CANADA
DEPARTMENT OF MINES
HON. MARTIN BURRELL, MINISTER; R. G. MCCONNELL, DEPUTY MINISTER

MINES BRANCH
EUGENE HAANEL, PH.D., DIRECTOR.

BULLETIN No. 30

SMELTER TREATMENT RATES.

Report of the Committee of Investigation in the Matter of Tolls charged by the Consolidated Mining & Smelting Co. of Canada, Limited

AT

TRAIL, BRITISH COLUMBIA
JUNE, 1919

OTTAWA
J. DE LABROQUERIE TACHÉ
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1919

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No. 519

PREFACE.

Prior to the introduction of Schedule "B" and for some time afterward, the lead-smelting operations of the Company were conducted at a loss.

Whilst other causes of this loss existed, it was attributable chiefly to the nature of the general ore supply, the increased prices of metals—particularly that of silver—having induced relatively large shipments of ores and mill products high in zinc content, which, if sold at previously prevailing metal prices, would have been far less, if at all, profitable.

The schedule was devised as a fair means of securing improvement of quality of the general ore supply through elimination of some of the zinc, or placing the burden of cost, arising from its presence in undue amount in the furnace charge, upon those who fail to help to bring about the desired end.

The result of operation under the schedule, during recent months, is manifested by marked improvement in the behaviour of the furnaces, by substantially increased recovery of silver and lead and by decreased cost.

No undue margin from increased treatment rates has been derived by the smelter, and in the opinion of the Committee "the end has justified the means".

Finally, the general improvement of conditions warrants the Committee's expectation of important concessions in favor of the shippers, upon whom, nevertheless, there still rests the duty of helping themselves.

LETTER OF TRANSMITTAL.

KASLO, B.C., June 9, 1919.

Hon. MARTIN BURRELL, M.P.,
Minister of Mines,
Ottawa.

Sir,—

The Report of the Committee of Investigation, "as to the fairness or otherwise of the smelting charges" against Silver-Lead-Zinc ores by Consolidated Mining & Smelting Co. of Canada, Limited, at Trail, B.C., is herewith respectfully submitted.

(Signed)
Samuel S. Fowler, Chairman.
James Anderson, Secretary.
Ivan DeLashmutt.

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BEGINNING OF SMELTING INDUSTRY.

Statistical record of the production of lead ore mined in British Columbia commenced in the year 1887. The lead ore mined in the succeeding 32 years ending with 1918 contained, according to Reports of the Minister of Mines of British Columbia, nearly 484,000 tons of lead, having a gross value, at New York prices, of more than $42,000,000. By far the greater part of this lead ore has been mined in the districts of East and West Kootenay, and has served as the basis of a lead smelting industry which is now well established. All of this ore contained more or less silver, and some of it a small but appreciable amount of gold. Ores and concentrates containing either gold or silver or both, but no important amount of lead or copper, are commonly smelted with lead ores, and constitute a part of the supply upon which the smelter depends.

EARLY SMELTING PLANTS.

Prior to 1890, at Vancouver and Revelstoke, and in that year at Golden, small lead-smelting furnaces were erected; but conditions affecting ore supply and operation were unfavourable, and these plants soon became a total loss to their owners.

In 1894, a smeltery was built at Pilot Bay on Kootenay lake, primarily for treatment of lead ore from Bluebell mine, and incidentally of such custom ores as could be had; but the cost of operation was prohibitive, and this plant which ceased work late in 1896 or early 1897, was finally dismantled in 1907.

LATER PLANTS.

In the meantime, the Crow's Nest railway was projected, and completed about 1898, and this soon resulted in an adequate supply of good and cheap coke to smelters erected in 1895 at Nelson and Trail, originally for the treatment of gold and silver bearing copper ores. In view of the promise of sufficient supply of lead ores, however, both these plants were made ready for treatment of such material, and since then, by far the greater part of the silver and lead ore output has found a local market.

Prior to the beginning of successful local smelting, practically all of the British Columbia tonnage found its market at at least seven American smelteries, but the cost of freight to these, although covered by a combined "Freight and treatment rate," was necessarily an important charge against the ore.

Concurrent operation of the plants at Nelson and Trail presumably afforded competition, and no serious fault was found by shippers. But because of financial difficulties the Nelson plant ceased operation in September, 1907, and since that time the local smelting field has been

occupied solely by the plant at Trail, owned by The Consolidated Mining & Smelting Co. of Canada, Ltd. The absence of competition in the interim, however, has not been seriously felt, and no pronounced objection to the several schedules of rates issued from time to time, even during the period of disturbance caused by war, was manifested, until what is known as Schedule "B" was published in January, 1918, effective February 1, 1918.

APPOINTMENT OF COMMITTEE.

The matter of the justification of rates and terms imposed under Schedule "B" quickly became contentious, especially through the activities of local Boards of Trade and a small number of shippers of very high-silver-zincky-lead ore, which was undesirable to the smelter, and the opposition to the application of the new rates took definite form at the annual convention of the Associated Boards of Trade of South Eastern British Columbia, held at Nelson 26th and 27th February, 1918. Representatives of the Smelting Company were present, and after several conferences had been held, in course of which they stated their willingness to open their books and afford all facilities for investigation to an acceptable committee, the following resolution was passed:—

Whereas the silver-lead-zinc mining industry of British Columbia has for years been in a most unsettled and unstable condition, and notwithstanding the high market prices prevailing during this war period, for the smelted products of these ores, successful development of the mines is gradually becoming so hampered as to now threaten disaster to the industry and ruinous to those mining interests; and,

Whereas the Consolidated Mining and Smelting Company of Canada have offered to the mine owners to afford a full opportunity to a commission to investigate and report as to the fairness or otherwise of the smelting charges;

Therefore be it resolved by the Associated Boards of Trade of Eastern British Columbia that the Federal Government be petitioned to appoint forthwith a special commission to be composed of Messrs:

Ivan DeLashmutt, James Anderson, S. S. Fowler.

Alternatives: F. C. Moore, W. H. Burgess, R. Bruce.

With power to call on Mr. W. E. Zwicky when necessary, and in whom the smelting company and mine operators have expressed their full confidence, and which Commission shall be given authority to engage necessary metallurgical and accounting advice and to investigate and report as to the fairness of the charges for smelting.

The principals named in the resolution conditionally accepted appointment, and after extended correspondence having in view their being granted adequate powers and financial support by the Dominion Government, they organized on October 9, 1918, and adopted a plan of procedure.

PLAN OF PROCEDURE.

APPEAL TO SHIPPERS.

Having in mind that in the application of any schedule of smelting rates, fault is commonly found not only with the charges as such, but with modes of settlement, assays, and sampling, the Committee felt that it was desirable to get as much evidence, suggestion, or complaint as possible directly from the producers of ore, before proceeding with consideration of the main issue. In order to carry out this idea, it was arranged that meetings with the producers would begin 31st October, 1918.

Public meetings were interfered with however, by the action of health authorities on account of the "influenza" epidemic, for a further three months until 21st January, 1919. At this latter date a meeting was held. Non attendance of complainants made it seem advisable to offer to afford opportunity for private hearings, and this was done by means of advertisement and letters addressed to every shipper. In response to these appeals, no requests for hearings and about half a dozen letters were received by the Committee. In view of the fact that during the year ending 30th September, 1918, ore had been received by the smelter from 96 individual custom shippers in British Columbia alone, the result is regrettable, and seems to show; either belief in the futility of the inquiry, or change of opinion as to the fairness of the smelting tolls, due to an improved knowledge of conditions. No further formal appeal for assistance from shippers was made.

Whatever ground of reasonable complaint there may have been, however, still existed, for although a year had elapsed since Schedule 'B' went into effect no modification of rates had been made, and some dissatisfaction or suspicion still probably existed. The Committee therefore proceeded with its investigation at Trail.

INVESTIGATION.

Prior to the publication of Schedule 'B' officials of the Company had stated that because of the combination of increased prices, the rising cost of furnace operation due to the influence of a high ratio of zinc to the slag-forming elements of the ore treated, and the concurrent increase of loss of metal value over the amount paid for, the smelting department not only had been unprofitable, but its operation had been continued too long at a loss. Furthermore they desired to make and would be content for the time being to make an average profit of one dollar per ton of custom-ore treated, and as soon as the purpose of the schedule should be accomplished it was their intention to revise its terms.

Using this statement as a premise, the Committee formulated the following general scheme of inquiry:—

(A) Determination of what if any return upon capital involved has been earned recently from lead-smelting operations. If it has not been earned is it because of:—

(B) (1) Marketing conditions.
(2) Nature and volume of ore supply.
(3) Faulty metallurgy.
(4) Inadequacy or inefficiency of plant.
(5) Operating costs being greater than justified by prevailing prices.

(A) Upon request from time to time the Company placed all required data before the Committee, who became convinced that the main claim of the Company—to wit: that the smelting of lead ore had been conducted at a loss for several years—was substantially correct, and as a consequence changes of schedule became imperative.

(B) **Market Conditions.**—Prior to November, 1917, the cost of refining and marketing the metals derived from lead ores was collected from shippers through the operation of a flat rate deduction per pound of lead presumably

recovered, without consideration of destination of the metals, or the varying cost of refining due to fluctuation of the tonnage refined, or whether or not the lead could be sold. Largely as the result of war, the arrangement proved to be burdensome and unfair to the smelter, and had to be abandoned. In its place a pooling scheme for the sale of lead was inaugurated, which provides for contingencies such as lack of demand, competition and changed or unequal freight to points of sale, and under which a proper part of the burden was justly shifted from the smelter to the miner.

The charge for refining, selling costs and minimum freight continues, but is considered fair under prevailing circumstances. The cost of refining, per ton, naturally varies inversely as the tonnage of lead treated, the amount of labour and overhead required being roughly the same for small as for large amounts. Statistics of production of refined lead show a decided reduction of output since 1915; which fact indicates that whilst the marketing charge of $30 per ton of lead yielded a margin to the smelter when the output was at the rate of, say, 20,000 tons per annum, (as in 1915) the same charge against the output for the Company's year 1918, (less than 11,000 tons) results in loss. Similar conditions have prevailed at United States refineries, at some of which the refining and marketing charge is now $35 per ton.

The inability of the Company, as a lead-selling agency, to dispose of existing stock within a specified time is not its fault, and any advances to the miners against the value of such unsold lead necessarily involve payment of interest as provided by schedule.

The reasonableness of the changes required had been fully explained at a conference of Company officials and producers, and they were accepted with as good grace as could be expected. There can be no question as to the fact that marketing conditions are unfavourable and the cost high, but it should be remembered that among others there is one important reason for this—namely, the lead is mined, smelted and refined in a region about as far as possible from the source of some of the cost-elements and the points of its consumption.

ORE SUPPLY.

The volume of lead-smelting ore supply in British Columbia has been subject to great fluctuations, the extent of which may be gauged by reference to government reports or the accompanying graph (Fig. 1) of lead contents of such ores prepared from the several annual reports of the Minister of Mines.

The abrupt changes arise in part from minor causes, such as strikes at coal mines, which interefere with the fuel supply, a strike at the smeltery in 1917, which caused an entire suspension of work for a time, and lack of market which compelled curtailment of receipts. These have tended to create a feeling of uncertainty at the mines which has undoubtedly been discouraging. But the more important causes are high prices of lead and silver, and discovery and depletion of the ore bodies, and these causes may or may not synchronize. The effect of high prices need not here be commented upon so far as tonnage is concerned, but will be alluded to later as affecting the quality of ore.

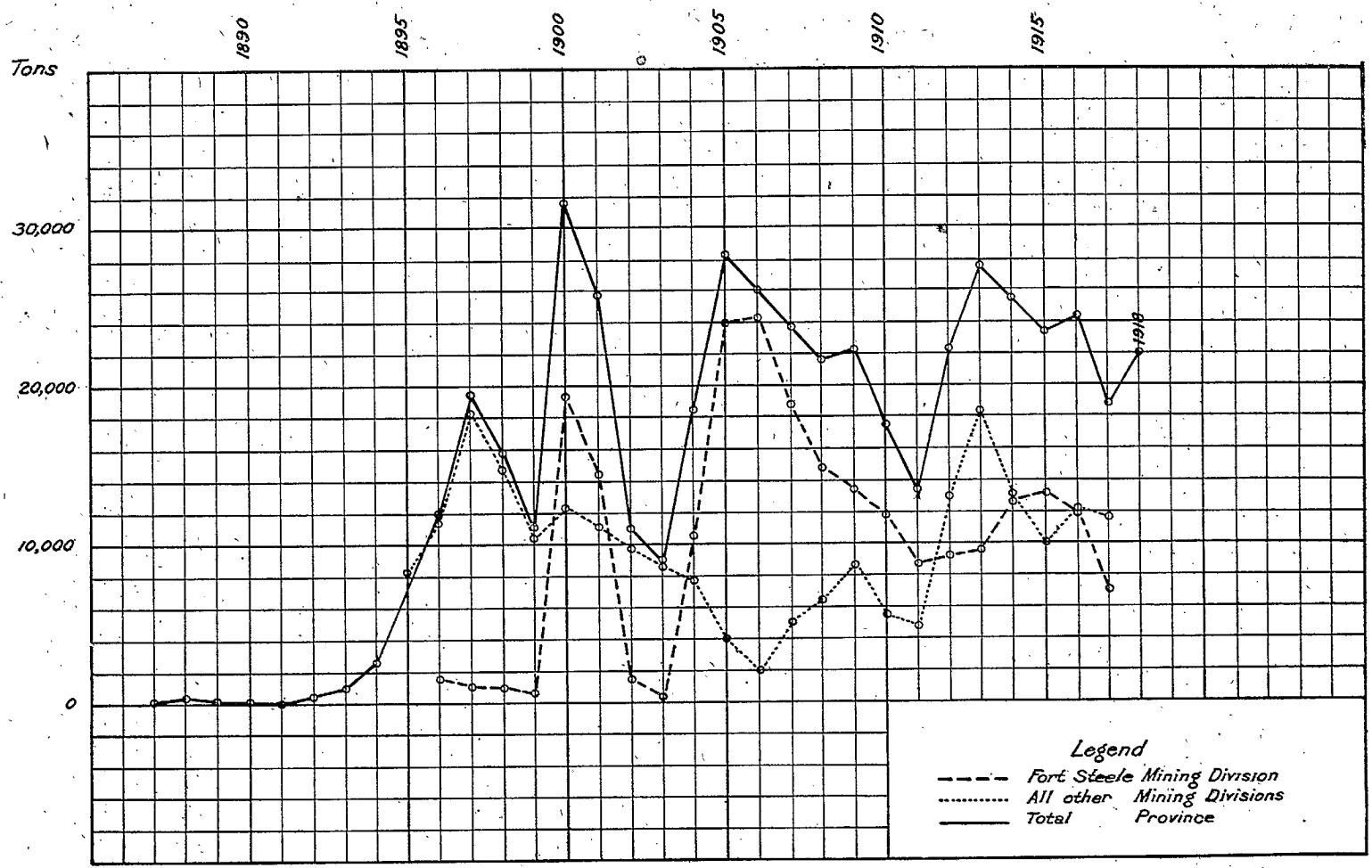

FIG. 1. LEAD CONTAINED IN LEAD ORE MINED IN BRITISH COLUMBIA.

