Tin Smelting Company, Ltd.; to ask Sir Gilbert Garnsey, of Messrs. Price Waterhouse and Co., to make an investigation of each and help to prepare a plan.

As a result a holding company would be formed which would acquire by exchange the shares of the constituent companies, or so many of them as the shareholders might be willing to exchange. The authorized capital had been fixed at £5,000,000 in £1 shares, and the holding company would offer the Eastern Smelting Company shareholders to exchange their shares on the following basis :—For 100 Preferred Ordinary shares in Eastern Smelting Company—140 Preferred and 109 Ordinary shares in the holding company. For 100 Ordinary shares in Eastern Smelting Company—117 Preferred and 109 Ordinary shares in the holding company.

The Board of the holding company was to be constituted as follows :—President, His Excellency Simon I. Patino. Chairman, Mr. R. J. Hose. Vice-Chairman, the Rt. Hon. Sir Philip Cunliffe Lister, and directors :—Sir C. L. Budd, Mr. J. C. Budd, Mr. J. Howeson, Mr. A. Patino, Mr. E. V. Pearce, Sir F. G. Penny, M.P., Mr. R. M. Vargas. The resolution was carried unanimously.

ROBINSON DEEP, LIMITED.

(Registered in the Union of South Africa.)

NOTICE TO SHAREHOLDERS.

NOTICE IS HEREBY GIVEN that the Fourteenth Ordinary General Meeting of Shareholders in the above Company will be held in the Board Room, Consolidated Gold Fields Buildings, Simmonds Street, Johannesburg, on Thursday, the 24th April, 1930, at 11.30 o'clock in the forenoon, for the following purposes :—

To receive and consider the Balance Sheet and Accounts for the year ended 31st December, 1929, and the Reports of the Directors and Auditors ; to elect Directors and Auditors, and to transact such other business as may be transacted at an Ordinary General Meeting.

The Transfer Books of the Company will be closed from 10th to the 24th April, 1930, both days inclusive.

Holders of Share Warrants to Bearer intending to vote at this Meeting must comply with the Regulations concerning the issue of Share Warrants.

By Order,

A. J. PARKIN, *London Secretary.*

LONDON OFFICE, 49, MOORGATE, E.C. 2.
3rd January, 1930.

SIMMER AND JACK MINES, LIMITED.

(Registered in the Union of South Africa.)

NOTICE TO SHAREHOLDERS.

NOTICE IS HEREBY GIVEN that the Sixth Ordinary General Meeting of Shareholders in the above Company will be held in the Board Room, Consolidated Gold Fields Buildings, Simmonds Street, Johannesburg, on Thursday, the 1st May, 1930, at 11.30 o'clock in the forenoon, for the following purposes :—

To receive and consider the Balance Sheet and Accounts for the year ended 31st December, 1929, and the Reports of the Directors and Auditors ; to elect Directors and Auditors, and to transact such other business as may be transacted at an Ordinary General Meeting.

The Transfer Books of the Company will be closed from the 17th April, to the 1st May, 1930, both days inclusive.

Holders of Share Warrants to Bearer intending to vote at this Meeting must comply with the Regulations concerning the issue of Share Warrants.

By Order,

A. J. PARKIN, *London Secretary.*

LONDON OFFICE, 49, MOORGATE, E.C. 2.
3rd January, 1930.

Professional Directory

ADDICKS, Lawrence,
 Consulting Engineer.
 Bel Air, Maryland, U.S.A.
 Cables: Galia, New York.

BELL, J. Mackintosh,
 Mining Geologist,
 Ottawa Electric Building, Ottawa, Ont., Canada.
 Cables: Jamackbell.

AGNEW, John A., Tel.: London Wall 7751.
 49, Moorgate London, E.C.2.
 Cables: Lingulina, London.

C. P. C. BERESFORD, J. T. GLIDDEN,
BERESFORD & GLIDDEN,
 Mining Engineers,
 Cassilla 557, La Paz, Bolivia.
 Cables: Beresford, La Paz.

AQUILAR-REVOREDO, J. F.,
 Mining Engineer,
 Casilla 900, Lima, Peru.

BEST, James P.,
 Mining & Mechanical Engineer
 (Alluvials),
 P.O. Jemaa, Plateau Province, N. Nigeria.
 Code: Broomhall.

ALDRIDGE, Walter H.,
 Mining and Metallurgical Engineer,
 41, East 42nd Street, New York.

Tel.: London Wall 3900.
BEWICK, MOREING & Co.,
 62, London Wall, London, E.C. 2.
 Cables: Bewick.

ALLAN, Clyde,
 Mining Engineer,
 P. O. Jos, Northern Nigeria.

BOISE, Charles W.,
 Mining Engineer,
 Foreign Exploration,
 Room 1507—14 Wall Street, New York.
 Cables: Mukeba.

ANDERSON, Robert J.,
 Aluminium Consultant,
 704, Locust Ave., Fairmont, W. Va., U.S.A.

BOTSFORD, R. S.,
 Mining Engineer,
 Fraser Brace, Ltd., Medellin, Colombia, S. Am.
 265, Gresham House, London, E.C. 2.

ASHCROFT, Edgar A.,
 Consulting Metallurgist,
 New Methods in Metallurgy.
 Weye House Laboratories, nr. Ashburton, S. Devon.
 Cables: Nutalgy, Ashburton.

BOYD, Julian,
 Consulting Mining Engineer,
 1014, Central Building, Los Angeles, California.
 Cables: Boydite.

BANKS, Charles A.,
 Mining Engineer,
 612 Pacific Building, Hastings Street, W.,
 Vancouver, B.C.
 Cables: Bankca. Code: Bedford McNeill.

BOYDELL, H. C.,
 Mining Geologist and Engineer,
 310, McKinnon Building, Toronto, Canada.
 Cables: Husky.

BARRY, John G.,
 Consulting Mining Geologist and Engineer,
 609, Mills Building, El Paso, Texas.
 Cables: Bargo. Code: Bedford McNeill.

BOYES, H. H. W.,
 MESSRS. FOLEY, BOYES, BUTLER & PEEK,
 Consulting and Mining Engineers,
 P.O. Jos, Northern Nigeria.
 Cables: Foyes, Jos. Codes: Bentley, Broomhall.

BARTON, Donald C.,
 Consulting Geologist and Geophysicist,
 Specialist: Eotvos Torsion Balance,
 Petroleum Building, Houston, Texas.

Tel.: London Wall 6940.
BROADBRIDGE, Walter,
 Consulting Mining & Metallurgical Engineer,
 Minerals Separation, Ltd., 62, London Wall, E.C. 2.
 Cable: Rillstope, London.

BEATTY, A. Chester,
 25, Broad Street, New York.
 No professional work entertained.

BRODIE, Walter M.,
 Mining Engineer and Metallurgist,
 1807, Phelps Place, Washington, D.C., U.S.A.