Errata:—

	Graph should show	
	1895	1896
"Total"	8238	12100
"Fort Steele"	——	1400
"All others"	8238	10696

As to the nature of the ore deposits, it must be admitted that although from time to time bodies of silver-lead ore of great importance to the community and their owners have been exploited, the total Canadian production has been small, as compared with that of lead-producing regions elsewhere, yielding less than two per cent of the world's lead supply during the ten years preceding war. With many notable exceptions the individual shipping mines are not in the large mine class, and their owners are quickly affected by adverse conditions. They cannot be depended upon by the smelter for regular supply, and thus tend to deprive him of necessary protection, the lack of which becomes an element of cost of smelting which is admittedly high.

BRITISH COLUMBIA CUSTOM LEAD ORES.

Table of Relative Tonnage of Smaller and Larger Mines as received at Trail.

Shippers. No.	%	Range in Tonnage.		Amount Shipped. Tons.	%	Average Tons per Shipper.	Total Tons per Month.
			January-September, 1917.				
37	51	1–	30[1]	425	2	12	47
15	21	31–	100	869	4	58	97
11	15	101–	500	2,352	12	214	261
3	4	501–	1,000	1,939	10	646	216
7	9	over	1,000	14,781	72	2,111	1,642
73	100	.....		20,366	100	279	2,263
			Year ending 30th September, 1918.				
54	57	1–	30[1]	641	3	12	53
20	21	31–	100	1,110	5	55	93
10	10	101–	500	1,829	8	183	152
6	6	501–	1,000	4,099	17	683	342
6	6	over	1,000	15,610	67	2,601	1,301
96	100	.....		23,289	100	244	1,941

[1]Minimum carload.

These figures show that approximately 75 per cent of the mines produce only 7 per cent of the custom ore supply, and less than one car per year each. The other 25 per cent of the mines produced 93 per cent of the supply and an average less than 950 tons each. The comparison may seem invidious to the small shipper; it is not intended to be so, but is adduced to show that there is good reason for the desire of the smelter to protect itself against the extra cost of handling and sampling the many small lots of ore received.

Aside from the yearly variation of output of mines, there is a certain seasonal fluctuation of receipts at the smeltery, illustrated by an accompanying graph (Fig. 2), which distinctly shows the irregularity of tonnage of

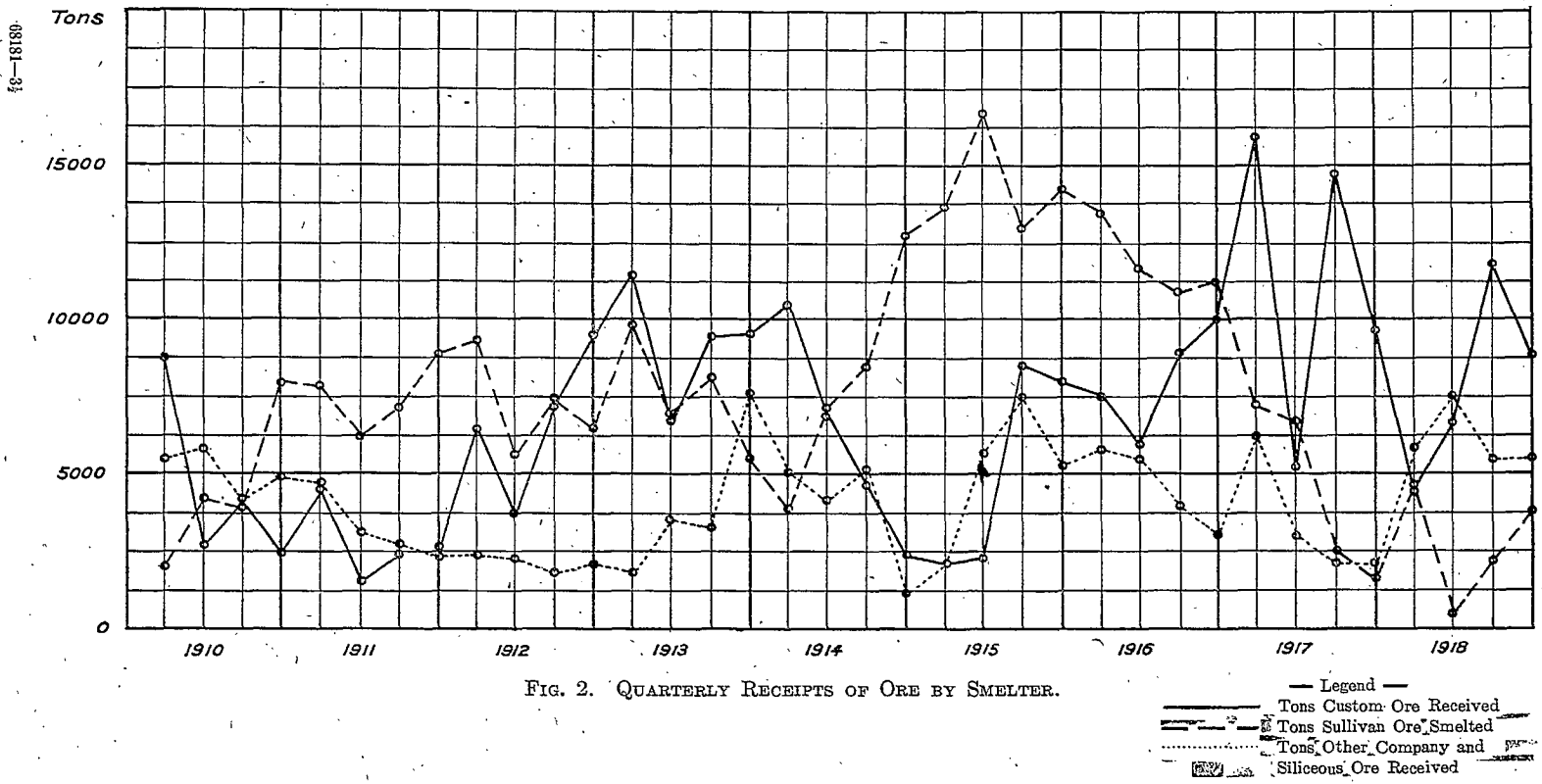

FIG. 2. QUARTERLY RECEIPTS OF ORE BY SMELTER.

custom ores received quarterly, (receipts by months having been much more variable). It also shows that as tonnage of custom ores increased, that of the Company's supply was decreased to make room for it, thus depriving it, to an important extent, from participation in the benefit derived from high prices. On the other hand, when the former decreased, no matter what the cause, the smelter necessarily was compelled to draw more from Company mines in order to avoid suspension of work and disruption of its organization, for no condition is more quickly fatal to successful operation than frequent cessation and resumption of furnace campaigns.

The average and monthly receipts of British Columbia custom lead-ores for first nine months of 1917 was 2,263 tons, and for the year ending 30th September, 1918, was 1,941, or, per day respectively, 75 tons and 64 tons, which cannot be regarded as sufficient basis for a successful (or at least cheaply operated) smelting industry. In other words local custom ore miners are dependent, in large measure, on ore supply from the Company mines for sufficient tonnage to maintain smelting facilities.

NATURE OF ORE.

But whilst production of custom ores was curtailed in the last quarter of 1917, in part because of a strike at the smeltery, and in part on account of decline in the prices of lead from former high levels, the price of silver was increasing:—

Price of silver in cents per ounce at New York[1]:—

1915	49·684
1916	65·661
1917	81·417
1918	96·772

And this quite naturally resulted in determination on the part of producers of silver-bearing ores to realize, without consideration of other matters. It was noticed particularly in the increased quantity of zincky middling included with concentrate shipped.

Now in order to secure permissible smelting conditions it is necessary that the ratio of slag-forming materials—essentially "silica," "iron" and "lime"—to the zinc contained in the furnace charge, should be if possible not less than nine to one, independently of the ratio of slag elements to each other. Hofman says[2], " a slag ought not to contain more than from 6 per cent to 8 per cent. zinc . . . . Slags are made that contain more than 8 per cent zinc, but that this is commercially good practice nobody will maintain."

The most important result to the smelter of the increase of the price of silver had been to decrease that ratio of slag to zinc in custom ores to that exhibited in the table hereunder, which shows the average nature of receipts of British Columbia custom ores during the period January-September, 1917, that is, prior to publishing Schedule "B":—

[1]Engineering and Mining Journal.

[2]Metallurgy of Lead, 1st Ed. p. 147.

—	Ores with Ratio[1] nine or more.	Ores with Ratio[1] less than nine.	Average.
Tons received	5,731	14,635	20,366
Silver ozs. per ton	30·4	67·7	55·8
Lead per cent	34·2	42·6	40·3
Zinc per cent	2·0	8·9	7·0
Sulphur	14·0	14·6	14·4
Silica	20·2	6·9	10·6
Iron	14·9	6·0	8·5
Alumina	3·6	2·7	3·0
Lime	1·8	6·9	5·5
Magnesia	0·9	2·5	2·0
Total	91·6	91·1	91·3
Ratio	20·6	2·8	4·2

[1]Including Alumina.

In plain words the ore contained more than twice too much zinc in proportion to slag elements present, and the smelter had to provide sufficient further desirable ore or barren flux, or both, to increase the ratio to the desired extent. Some of this necessary increment of smelter supply had been coming from American mines, and the necessity of the disposal in Canada of the lead produced from it was objectionable, of course, as the demand was becoming restricted. Importation of such foreign ore, however, was much reduced in the latter part of 1918.

One of the objects of Schedule "B" was to bring about an increase of the ratio in all ores requiring it, through the elimination of some of the zinc, and the effect of this is shown in the subjoined table of composition of custom ore receipts for the twelve months ending 30th September, 1918.

NATURE OF BRITISH COLUMBIA CUSTOM LEAD ORES.

Twelve months to 30th September, 1918.

—	Ratio[2] nine or more.	Ratio[2] under nine.	Total and Average.
Tons received	9,470	13,819	23,289
Silver ozs. per ton	24·4	58·4	44·5
Lead per cent	24·4	45·3	36·8
Zinc per cent	1·5	7·3	5·0
Sulphur	7·3	14·6	11·6
Silica	31·4	8·3	17·7
Iron	14·4	5·8	9·5
Alumina	2·3	1·2	1·6
Lime	1·8	4·3	3·3
Magnesia	1·0	1·7	1·4
Total	84·1	88·5	86·9
Ratio	34·3	2·9	6·8

[2]Including Alumina.

This indicates an improvement in ratio of 62 per cent compared with the 1917 figures, and it was brought about by a reduction of 29 per cent in the rate of receipts of ore with ratio under nine—the ratio in these ores still being 2·9 as against 2·8 for the previous period and by an increase of ratio from 20·6 to 34·3, through the effect of an increase of receipts of oxidized ore (from but two of the largest shippers) amounting to nearly 3,500 tons, containing not more than 1 per cent zinc.

But as this latter increase is not likely to be permanent, the fact may be emphasized that continued improvement of the quality of average ore-receipts having a ratio under nine, is essential to the general welfare of custom shippers.

COMPANY'S MINES.

It is common knowledge that the "Sullivan" mine at Kimberley, B.C., property of the Company, has been for several years the dependable source of lead ore supply to the smeltery. It is moreover generally believed that the tenure of the Sullivan ore in zinc, sulphur, and iron is high, and that the ratio of slag to zinc is low. For this reason it has been felt by some shippers of custom ore, and especially by those whose returns have been seriously affected by the operation of Schedule "B," that their interests are being prejudiced through their being made to pay for at least some of the deficiencies of Sullivan ore, and that thus, indirectly the smelter was gaining an undue advantage.

It is admitted by the Company that the Sullivan ore has not been at all a faultless smelting material, in view of the nature of custom ore supply. It requires a certain amount of extraneous silica and lime to slag its iron and create the proper ratio to zinc. This required flux, however, cannot be derived from the custom ores, for they are, as shown by the figures given above, already deficient. If the flux were available, those shippers who provide it would receive the credit accorded under the schedule. But even if some slight advantage had been gained by "Sullivan" ores at the expense of other mines, it might be justified on account of benefit derived by the latter from the supply of such tonnage from the Company mines as tends to permit constant operation of the smeltery, and therefore the continuance of a local market for ore.

IMPROVING QUALITY OF "SULLIVAN."

The Company, has, however, fully recognized the disadvantages inherent in the "Sullivan" ore, and has experimented extensively with the object of putting that mine in position to make an improved showing with respect to its lead ore. These experiments have been so successful that the resulting lead-bearing concentrate produced in 1918 had a slag ratio of 3·4 against 2·9 for the less desirable custom ores, whilst the tonnage produced was sufficient to be of much importance in bringing about a general improvement of smelting conditions.

ENGAGEMENT OF MR. O. R. WHITAKER.

Proper investigation of the nature and layout of plant and equipment, criticism of the scheme of operation and quality of the metallurgical

control seemed to the Committee more likely to be attained by means of the assistance of a person possessed of recent experience in these very practical matters, and thus more likely to result satisfactorily to all concerned than if undertaken by the Committee itself. The Committee therefore, with the consent of the Minister, and after due inquiry, engaged the services of Mr. O. R. Whitaker, of Denver, Colorado. Mr. Whitaker had conducted a similar work for the "Smelting and Ore-Sales Investigation Committee" of the State of Colorado in the autumn of 1917, and it was considered by some of the British Columbia shippers that his report had resulted in much good to their Colorado confreres confronted by presumably similar conditions. Mr. Whitaker arrived at Nelson, 18th April. He there and at Trail conferred with the Committee, received all the information already acquired, made his investigation and in due course submitted his report to the Committee. It is now given, and will be followed by the continuation of that of the Committee.

ORVIL R. WHITAKER.

ENGINEER OF MINES,

932 EQUITABLE BUILDING,

DENVER, COLORADO.

NELSON, B.C., May 7, 1919.

The Committee of Investigation in the matter of Smelter Treatment Rates, Nelson, B.C.

Gentlemen,—In accordance with your instructions to make an investigation and report on the " reasonableness, or otherwise, of the rates of treatment on custom silver-lead-zinc ores charged by the Consolidated Mining and Smelting Company at Trail, British Columbia," I beg to submit the following report:—

This work covers the period from 1910 to February 28th, 1919, inclusive, and deals in a general way with averages. The conclusions given for the summary of the several operations are for operating and metallurgical results on the ores treated, and no account is taken of the profit or loss from the market fluctuations.

ORE SCHEDULES.—The following are the representative ore schedules issued by the Trail Smelter, together with circular letters relative to terms of settlement, which were used in making adjustments on ores received from 1907 to date.

SCHEDULE—1907.

LEAD ORE.

PAYMENTS.—Gold 95 per cent at $20 per oz. of over 10 oz. Silver 95 per cent at New York quotation. Lead 90 per cent at London quotation, less $20.

TREATMENT.—Freight and treatment, $8 for 70 per cent lead with 10 c. per unit added for each unit below 70 per cent, to a maximum of $12.

SLIDING SCALE BASIS:—

70 per cent lead	—	Treatment	$ 6.50
65	"	"	7.00
60	"	"	7.50
55	"	"	8.00
50	"	"	8.50
45	"	"	9.00
40	"	"	9.50
35	"	"	10.00
30	"	"	10.50
25	"	"	10.50
20	"	"	10.50

ZINC PENALTY.—Zinc over 8 per cent, at 50c. per unit.

SCHEDULES 1908–1916.

LEAD ORES.

PAYMENTS.—Gold, 95 per cent at $20 per oz. if over .10 oz. Silver, 95 per cent at New York quotation. Lead, 90 per cent at London quotation, less $20.

TREATMENT.—Freight and treatment $10 for 70 per cent lead with 10c. per unit added for each unit below 70 per cent to a maximum of $12.

SLIDING SCALE BASIS:—

70 per cent lead	—	Treatment	$ 8.50
65	"	"	9.00
60	"	"	9.50
55	"	"	10.00
50	"	"	10.50
45	"	"	10.50
40	"	"	10.50
35	"	"	10.50
30	"	"	10.50
25	"	"	10.50
20	"	"	10.50

ZINC PENALTY.—Over 8 per cent at 50c. per unit.

N.B.—In 1915 settlement for lead on Montreal price less $30 was substituted for London, less $20.

SCHEDULE EFFECTIVE JAN. 1, 1917.

LEAD ORES.

PAYMENTS.—Gold 95 per cent at $20 per oz. if over .10 oz. Silver 95 per cent at New York quotation. Lead, 90 per cent if over 5 per cent lead.

TREATMENT.—Treatment, minimum of $10 per ton, with 10c. per unit added for each unit of lead under 70 per cent to a maximum of $12 per ton.

ZINC PENALTY.—Zinc over 8 per cent at 50c. per unit. Final settlement at average of second month's quotation succeeding date of arrival of shipment. Basis of settlement, Montreal price, less $30, except as modified by shell prices, etc., in accordance with circular letters.

N.B.—This rate was increased on May 12th, 1917, by 50c. per ton, making the minimum $10.50 and the maximum $12.50 per ton.

SUMMARY OF CIRCULAR LETTERS REFERRING TO LEAD ORE SHIPMENTS.

June 26, 1915.

The Canadian lead market has been so affected by the establishment of a very considerable industry in the manufacture of munitions of war, that the prevailing basis of settlement for lead must be modified to suit the changed conditions. We have been successful in having the Shell Committee specify Canadian lead in their Canadian contracts, thus preventing the importation of American lead free of duty, under drawback regulations, otherwise it would have been necessary to have exported approximately 50% of the Canadian lead or to have sold a considerable quantity free duty prices. In either case it would have been manifestly impossible to continue purchasing lead from shippers on the Montreal price. The Committee, however, by their method of awarding contracts to manufacturers for large quantities for delivery over considerable periods in the future, thus settled the price which we shall obtain for an important portion of our product for months ahead, each time they award a batch of contracts to the manufacturers. The lead is quoted each time for the shells and the price settled at the time that the contract price for the bullets is settled between the Committee and the contractors. The last lead orders for this purpose, deliveries against which extend over the remaining months of this year, were placed at $5.50 f.o.b. Montreal.

It will be necessary that all producers share alike in this business, and future business of a similar nature. We are assured that future contracts will be placed at the Montreal market price at the time such contracts are let.

Commencing with shipments received at the smelter on July 1st, we will, therefore, settle for lead as follows:—

(1) Figure the advance payment on the basis of the average between $5.50 and the current price in Montreal upon the date of arrival, this figure being in no way a final settlement, but merely a rough approximate value for the advance.

(2) Each month's deliveries against shell orders and prices received therefore will be proportioned among shippers, including our own lead mines, in the ratio that the receipts of lead from each mine bears to the total lead received.

For this purpose, at the end of each month, each shipper will be supplied with a statement showing:—

(a) Amount of lead delivered for sell orders in that month.

(b) Total receipts of lead at the smelter for that month.

(c) Total receipts from such shipper's mine for that month.

(d) Percentage that receipts from such shipper's mine are of total receipts at the smelter.

The shipper will receive for an amount of his lead equal to a like percentage of the lead delivered for shell orders, the price received in Montreal for lead supplied for shell orders less 1½c. per lb. The balance of the receipts from his mine will be settled for in the usual way on the basis of the Montreal price average of SECOND month succeeding arrival at the smelter. The total lead paid for will be in all cases 90% of the fire assay.

For example, suppose:—

Receipts from Mine "A" in July equal 300 tons of 40% lead ore, or 120 tons of lead. Total receipts at smelter for July, 2,400 tons of lead.

120 tons of lead from Mine "A" equals five (5%) per cent of 2,400 tons.

In the same month 1,000 tons of lead are delivered for shells at $5.50 per cwt. f.o.b. Montreal.

Five per cent (5%) of 1,000 tons equal 50 tons.

Therefore, for 50 tons of lead, Mine "A" receives payment at $5.50 less 1½c. per lb. or $4.00 for the balance of his lead (90 per cent of 120 tons or 108 tons less 50 = 58 tons) he receives payment at 1½c. per lb. less than the Montreal price average of the SECOND month succeeding arrival at smelter.

We trust that the above, with the reasons for the change will be thoroughly understood by shippers.

We shall be pleased to give whatever assurances, as may be required, of the correctness of figures supplied in the carrying out of this scheme.

December 18, 1916.

Each month the cost of smelting operations shows an increase. We had hoped that things might change and enable us to continue the rates put into effect prior to the war. However, everything entering into our cost sheet has appreciated to such an extent that we cannot afford to protect any longer the rates that were fixed under altogether different conditions. To prevent a loss—rather than to make a profit—we are compelled to increase your smelting rate One Dollar and Fifty cents ($1.50) per ton, to become effective January 1st, 1917.

THE CONSOLIDATED MINING & SMELTING CO. OF CANADA, LIMITED.

TRAIL, B.C., October 6, 1917.

TO SHIPPERS OF LEAD ORES:—

In anticipation of the continued needs of the Imperial Munitions Board, we have accumulated approximately 15,000 tons of lead ores in addition to about 2,000 tons of lead matte.

The Board now inform us that owing to a reduction in the shrapnel programme, they are unable to take more than approximately 1,000 tons of lead per month until January 1st, and that they cannot say definitely what they will take after January 1st.

In order to meet the situation, it is necessary to restrict shipments. We have stopped mining lead ore in Sullivan mine, and have to notify you that we can only accept such customs ores and concentrates as carry 4 per cent, or less, zinc content. By adopting this policy, we will be able to put more ore through the furnaces, and in this way clean up the large accumulation, and get ready for a possible further falling off of munitions orders after January 1st.

We should really shut off all shipments for the present, but we realize that this might seriously embarrass you. The policy of accepting ores and concentrates carrying not more than four per cent zinc will enable

you to market a large part of the highest grade of your product immediately, and in this way finance your mining operations. Such of your products as cannot be graded down to four per cent zinc content, can be stored for the present.

We need not say that we regret that we are compelled to take this step, but the Munitions Board find themselves unable to give us sufficient assurances to warrant our taking all ores offered, which has been our policy up to the present.

All shipments of lead ores made on and after the 15th October, will be covered by the terms of this letter.

Please acknowledge receipt.

JAMES J. WARREN,
Managing Director.

TRAIL, B.C. November 5, 1917.

Following the announcement which we made at the Nelson meeting as to the resumption of lead ore shipments and the settlements therefor upon the basis of our sales price, but only to the extent of our actual sales from month to month, we wish to advise you that the situation (as at November 1st) is approximately as follows:—

We have in ore and in process about 7,800 tons of lead. We do not expect to have all of this lead marketed until late in February or possibly early in March. We are taking an inventory as at November 1st. This will be available the latter part of the month.

The amount of unsold lead at November 1st will be shown in this inventory, and will be communicated to you.

As early as possible in December, we will send you a statement showing:—

(1) Lead unsold November 1st;
(2) Lead ore receipts during November;
(3) Lead sold during November, and the price;
(4) Balance on hand at the end of November.

A similar statement will be sent to you monthly thereafter.

Ore received after the 1st November will be settled for finally as soon as a monthly statement shows the stock at November 1st completely disposed of, and further sales actually made from ore shipments received after November 1st.

Each mine from which ore is received after November 1st will receive, monthly, a detailed statement showing how it stands and what proportion of the sales actually made it is entitled to. Whenever sales are sufficient to settle for a full month's lead receipts, this will be done promptly.

Shipments from our own mines will be pooled with customs ore receipts and treated in exactly the same manner.

On account of the large accumulation of ore on hand, advances on preliminary settlements will be calculated as follows.

When Montreal lead price is 8c. or over, sixty per cent (60%) of the apparent value based upon silver quotations of the date of arrival and a Montreal lead price of eight cents;

When Montreal lead price is 6c. to 8c., seventy per cent (70%) of the apparent value based upon silver and lead quotations of the date of arrival;

When Montreal lead price is less than 5c., eighty per cent (80%) of the apparent value based upon silver and lead quotations, of the date of arrival.

Shippers will be charged interest at 6 per cent on any advances against lead which are carried longer than the first day of the third calendar month succeeding the calendar month in which the ore arrives.

As arranged, September lead will be settled on the average sales price for the month of November and October lead on the average sales price for the month of December. The new settlement basis outlined above will govern receipts from and after November 1st.

Our existing arrangement with the Imperial Munitions Board continues until March 1st next. We hope to have this extended, but there is no certainty, not because of any unwillingness on the part of the Board or because lead is not needed, but for financial reasons.

In the meantime, with your co-operation, we are doing our utmost to occupy the entire Canadian market.

Until further notice, all mines may ship up to their average shipping rate of the twelve months prior to November 1st, 1917. That is, they may ship in any month a tonnage equal to one-twelfth of the amount of ore shipped during the preceding twelve months. Special arrangements will have to be made for any tonnage exceeding this amount. New shippers will be taken care of as far as possible.

January 18, 1918.

Owing to the slackness in the demand for lead, we called a meeting of lead shippers in Nelson on December 27, 1917, where the following modifications were made to our circular letter of November 5, 1917.

That each shipper could ship in each month commencing February 1, 1918, up to one-twelfth of the lead tonnage he shipped in our last fiscal year,—that is, in the twelve (12) months ending September 30, 1917,—but that, while we would receive, sample and smelt this ore and pay for the silver contents, we would be unable to pay for the lead except as follows:

Twenty-five per cent would be pooled to be settled for as in the circular of November 5, 1917,—that is, it would be paid for at the price received for it less one and one-half cents ($1\frac{1}{2}$c.) when sufficient lead had been sold in excess of the lead then on hand to settle one month's business. The surplus lead in such shipments to be paid for whenever we can sell sufficient lead in excess of the 25 per cent to clear one month's surplus,—this lead also to be pooled as above, both as to date of settlement and price. This lead will be stored in such a manner as to make a desirable security for bank loans.

That whenever conditions warrant we will increase the agreed production from each mine and also we would treat our own mines exactly as we do those of our customers.

We have received from you in this fiscal year ended Spetember 30, 1917, ... tons of lead (these are the tons paid for). We will, therefore, be prepared after February 1, 1918, to receive and make preliminary

settlement for ..... tons (i.e. tons to be paid for according to Schedule B—lead ore rates), in each calendar month until further notice. If you ship any more than this, the remainder will be held over as indicated. Should you desire us to do so we shall be pleased to furnish certificates of quantities so held over on your account, to be used as a basis for advances by your bank.

As we intimated at the above-mentioned meeting, we have been obliged to make a revision of our lead ore rates to meet our rapidly increasing costs, and to cover excessive metallurgical losses due to the heavy percentage of zinc contained in shipments with relation to slag forming elements present. We would suggest in concentrating ores, the possibility of cutting the middlings carrying most of the zinc and shipping this product elsewhere or re-treating this material to try to lower the zinc contents. If you do this you should be able to hold your rate down very materially and probably obtain as good a rate as at present.

SCHEDULE "B."

Effective February 1, 1918.

LEAD ORES.

PAYMENTS.

GOLD.—Pay for 95 per cent of the assay at $20 per ounce. No pay for gold unless five one-hundredths of an ounce (0·05 oz.) per dry ton or over.

SILVER AND LEAD.—Payments for silver and lead will be based upon the zinc contents of the ore on the following schedule.

Zinc Contents.	Silver Payment.	Lead Payment.
4% or under	95%	90%
Over 4% and including 5%	94½%	89%
" 5% " 6%	94%	88%
" 6% " 7%	93½%	87%
" 7% " 8%	93%	86%
" 8% " 9%	92½%	85%
" 9% " 10%	92%	84%
" 10% " 11%	91½%	83%
" 11% " 12%	91%	82%
" 12% " 13%	90½%	81%
" 13% " 14%	90%	80%
" 14% " 15%	89½%	79%
" 15% " 16%	89%	78%
" 16% " 17%	88½%	77%
" 17% " 18%	88%	76%
" 18% " 19%	87½%	75%
" 19% " 20%	87%	74%
" 20% " 21%	86½%	73%
" 21% " 22%	86%	72%
" 22% " 23%	85½%	71%
" 23% " 24%	85%	70%
" 24% " 25%	84½%	69%

No ore containing more than 25 per cent zinc will be accepted under this Schedule.

SILVER.—Will be paid for to the extent shown by the above Schedule on the fire assay at the average of the Engineering and Mining Journal, New York, quotations for the second calendar month succeeding the date of sampling at Tadanac, B.C. In no case will the deduction from the silver assay be less than one-half ounce (0·5 oz.) per dry ton.

LEAD.—Will be determined by the wet method of analysis from which one and one-half units will be deducted to arrive at the dry lead assay. Lead will be accounted for to the extent shown by the above schedule, provided, however, that in no case will the deduction from the said dry lead assay be less than one unit or twenty pounds per dry ton. Settlement for lead will be made on the basis of our circular of November 5th, 1917, as modified by our circular of January 18th, 1918.

DEDUCTIONS.

SMELTING.—Per dry ton of material seven dollars and fifty cents as a base rate, which will be modified in accordance with the following formula:—

(1) Add to the base rate per ton (9) nine times the units of zinc shown by analysis at nine cents (9c.) per unit.

(2) Deduct from this result the total units of Silicia, Iron, Manganese, Lime and Magnesia at nine cents (9c.) per unit.

Provided that in no case shall said base rate be reduced more than three dollars and fifty cents ($3.50) as the net result of the additions and deductions.

Provided, also, that in making the above computation Iron, Silicia and Lime if 1 per cent or under, and Manganese and Magnesia if 3 per cent or under will be disregarded.

SULPHUR.—A charge will be made in addition to the above for all Sulphur contained at fifty cents (50c.) per unit per dry ton of material, provided that such charge shall not exceed four dollars per ton in any case.

MOISTURE.—A minimum moisture deduction of one-quarter per cent (¼%) will be made. The following penalty for moisture will apply to fine concentrates and clayey ore only. If over five per cent charge for contents at ten cents per dry ton per unit.

FLOTATION CONCENTRATES.—Flotation concentrates will be charged $1 extra per dry ton.

SIZE.—Coarse and fine concentrates and ores must be shipped separately if over 30 per cent will pass through a ¼-inch screen, otherwise an extra charge of 50 per cent per ton will be made.

SAMPLING.—If the shipment is less than a car lot or contains more than one lot per car, a deduction will be made for extra sampling, assaying, etc., of $10 per lot.

WEIGHTS AND SAMPLES.—To be used in settlement shall be those made at the smelter.

REPRESENTATION.—Shippers are expected to notify us as to who will represent them while their shipments are being weighed and sampled. Failure to do so will be construed as meaning that the smelter will have authority to appoint one of the local mine representatives at the shipper's expense, unless the shipper notifies us that a representative is not required. All shipments will be released for smelting as soon as sampled.

ASSAYS.—Shippers will supply the smelter with their assays on smelter pulps shortly after sampling. In case of difference in assays requiring it, the umpire pulp will be referred to an umpire mutually agreeable. The party whose result is farthest from the umpire's result will pay his fee.

SETTLEMENT.—Advances on preliminary settlements will be made as set out in our circular of November 5th, 1917, as modified by our circular of January 18th, 1918. The final settlement for the silver will be adjusted between the parties shortly after the close of the second calendar month succeeding the date of sampling when quotations are available. The final settlement for the lead will be adjusted whenever the pooling arrangement will permit.

If the present price of coke is changed the above rates will be increased or decreased 25 per cent of whatever price per ton coke costs more or less.

If our present price of labour is changed the above rates will be increased or decreased 1½ cents per ton for each 1c. change per shift for labour.

The above rates are subject to change without notice.

SUMMARY OF CIRCULAR LETTERS REFERRING TO LEAD ORE SHIPMENTS UNDER SCHEDULE "B."

1. Settlement for lead will be based upon our sales price and only to the extent of actual sales from month to month (subject to freight adjustment mentioned in Clause 7).

2. Whenever sales are sufficient to settle for a full month's dead receipts this is done promptly. Lead from our own mines is pooled with that purchased from others and treated in exactly the same way.

3. Each month we issue a statement showing the condition of the pool. If you have already shipped, you have a copy of the last one issued, otherwise we enclose a copy.

4. Settlement for silver is made upon the average New York quotation for the second calendar month succeeding the date of sampling, *e.g.* silver in ore sampled in May is settled for on July average.

5. Payment for the ore is made as follows:—

(a) Shortly after sampling an advance payment of 90 per cent of the apparent value is forwarded. The silver price used in estimating the apparent value is that of the date of sampling; the lead price used in estimating the apparent value is the previous month's sales price.

(b) When the final settlement is made possible by reason of silver quotations of the second month after sampling being available and by reason of the lead having been sold, the final value is computed and any adjustment necessary is made between the smelter and mines.

6. Schedule B applies to all lead ores and the prices for lead and silver mentioned above are subject to the deductions mentioned in Schedule B. Effective Aug. 1st, the base rate on Schedule B was raised from $7.50 to $8.30 per ton to compensate for rises in coke and wages.

7. In addition to deductions provided in Schedule B and commencing with August lead receipts, the sales price for lead is reduced in making settlement by $2.30 per ton on sales at Toronto and common points and

$4.50 per ton on sales at Montreal and common points. This is to cover the actual increases in freights: e.g. should sales be in any month 2,000 tons and say 1,200 tons for delivery at Toronto and 200 tons for delivery at Montreal, the freight adjustment would be three-fifths at $2.30, and two-fifths at $4.50 or $3.18 per ton of lead. As already explained, this freight adjustment is more than compensated for by freight increases on competing lead raising the price obtainable in eastern markets.

8. The price of coke has advanced 40c. per ton which indicates an increase of 10c. per ton of ore. The price of labour has decreased since then ·3646 per shift, which indicates a decrease of ·55c. per ton of ore.

The prevailing base rate of $8.30 per ton will be reduced effective April 15th, 1919, 45c. per ton or from $8.30 to $7.85 per ton of ore.

ZINC ORE SCHEDULES.

March 6th, 1917.

We are now in a position to treat custom zinc ores, and will not accept, after April 1st, 1917, as lead ores, ores containing more than 15 per cent zinc, but will accept for treatment in the zinc plant ores having an excess of 25 per cent of zinc over the iron content, subject to satisfactory analysis for copper, cadmium, cobalt, etc.

If shipments of zinc ores are contemplated, samples should be sent to us for analysis, when we shall be pleased to quote a basis of payment for this ore.

ZINC ORE SCHEDULES.

On ore containing 50 per cent zinc or over, we deduct 25 per cent of the contents, paying for the remaining 75 per cent at 4 cents per pound.

On ore containing less than 50 per cent zinc, we make a further deduction at the rate of $1\frac{1}{2}$ per cent of the zinc contents for each 1 per cent that the ore runs less than 50 per cent.

For instance, we would pay for 60 per cent of the zinc contained in an ore running 40 per cent of zinc.

No pay for silver.

Cadmium is penalized at $1.50 per ton of ore per unit if over one-fourth of one per cent is obtained.

Lime is penalized at 40 cents per ton of ore per unit if over 3 per cent is contained.

THE CONSOLIDATED MINING AND SMELTING CO. OF CANADA, LTD.

TRAIL, B.C., April 17, 1918.

TO LEAD ORE SHIPPERS.—We are pleased to advise you that lead marketing conditions show considerable improvement. The indications are that the greater part of the lead which will be included in the pool up

to the end of April will be liquidated by July 1, though slow movement on the railways is retarding the process somewhat.

The marketing prospects are such that we feel justified in removing the restrictions upon ore receipts contained in our circular of January 18, and we are willing, therefore, until further notice, to accept normal shipments from the mines on and after May 1, 1918, the pooling arrangement outlined in our circular of November 5, 1917, to continue in effect and to include from May 1 all the lead from such shipments.

We are also prepared to advance ninety per cent (90%) of the apparent value on preliminary settlement, instead of the lesser amounts stated in our November 5 circular.

Otherwise, schedule " B," Lead Ore Rates will apply in settlement.

Yours truly,

THE CONSOLIDATED MINING & SMELTING CO. OF CANADA, LTD.

FIGURE 3.

(*Schedule " B."*)

This deals with percentage deductions from total lead contained, and on ores of any lead content shows the effect of taking 1·5 per cent off the wet or total assay to get the corrected assay. Also it shows the combined effect of the 1·5 per cent deduction and 10 per cent off corrected assay.

In addition, a steep broken curve shows the effect of a minimum deduction prescribed by schedule which must be at least 1 per cent off corrected assay.

Note that combined deduction shown on the 10 per cent deduction curve applies to ores that do not carry more than 4 per cent zinc. This curve shows that low grade ores suffer a greater percentage deduction from total lead contained by wet assay than do high grade ores. On the other hand, the latter lose more pounds of lead per ton than low grade ores, thus explaining Mr. Whitaker's remark in that respect.

These deductions are used by many smelters, although they usually do not apply the 4 per cent zinc limit.

FIGURE 4.

(*Schedule " B."*)

The Upper Graph deals with percentage deductions from total lead contained by corrected assay, percentage deductions from total silver contained, and how these are influenced by zinc content of the ore. In addition the zinc penalty in dollars per ton at 81 cents per unit is shown as a straight line for ores carrying up to 25 per cent zinc. It will be noted that when zinc content is above 4 per cent the percentage deduction from lead amounts to 1 per cent, and from silver to half of 1 per cent for each per cent excess of zinc content above four.

The Lower Graph deals with roasting charge or sulphur penalty of 50 cents per unit. The maximum penalty of $4 per ton is reached at 8 per cent sulphur.

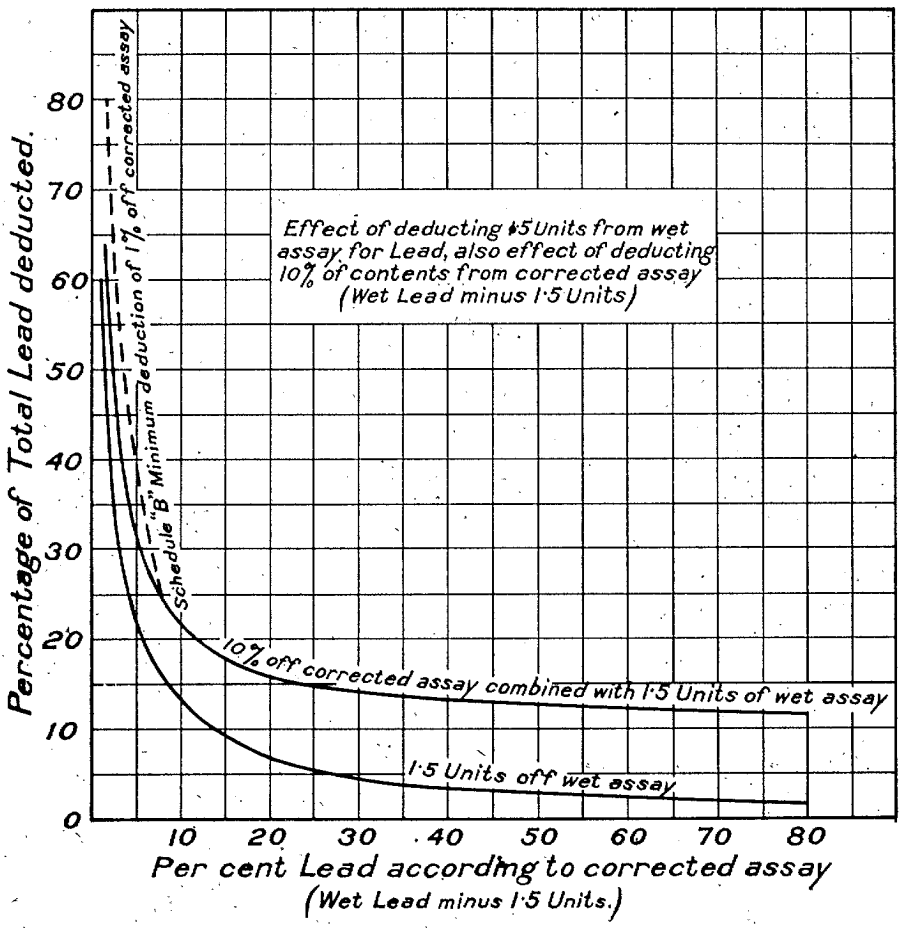

FIG. 3. (*Schedule "B."*).

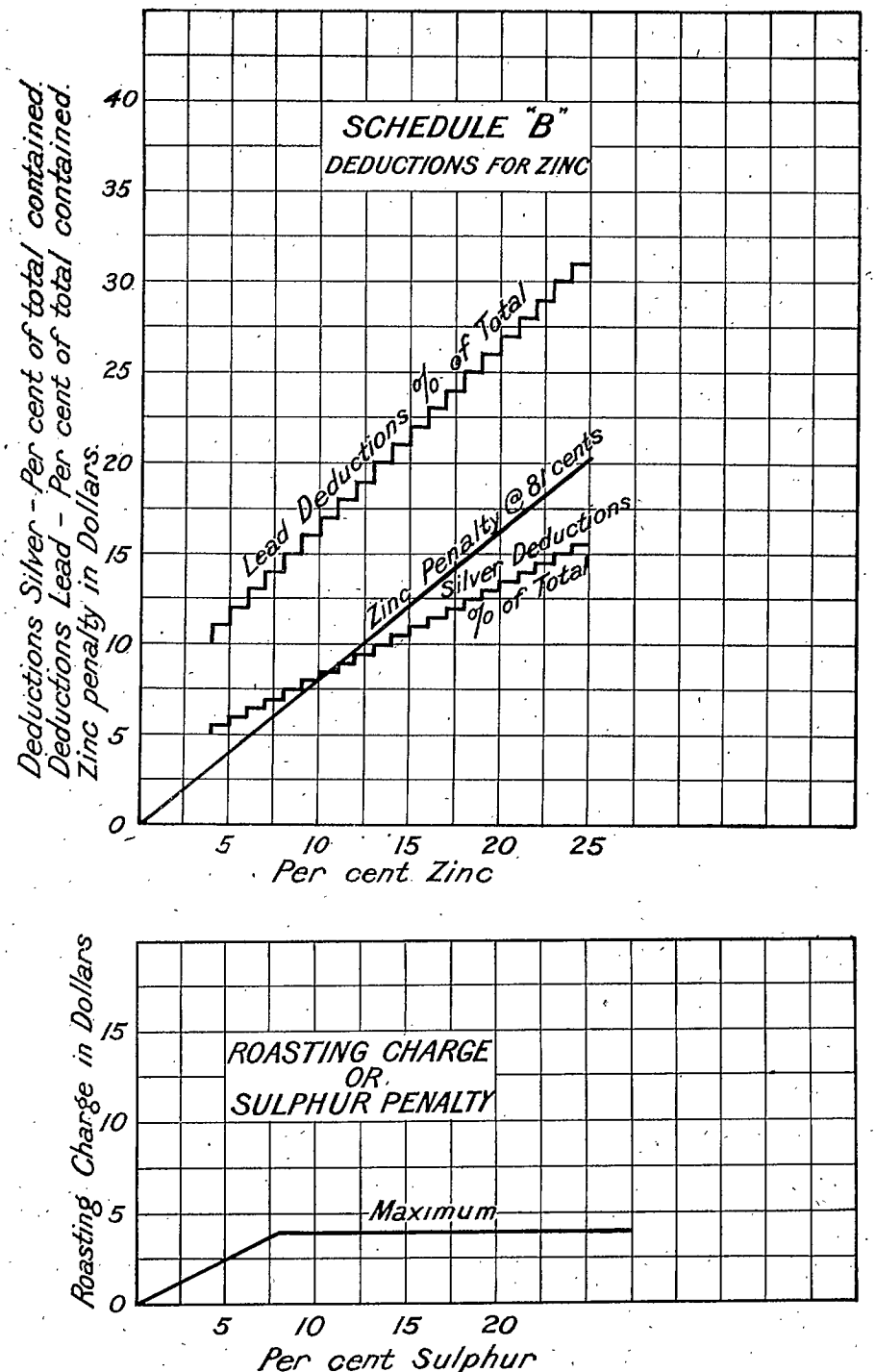

FIG. 4. (*Schedule "B."*).

FIGURE 5.

(Schedule "B.")

This gives much the same information, as shown in the upper graph of Fig. 4, but is in a different form. In this graph the percentage of the total lead content paid for, and the percentage of the total silver content paid for, in connexion with their relation to the zinc content, have been plotted. It will be observed that the lead payment is 90 per cent, and the silver payment 95 per cent up to 4 per cent zinc. These percentages are the ones in common use, although at most smelters they are not changed by the zinc content. For convenience, the zinc penalty of nine times nine cents, or 81 cents per unit, has been plotted in dollars and cents.

FIGURE 6.

(Schedule "B.")

The graph *on the left* shows how the corrected assay of ores carrying 10 per cent, 20 per cent, 30 per cent, 40 per cent, 50 per cent, 60 per cent and 70 per cent lead are practically reduced by extra percentage deductions after the zinc reaches 4 per cent.

The falling off in the assays is much more rapid in the case of high than in low grade ores.

The right hand graph shows a comparison between the credit allowed for fluxing elements at nine cents per unit and the base rate. At the time the graph was drawn this rate was $8.30 per ton, but at the present time is $7.85 due to fluctuations in the cost of coke and changes in wage scale.

The maximum credit allowed is reached when the total percentage of all silica, iron, lime, manganese and magnesia is 38·9. At that figure the credit of $3.50 per ton practically cuts the present base rate to $3.95 which is the minimum figure obtainable under the terms of the schedule.

FIGURE 7.

(Schedule "B.")

This shows the number of ounces silver per ton of ore deducted especially on account of zinc contained, and gives the separate curves for ores according to zinc content. The extra deductions made are over and above the ordinary 5 per cent deduction in general use.

FIGURE 8.

(Schedule "B.")

This graph shows the pounds lead deducted per ton for ores of any lead content, the figure used for lead being the corrected assay. In this chart all the various deductions have been combined. The deduction of 1·5 per cent to get the corrected assay is equivalent to 30 pounds of lead per ton of ore, and has been deducted throughout. To this figure is added the percentage deductions from the corrected assay called for by the schedule, separate curves being given for ores of varying zinc content. The minimum deduction of at least 1 per cent from the corrected assay has also been taken to account.

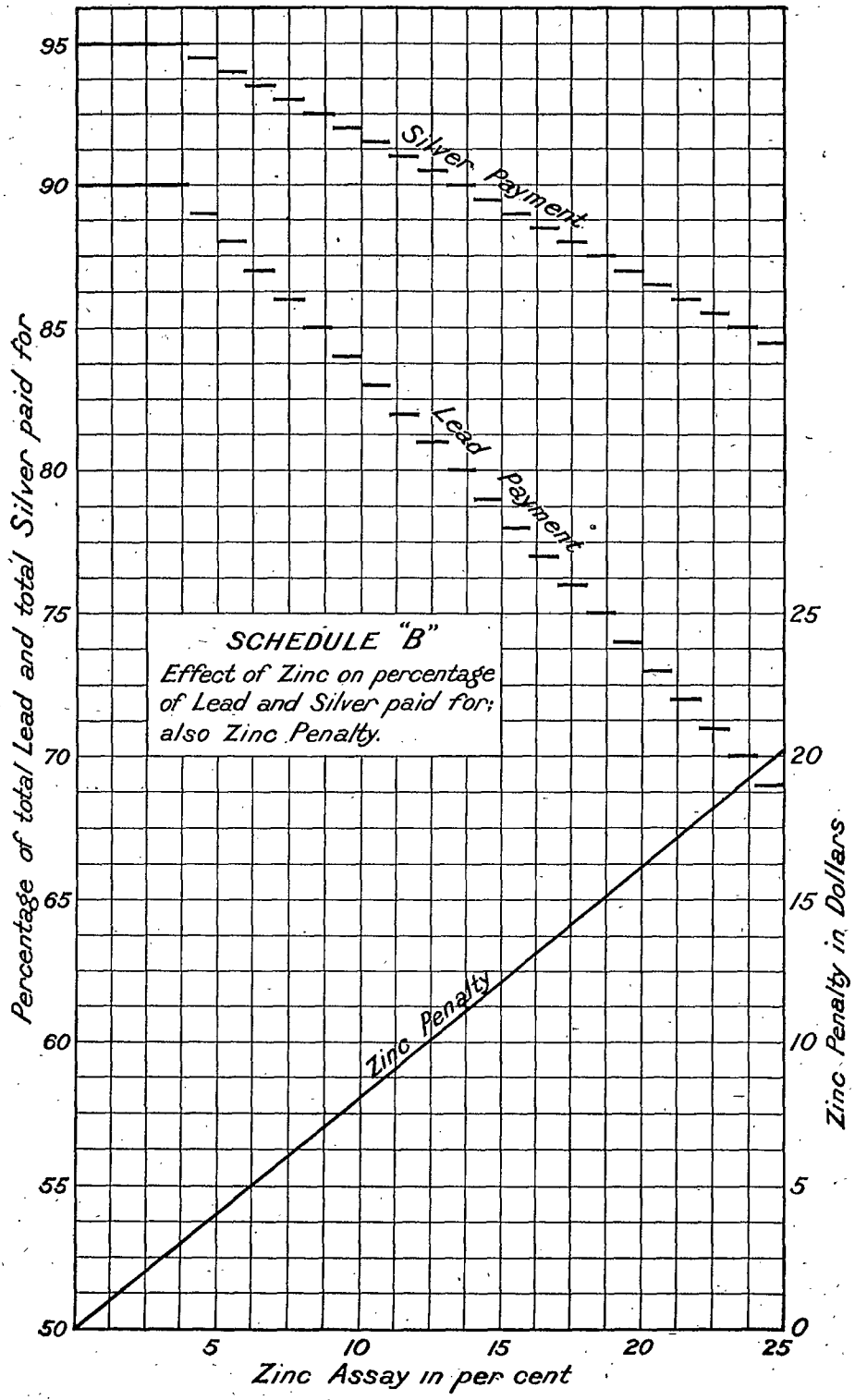

FIG. 5. (*Schedule "B."*).

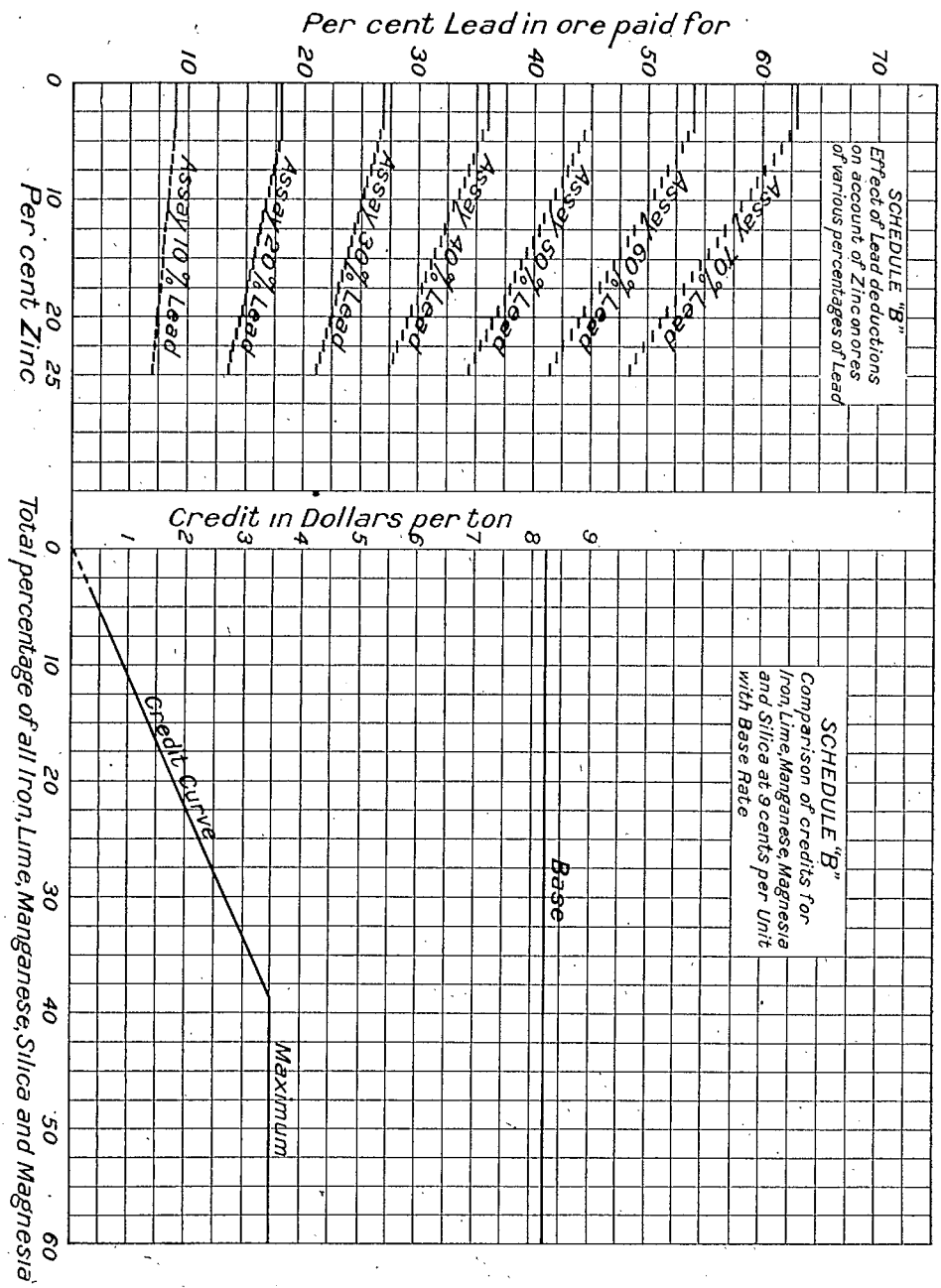

FIG. 7. (*Schedule "B."*)

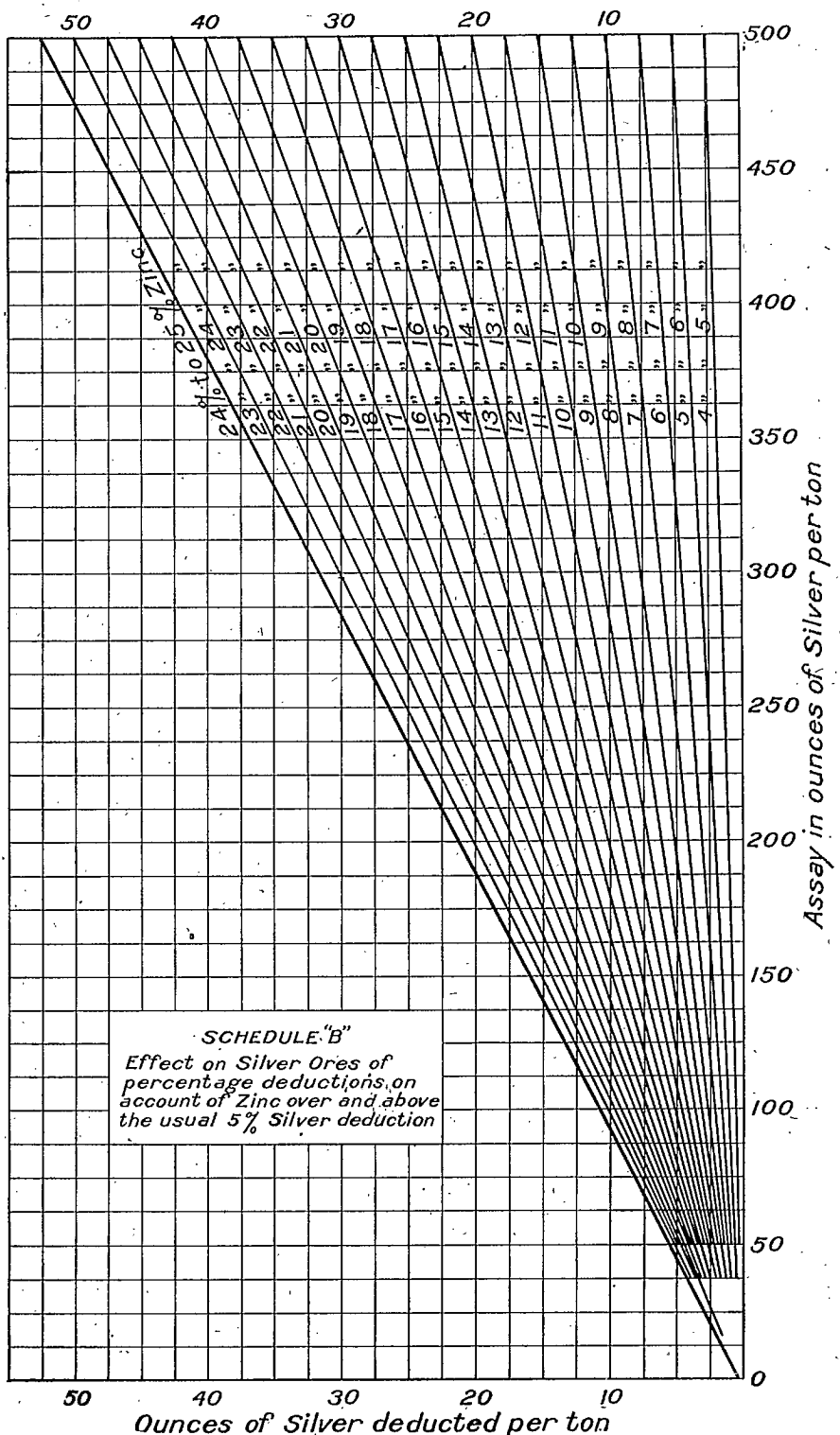

FIG. 7. (*Schedule "B."*).

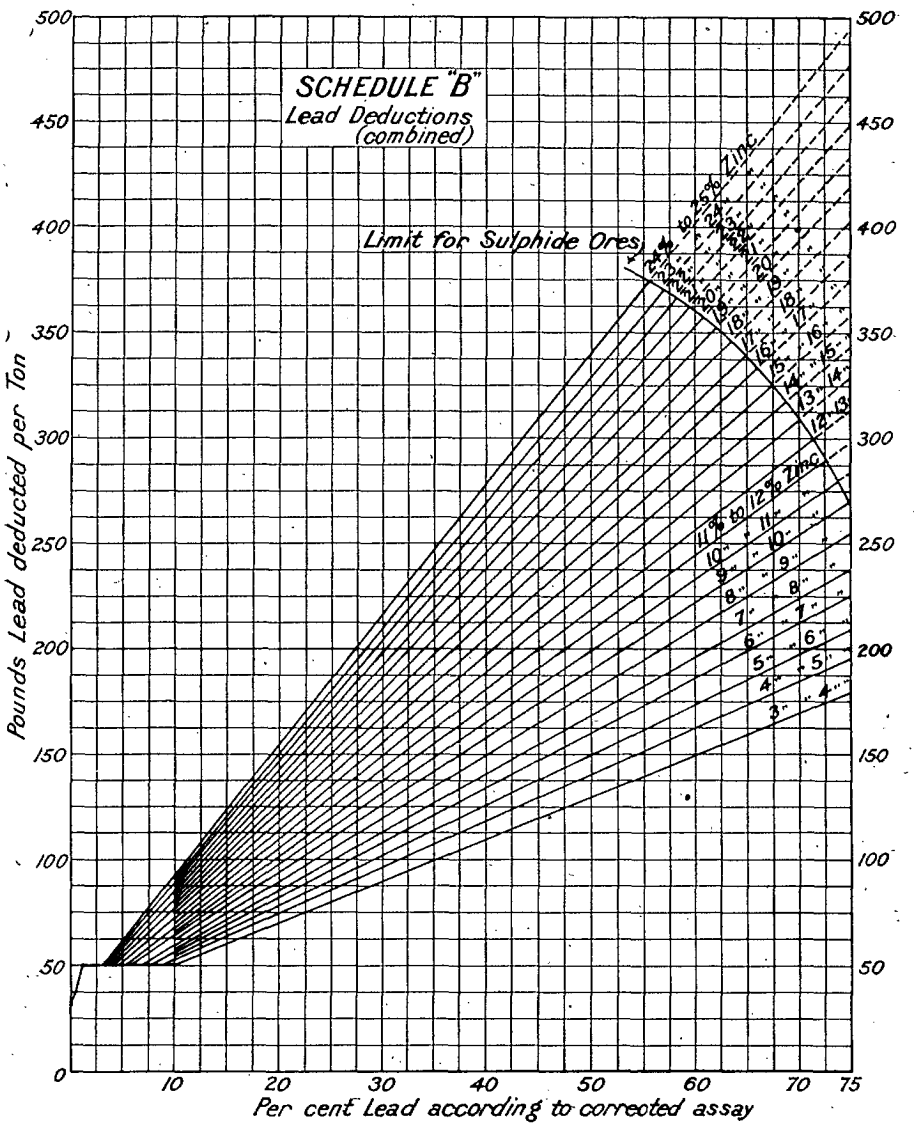

FIG. 8. (*Schedule "B."*).

TREATMENT RATES.—It is essential for smelter requirements that the ore mixture be so apportioned that a slag can be formed. Depending upon the nature of the supply, various ores may be purchased from time to time on a purely fluxing basis.

The object of the smelting business is to recover and deliver in a marketable form the valuable contents of the ore received at the plant. Since the business is carried on solely for ore treatment, the expense of operation must come from the realization on the metal values extracted. It is necessary, therefore, to charge the ore received with the total cost of treatment and losses, in addition to the smelter's profit. This total, by the number of tons treated, gives the cost per ton, and may be used as a flat treatment rate in receiving custom ores, provided all the ores are uniform in analysis, and are self-fluxing.

The existing schedules are the result of a gradual evolution of the ore purchasing business, and, as far as possible, are drawn to cover in one contract the items of paying for the values in the ore, and the subsequent expense connected with the recovery and disposition of the product, as well as providing for the bonuses and penalties. In their use for calculating the value of an ore to a plant, it is necessary to debit and credit on the basis of the analysis and in accordance with the plant requirements.

The basic smelting charge is the criterion upon which the treatment rates are based. In the case with a majority of the lead smelters, if an ore is received that contains more silica than is permissible in the ideal furnace charge, a proportionate penalty is imposed. Also, in the case of an ore with an excess iron, a credit will be allowed. The effect of this is to increase the charge made for smelting siliceous ores and decrease it on iron ore, without changing the charge made for handling the furnace mixture. By this means the production of iron ores is stimulated and the production of siliceous ores is discouraged.

There are certain districts in which iron ores are more plentiful than siliceous ones, and in such cases the penalty may be placed on the iron and a bonus given for the silica.

The Trail smelter lead ore supply is of a complex nature, in which the slag-forming elements do not exist in sufficient quantity to allow a smelting mixture to be formed. In order to smelt this mixture, it is necessary either to add barren material containing the slag-forming elements desired, thereby causing dilution and loss, or to endeavour to balance the ore supply by a system of bonuses and penalties on the ore purchased.

The payments made and the penalties imposed by ore contracts are not uniform and will vary in price and limits according to the character of the ore supply. Experience gained from the results of smelting an ore supply for the period immediately preceding the effective date of a schedule should form the basis.

In figuring the value of an ore the basis used should be the price per standard unit of quantity of the recovered metals, at some principal market centre, at the time the valuation is made, less the combined expense of treating the ore and marketing the refined products, together with a deduction for the total losses in the several processes.

METAL LOSSES.—The production of ores containing metals that fluctuate in price is usually increased or decreased according to the variations in the metal market.

The financial loss to the smelter from this cause will vary directly as the metal prices vary, the loss being debited at its value to the plant.

Metal losses occur in every metallurgical process. In lead smelting, these losses will vary depending upon the character of the material treated. In general, the following limits represent good practice:—

Lead, 5 per cent to 20 per cent. *Silver*, 1·5 per cent to 5 per cent. *Gold*, 0 per cent to 5 per cent of the ore content.

When a 20 per cent lead loss is equal to 80 pounds of lead per ton of ore, on a 4-cent market, it would mean $3.20 per ton, while the same loss on an 8-cent market would be $6.40 per ton. The same reasoning would also apply to any metal having a variable price.

Recovery of by-products, such as arsenic, antimony, cadmium and bismuth, is sometimes made at lead smelting plants. It is usually, however, the result of an accumulation and concentration from the material treated. With the exception of possible special occurrences, these metals are probably associated with others, and the quantity of any one of these in the original ore is so small that the extra expense of its recovery from the crude ore would not be justified. Therefore no accounting is made of their value in the purchase of ores for the lead smelter.

CUSTOM ORE.—The custom ores received at the Trail smelter, together with the ores produced by the Company's mines, constitute the available supply of the district.

In order to operate successfully a smelter, the mixtures going to the furnaces cannot be varied from hour to hour, or even from day to day; hence, to get the proper mixture of ores, the smelters desire large and regular shipments. A small shipment involves practically as much work for sampling, assaying and general charges, as a large shipment. It is, therefore, not unreasonable to expect that the costs per ton should be higher on small lots.

Small irregular shipments often influence the ore mixtures, and upset the routine operations to such an extent that they are refused by the smelter, especially when there is an excessive supply.

In determining the treatment rate for an ore, the deductions made by the smelter must, in some form or other, take into account the cost of capital invested, power, fuel, labour, supplies, repairs, depreciation of plant, metallurgical losses, market variations and profit. It is, therefore, necessary to know the contents of the ore received in terms of its fluxing value and slag-forming properties, as well as the metallic contents, in order to control the smelting operations.

All ores, as received at the plant, are weighed and sampled, and the dry weights, together with the results obtained from the analysis of these samples, form the basis of treatment rates and settlements.

TONNAGE TREATED.—The total lead ore treated by the Trail smelter from 1910 to February 28, 1919, was 725,116 tons, giving a yield of 160,558 tons of lead bullion, or an average of 22½ per cent recovered.

Of this total, the Company's mines produced 482,066 tons, being 66 per cent, and custom ore produced 243,050 tons, being 33 per cent.

SMELTER OPERATIONS.—The average metallurgical results obtained during the years 1907 to 1911, while receiving ores under the schedules then in force, are summarized as follows:—

Gold loss, 3·2 per cent. *Silver loss*, 5·7 per cent. *Lead loss*, 8·5 per cent.

The deductions provided for in schedule were:—

Gold, 3·2 per cent. *Silver*, 5·0 per cent. *Lead*, 10·0 per cent:

showing an even break on the *Gold*; a loss of 0·7 per cent on the *Silver*, and a gain of 1·5 per cent on the *Lead*—over and above that provided for.

The treatment rate was $8 to $12.50, which sum, together with the net in the metals, was applicable to the payment of freight, operating expenses and profit. During this period the smelter operations showed a balance for *profit*.

From 1912 to 1917, various open schedules were in force on custom lead ores, and, also, on dry ores. Special terms were offered to shippers on the basis of the quantity and character of the ore to be supplied.

The average metallurgical results on the ores smelted during this period were:—

Gold loss, 7·5 per cent. *Silver loss*, 6·5 per cent. *Lead loss*, 19·5 per cent.

The deductions provided for in the average schedule were:—

Gold, 8·2 per cent. *Silver*, 5·0 per cent. *Lead*, 10·0 per cent. Zinc, over 8 per cent, at 50 cents per unit.

The result of operations during this period was:—

A gain of 0·7 per cent on the *Gold*, a loss of 1·5 per cent on the *Silver*, and a loss of 9·5 per cent on the *Lead*, over and above that provided for. No *Zinc* was recovered.

The treatment rate of $10.50, with a maximum of $12.50 per ton, together with the net metallurgical results, would be applicable for operating expenses, etc. The net result for this period was an operating *loss*, which was materially increased during the years 1916-17, when metal prices were high.

From February 1, 1918, to the present time, Schedule "B", together with its modifications from time to time by circular letters, has been in force, and all lead ores are received under this contract.

The average metallurgical results up to February 28, 1919, on ores received under Schedule "B" were:—

Gold loss.	*Silver loss.*	*Lead loss.*
4·6 per cent.	5·0 per cent.	15·0 per cent.

No recovery on *Zinc*.

The deductions provided for in Schedule "B", regardless of the analysis of the ore, are:—

Gold.	*Silver.*	*Lead.*
8·2 per cent.	0·50 ounces Min.	20 pounds, Min.
	5·0 per cent Max.	30 " Max.
		Plus 10 per cent.

Base treatment, $7.50 per ton.

Various additional deductions are made, as will be seen by referring to the schedule, and depending upon the zinc content of the ore. From 4 per cent to 25 per cent zinc as follows:—

Silver, 5·5 per cent to 15·5 per cent.

Lead, 11·0 per cent to 31·0 per cent.

The smelting operations for the period show an operating *gain*, over and above that provided for in the schedule, of $1.65 per ton of ore treated, with a metallurgical *loss* of $0.90 per ton to September 30, 1918, and a metallurgical *gain* of $1 per ton from October 1, 1918, to February 28, 1919; the total of which is applicable for:—

Interest and depreciation.

Profit on ore treated.

The average operating *profit*, made during the period from September 30, 1918, shows a marked increase. The metal recoveries for the same period also show an improvement.

SCHEDULE "B."

Owing to the increase in operating expenses, the low metal recoveries and high metal prices, the deductions and payments provided for in the existing schedules of 1917 were not sufficient to prevent loss from smelting the available ore supply.

Schedule "B" was devised with the object of settling for all ores on the same basis, and to provide a protection to the smelter. The system of bonuses and penalties was based upon the operations for the period immediately preceding the date of the schedule, and is intended to encourage the production of clean ores, to stimulate the production of desirable ores, and to penalize the undesirable ones.

The base rate, $7.50 per ton, to cover operating expenses, is a fair rate, and compares with good practice, where full contents of the ore is considered.

The gold, silver and lead payments on clean ore are in accordance with good practice in most lead smelters.

The initial lead deduction of 1·5 units from the wet assay is made to provide for the slag loss, which is assumed to be fairly uniform. The additional deduction of 10 per cent is made to cover roasting, smelting, refining and mechanical losses. General practice assumes that wet lead, less 1·5 units is equivalent to furnace loss on clean ores of medium grade. The percentage of content loss is greater on a low grade ore than on a high grade ore; hence, by double deduction, the burden is carried by the high grade ores.

The deduction for lead in proportion to the amount of zinc contained in the ore is made to provide for the extra losses which occur in smelting such ores. Extra zinc in lead ores increase the slag loss, the volatilization loss, and the roasting loss, as well as the fuel and labour expense caused from the slow operation of the furnace.

The credits for the slag-forming elements, such as silica, iron, lime, manganese and magnesia, are based upon the cost and amount required to flux the zinc content of the ore. The maximum of $3.50 per ton is made as a protection to the smelter.

The cost of slag-forming elements at the smelter will average 9 cents per unit of each. The minimum amount of slag elements required to slag an ore carrying 20 per cent lead and 8 per cent zinc is 72 units.

The cost per unit by the number of units required equals 81 cents, which is the penalty for each unit of zinc.

The deductions on silver and lead payments due to zinc contents are made to provide for the increase in cost and loss caused by the zinc ores. Zinc causes no end of troubles in a blast furnace. To handle it with a complex ore base supply would cause losses and heavy expense, the amount of which can be determined only by treating the ore.

The penalty of $0.81 per unit on zinc contained in the ore is based on the amount and cost of slag-forming elements required to handle it. When slag-forming elements are plentiful in the ore supply a small percentage of zinc is usually admitted without penalty, also, at a lower rate per unit. This, also, is a matter of experience and not uniform for all smelters.

The sulphur charge of 50 cents per unit is made to cover the additional expense in roasting the ore. The limit in sulphur allowed in the ores will depend upon the ore supply. The cost of roasting may vary, depending upon the requirements for single or double roast. Zinc in the ore usually involves double roasting, and consequently carries a high cost.

The moisture deductions usually carry a minimum to account for combined moisture. Modifications are common where additional charges are made for flotation concentrates and fines to cover expense for handling and treatment to hold down dust losses.

A sampling and assaying charge is customary for small lots. This may be overcome in localities where ore-buying agencies or sampling mills operate. They receive the ore in small lots and mix, according to contents, for subsequent disposition to the smelters, and thereby get the advantage of the rates.

The sampling, weights, assays, representation and terms of settlement are matters usually agreed upon between the shippers and the smelter. Deferred settlements are made necessary when marketing conditions are bad.

Changes in labour and fuel prices materially affect the cost of smelting, as they constitute a large proportion of the expense.

Zinc Smelting.—

The electrolytic zinc plant was constructed at the suggestion of the Munitions Board. The metal recoveries of the plant to date are low and, therefore, the cost of production is high. None of the gold, silver or lead is recovered. Experiments by re-treatment of the residue are now in progress which have shown favourable results, and warrant the expectation of a substantially increased recovery in zinc, as well as part of the gold, silver and lead values in the ore.

The losses in zinc smelting are high, and may vary from 12·5 per cent on a 64 per cent ore to 25 per cent on a 32 per cent ore, and treatment charges range from $16 to $25 per ton.

This plant is not at present to be considered as a competitor for custom zinc ore.

General—

The "per ton" cost of smelting at the Trail plant will not compare favourably with that of the large custom lead plants in other localities; due account must be taken of the direct influence of:—

Freight rates,
Cost of material,
Cost of fuel,
Nature of the ore supply,
Small tonnage treated.

The general metallurgical practice of the plant conforms to that in use throughout the country on a similar ore supply. New processes are being introduced from time to time in an effort to improve operating conditions.

The plant is scientifically operated and well managed, and a conscientious effort is made to meet the complex ore situation to the advantage of all concerned.

The cost of refining is high, due to the small tonnage refined. The quantity of bullion handled has decreased from 20,000 tons in 1915 to 10,000 tons for 1918, which, proportionately, increases the fixed charges per ton. Considering the small tonnage of bullion available for refining, no advantage would be gained by the use of "the Parkes' Process," instead of "the Betts" now in use.

The mechanical arrangement of the entire plant is complicated, due to the several kinds of ore to be treated, thereby increasing the overhead expense. The equipment is good, and repairs and renewals are made in direct proportion to the requirements.

No advantage would be gained by smelting the custom ores separately, or in an independent plant, as practically all of the items of cost would be increased on account of the limited tonnage.

A large amount of experimental work is being carried on in the several departments, with the object in view of improving the metallurgy. An experimental mill is now in operation on the "Sullivan" zinc-lead ore. Satisfactory progress has been made in the work and will probably result in the milling of all of the mixed ores. By this separation there will be a clean lead product, a zinc product and an iron product. The elimination of the zinc and the advantageous use of the iron will materially improve working conditions on the lead furnaces.

The effect of operating under Schedule "B" has been to decrease the zinc content of the ore supply. This has been accomplished by the elimination of some of the zinc in the crude or by better sorting, and production of a cleaner concentrate from the mills. This condition has also been improved by the separation of the "Sullivan" ores in the mill, and sending a cleaner product to the smelter. The direct result on the operation of the smelter is shown by the increased metal recoveries made.

SUMMARY.

Schedule "B" is a material increase in the treatment rates previously in force at the Trail smelter. This increase was necessary to balance the metal losses and operating expense incurred in treating the complex and limited ore supply.

The subsequent modifications of the schedule, due to changes in the price of labour and fuel, are justified, and are in direct proportion to the increased cost of treatment, as both these items show an increase in 1918 of 60 per cent over that of 1914, and represent 70 per cent of the cost of treatment.

The object of the schedule was to endeavour to get a cleaner ore supply for the smelter, by discouraging the shipment of ores containing undesirable constituents, and to encourage the shipment of ore containing slag-forming elements.

The result has been an improvement in the metallurgical behaviour of the charge, with a corresponding increase in the metal recovery.

No zinc is recovered in the lead blast furnace smelting, and it is detrimental, causing losses, slow running, and high cost.

Under former schedules, in which the zinc carried a light penalty, high metal prices made profitable some of the silver-lead-zinc ores, which formerly could not be shipped. This caused an over supply of that character of ore but still not enough available ore containing slag-forming constituents to smelt it.

The custom ores received at Trail plant are treated along with the Company's ores, each carrying its proportion of the operating expense. Settlements are made on equal basis, according to contents. During high metal prices, the Company's lead-zinc ore production was curtailed, in order to accommodate the custom ore, due to the limited amount of slag-forming material available.

The increase in the charge for treatment, and the deductions for losses were justifiable in view of the low recoveries and high operating expense.

The deferred settlement for lead ores is necessary on account of the market conditions. The Company being unable to dispose of the lead, they should not be expected to carry the bullion from custom ores at their own risk. At the present time there is on hand at the plant 6,000 tons of unsold lead.

The treatment charges, when calculated on the basis of Schedule "B", do not compare favourably with the schedules used in many lead smelters, the difference being mainly due to the difference in the character of the ore supply. The system of credits and penalties takes into account the total contents of the ore, and each element is accounted for according to its worth in smelting the available mixture.

The items of maximum credit for slag-forming ingredients, the non-payment of a bonus for high lead content, the penalizing for all of the zinc, sulphur and moisture, as well as the deductions in lead and silver payments in lead-zinc ores, are matters the justification of which must eventually be determined by the experience of handling the ore in the plant, and will be points for modification from time to time as progress and improvements are made.

The treatment of the "Sullivan" ores along with custom ores has not worked a hardship on the latter. The "Sullivan" ores are high in zinc and short on slag-forming elements. This is also true of the average of the custom ores. The Company's mines produce enough ores containing slag-forming elements to bring their production to the average of the custom ores; hence, there is no additional loss accruing from the treatment of "Sullivan" ores together with the custom ores.

CONCLUSIONS.

In general, the rates imposed by Schedule "B", at the time of its going into effect, were reasonable, and, on the basis of the past metallurgical experience of the plant, no excessive profits would result from the increased charges. Subsequent metallurgical developments, improved operating conditions, and normal metal prices warrant the expectation of modifications in favour of the shipper.

Effective work on the part of the shippers, along lines of producing clean ores, or eliminating the undesirable elements before shipment, would further assist the smelter in improving conditions, thereby making possible the sought for reduction in treatment rates.

The financial results of the smelter operations being directly dependent upon the metallurgical results, an independent audit of the books of the Company is not considered necessary in order to determine the reasonableness of treatment rates now in force.

Respectfully submitted,

(Sgd.) O. R. Whitaker.

CONTINUATION OF REPORT BY THE COMMITTEE.

Resuming its own report the Committee may now at the risk of some duplication of statement, enlarge upon certain subjects alluded to by Mr. Whitaker.

NOTES ON DIAGRAMS.—Mr. Whitaker has included six diagrams which show graphically the effect of the application of certain terms of Schedule "B," according to the composition of ores to be treated. The several diagrams are accompanied by individual explanation.

LOSS OF LEAD.—Under the head "metal-losses," the statement is made that "the following limits represent good practice—lead 5 per cent to 20 per cent." This is not alone Mr. Whitaker's opinion; it is the result of experience gained through many years' practice of the art of lead-smelting. Hofman[1], quoting from his own report to the United States Treasury Department states in effect that for purposes of United States customs duties on imported lead ores, a loss of 20 per cent is allowable in cases of ores rich in arsenic and zinc.

The lower limit (5 per cent) is rarely exceeded and not often attained. It is well to note, however, that during the four years ending 1908, the average recovery of lead at Trail was 96 per cent. That was the period of greatest productivity of St. Eugene mine, property of the Company, which was then the mainstay of ore supply to the smelter; and during it, the zinc in the furnace charge was low, and the lead so high as to permit the establishment of what is believed to be a world record of output per furnace day during parts of the term.

The "Sullivan" mine, during this time, was not in possession of its present owners. It had its own smelting plant at Marysville, near the mine, which was operated almost entirely on "Sullivan" ore. Conditions

[1]Hofman. Metallurgy of Lead, 1918, Ed.

prevailing there at the time cannot now be ascertained with exactness; but the statement has been made[1] that "the ore is now of such a nature that no additional flux is required." This may have been a misstatement; but it indicates that quite apart from the success attained by the present owners in their efforts to improve the quality of "Sullivan" ore, the metallurgist then responsible was on the way, at least, to the solution of a difficult problem, and that realization of the resources of this now great mine was not hopeless.

During the period 1912–1918, the output of "St. Eugene" was no longer a factor of importance in the ore supply, "Sullivan" ore having taken its place. Whilst it is true that with the advent of "Sullivan" the amount of zinc in the furnace charge increased, together with the ratio of zinc to slag elements, the ratio of lead to zinc fell off sharply. These causes, combined with the increasing faults of some of the custom ore received, brought about a marked decrease of the average recovery of lead from 91·5 per cent to 80·5, thus nearly reaching the other extreme of loss allowed in "good practice." Permission of so great a loss as 20 per cent may seem to be a stigma; but it was too great to be ascribed to either indifferent management or unskilled metallurgy. It was simply a revelation of the cumulative effect of bad conditions and quality of ore supply, which ultimately became intolerable.

Fluxes.—The Company owns certain mines and quarries from which any necessary "silica," "iron" or "lime" is obtained. Whatever available gold or silver may be contained are credited against the cost of these materials at the smeltery and the difference is charged to "flux." As much of this as may be required for the treatment of any particular shipment of any ore received, is paid for by that ore through the operation of schedule, so that if or when "Sullivan" ore or concentrate needs more flux for its treatment than some other, it pays for more and in exact accordance with its requirements.

Sampling and Assaying.—There is no doubt that the receipt of many small parcels of ore involves both annoyance and increased cost in the operation of the sampling-mill and laboratory; nor can we question the propriety of some charge to compensate for these objections. In view of the fact, however, that only through affording every reasonable facility to the very small or new producer can he be encouraged to become a larger or regular one, it would seem wise to abate a part of the tax against him, the more so because the aggregate income to the smelter from this source can not well be of importance. The increase of freight per ton charged against less than carload lots is an effective incentive to every miner to produce to the extent of his ability. On the other hand some of the larger producers have made a practice of shipping two or more lots in one car apparently with the object of gaining special information without direct cost. In such cases the service rendered should be paid for, and it was these that were intended to be provided for by the schedule.

[1]Report of Minister of Mines of B.C., 1907, p. 84.

TREATMENT OF ZINC ORE.

The outline of the process used at Trail is as follows:—

The ore is roasted in such manner as to convert as much of the zinc as possible to soluble form, and is then leached by a dilute solution of sulphuric acid. The resulting sulphate of zinc together with any soluble salts of other metals present is then filtered from the insoluble residue—which contains any gold, silver or lead held by the ore. Any copper and cadmium present are then precipitated from the zinc-bearing solution which it is aimed to have perfectly clean, and the remaining solution of zinc sulphate is electrolyzed. Pure zinc results, and the sulphuric acid is available for re-use.

In theory it is quite simple, but the process requires constancy of conditions and careful manipulation. The details of operation cannot be altered without the risk of poorer extraction, impure products or increased cost. Whilst formerly the Company accepted custom zinc ore for treatment, it no longer does so, for the reason that irregular or small shipments, varying in composition as they have done, disturb the cycle of operation and so interfere with efficiency, which at normal price of spelter must be maintained in order to assure success.

When available and desirable custom ore shall amount to at least forty tons per day, or sufficient to justify treatment in a separate unit of a plant, it is expected that recent improvements in the details of manipulation will warrant the resumption of receipt of custom ore, and the payment to producers of a greater part of its gross value than has been possible in the past. At present, however, it must be said that the process is still in course of development.

COPPER ORES.

Copper ore was not mentioned in the resolution as the result of which the Committee was appointed. It is considered desirable, however, to allude briefly to the matter of its treatment.

The copper smelting equipment at Trail was provided originally for the smelting of ores from Rossland mines. Since then relatively small supplies have been received from outside that area. Until well within the war period all of the copper produced from the copper furnaces, together with the gold and silver accompanying it, was in the form of copper matte, which was exported for further treatment. Latterly, the conversion of matte and the refining of the resulting "Blister" copper have been done at Trail.

Whilst the details of treatment are less complicated, and the risk of loss of metal minimized, as compared with the treatment of lead ore, the cost of operation due to increased prices of essential factors has had the same effect on treatment charges for copper as for lead ores. The output has been quite small at best, and the refining cost necessarily relatively high. These items in connexion with increased marketing costs have combined to make treatment charges high, and possibly burdensome. Nevertheless, the Committee cannot find that the smelter's margin is at all excessive, and it has every reason to believe that so soon

as conclusion of certain anticipated business can be effected, the increased output will permit such concessions in the terms of copper schedules as will afford desired relief.

PROVINCIAL GOVERNMENT REPRESENTED.

Mr. A. G. Langley, resident engineer for the Eastern Mineral Survey, District of British Columbia, was appointed by Order in Council, to represent the Provincial Government during the investigation herein reported. Mr. Langley has been present at most of the sessions of the Committee, and has had access to all data and correspondence in the matter.

AUDIT.

Mr. Whitaker has stated succinctly that he considers an audit unnecessary. The Committee agrees. It is evident that inaccuracy of distribution of the many items (some 250 in number) entering into the cost of operation is of small importance, so far as the purpose of this investigation is concerned, compared with the matter of value of metal loss. The cost of departmental operation is determined mainly by allocation of pay roll, fuel, overhead and depreciation charges. No firm of auditors can well go back of the segregation of these items as fixed by the Company's officers, nor is its judgment as to the fairness of such any better than that of an engineer of Mr. Whitaker's experience, which has permitted him to make comparison of costs at Trail with those elsewhere. Accounts pertaining to sales, (practically the sole sources of income to the smelter) cost of operation and purchase of ore have been, and are frequently—not once a year—scanned by a highly reputable firm of auditors whose certificates of correctness should satisfy all concerned.

Duplication of even a part of this work by another firm would, in the opinion of the Committee, result in waste of public funds, for which the Committee declines to be responsible.

CONCLUSION.

The Committee finds that the lead smelting operations of the Company for an extended period prior to the publication of Schedule "B" were conducted at a loss. This loss resulted in part from increased labour, fuel and other items, in part from slow running of furnace due to presence of an excess of zinc in the furnace burden, and, finally, to the influence of that zinc in preventing recovery of the amounts of lead and silver anticipated by the then prevailing schedule of payments for those metals. Aside from loss on operating account, the arrangements for marketing lead also worked to the disadvantage of the Company. A new schedule therefore became necessary.

Experience gained by the application of Schedule "B" has proved its general justification. It has been efficacious in bringing about an improvement in the nature of the supply of ore, and a resultant decrease in the cost of operation, to such an extent in fact, that the Committee has felt

warranted in asking the Company now to act upon its undertaking to revise the existing schedule in favour of the producers of ore.

The Committee feels that the mode of its appointment and procedure has been wise, and productive of more essential information upon which it could form its judgment than could have been gained by other means. Whatever opinion of its accomplishment may be held by others, however, it may be said that further changes of mining or smelting conditions are almost certain to occur from time to time, and modifications of schedules either in favour of or against the interests of the mines will become desirable or necessary. For this reason it is suggested that the future welfare of all concerned can best be served by the appointment of a *permanent Committee* with functions similar to those of the present one. Inasmuch as determination of what may or may not be justly allowable in respect of future changes, cannot well be based upon experience of less than semi-annual periods, the work of such a committee need not be seriously burdensome.

Finally the Committee desires to express its appreciation of the uniform courtesy and frankness met with during all of its dealings with the Company's officials, of the co-operation of Mr. Langley, and of the invaluable assistance derived from the experience and judgment of Mr. Whitaker.

The Committee,

(Signed) Samuel S. Fowler, Chairman.
Ivan DeLashmutt,
James Anderson, Secretary.

APPENDIX.

"Schedule "C" Lead Ores" was issued by the Consolidated Mining and Smelting Company subsequent to the submission of the Committee's Report, but is included herewith as an appendix; together with an amendment to same: which came into force on October 1, 1919.

APPENDIX.

THE CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LTD.

TRAIL, B.C., June 24, 1919.

SCHEDULE "C."

LEAD ORES.

PAYMENTS.

GOLD.—Pay for 95 per cent of the assay at $20 per ounce. No pay for gold unless five one-hundredths of an ounce (·05 oz.) per dry ton or over.

SILVER AND LEAD.—Payments for silver and lead will be based upon the zinc contents of the ore on the following schedule:—

—	Silver Payment.	Lead Payment.
	Per cent.	Per cent.
10% zinc or under	95	90
Over 10% and including 11%	94½	89
" 11 " " 12 "	94	88
" 12 " " 13 "	93½	87
" 13 " " 14 "	93	86
" 14 " " 15 "	92½	85
" 15 " " 16 "	92	84
" 16 " " 17 "	91½	83
" 17 " " 18 "	91	82
" 18 " " 19 "	90½	81
" 19 " " 20 "	90	80
" 20 " " 21 "	89½	79
" 21 " " 22 "	89	78
" 22 " " 23 "	88½	77
" 23 " " 24 "	88	76
" 24 " " 25 "	87½	75

No ore containing more than 25 per cent zinc will be accepted under this schedule.

SILVER.—Will be paid for to the extent shown by the above schedule on the fire assay at the average of the Engineering and Mining Journal, New York, quotations for the second calendar month succeeding the date of sampling at Tadanac, B.C. In no case will the deduction from the silver assay be less than one-half (·5) oz. per ton.

LEAD.—The lead contents will be determined by the wet method of analysis deducting one and one-half units to arrive at the dry lead assay. Lead will be accounted for on the dry lead assay to the extent shown by the above schedule: provided, however, that in no case will the deduction from the said dry lead assay be less than one unit or twenty pounds per dry ton of ore.

The price for lead to be used in settlement will be our sales price delivered at destination in Canada less one and one-half cents per pound for refining and marketing as now in effect under the existing pooling scheme, which will be continued. There will be deducted also from the delivered sales price, $2.30 per ton on sales at Toronto and common points and $4.50 per ton on sales at Montreal and common points and similar differentials to other points. This freight adjustment is to cover actual increases in freights. E.g., should sales in any month be 2,000 tons and say 1,200 tons for delivery at Toronto and 800 tons at Montreal, the freight adjustment would be three-fifths at $2.30 and two-fifths at $4.50, or $3.18 per ton of lead.

The pooling scheme is outlined as follows:—

(a) Settlement is based upon sales price as above provided and only to the extent of actual sales from month to month.

(b) Whenever sales are sufficient to settle for a full month's lead receipts this is done promptly.

(c) Lead from our own mines is pooled with that purchased from others and is treated in exactly the same way.

(d) Each month a statement is issued showing the condition of the pool. All shippers have been sent a copy of the last one issued.

DEDUCTIONS.

SMELTING.—Per dry ton of material nine dollars and fifty cents as a base rate, which will be modified in accordance with the following formula:

(1) Add to the base rate per ton, 60 cents per unit for all zinc contained.

(2) Deduct from this result the total units of Silica, Iron, Manganese, Lime and Magnesia at nine cents (9c.) per unit.

Provided that in no case shall said base rate be reduced more than four dollars ($4) per ton as the net result of the said additions and deductions.

Provided also, that in making the above computation, Iron, Silica and Lime, if 1 per cent or under, and Manganese and Magnesia if 3 per cent or under, will be disregarded.

SULPHUR.—A charge will be made in addition to the above for all sulphur contained in excess of two per cent, at thirty cents (30c.) per unit per dry ton of material, provided that such charge shall not exceed three dollars per ton in any case.

MOISTURE.—A minimum moisture deduction of $\frac{1}{4}$ per cent will be made. The following penalty for moisture will apply to fine concentrates and clayey ore only.

If over five per cent, charge for all contents at ten cents per dry ton per unit.

SIZE.—Coarse and fine concentrates and ores should be shipped separately. If mixed, so that over 30 per cent will pass through a $\frac{1}{4}$-inch screen, an extra charge of fifty cents (50c.) per ton will be made.

SAMPLING.—If the shipment is less than a car lot or contains more than one lot per car a deduction may be made for extra sampling, assaying, etc. of $10 per lot.

WEIGHTS AND SAMPLES to be used in settlement shall be those made at the smelter.

REPRESENTATION.—Shippers are expected to notify us as to who will represent them while their shipments are being weighed and sampled. Failure to do so will be construed as meaning that the smelter will have authority to appoint one of the local mine representatives at the shipper's expense unless the shipper notifies us that a representative is not required. All shipments will be released for smelting as soon as sampled.

ASSAYS.—Shippers will supply the smelter with their assays on smelter pulps shortly after sampling. In case of difference in assays requiring it, the umpire pulp will be referred to an umpire mutually agreeable. The party whose result is farthest from the umpire's result will pay his fee.

SETTLEMENT.—(a) Shortly after sampling an advance payment of 90 per cent of the apparent value is made. The prices used in estimating the apparent value will be the New York price for silver and the Montreal price for lead of the date of sampling.

(b) When final settlement is rendered possible by silver quotations being available for the second calendar month after sampling and by all of the lead received during the calendar month in which the ore is sampled having been sold, the final value will be computed and any adjustment necessary will be made between the smelter and mine.

(c) Advances made on account will be carried by the smelter without interest until the last day of the second calendar month succeeding the calendar month in which the ore arrives. Interest at 6 per cent will be charged on advances upon lead after that date.

The above rates will be effective on shipments received here on July 1st, 1919, and are subject to change without notice.

(Signed) The Consolidated Mining & Smelting Co. of Canada, Ltd.

SCHEDULE "C" AMENDED.

A partial revision of the above Schedule came into force on October 1st, 1919, having been announced by the Company in a circular communication to lead ore shippers under date September 26, 1919, as follows:—

"To Lead Ore Shippers,—

"There has been a desire expressed by some of our shippers for a settlement for lead on a more definite date than is possible with the continuance of the present pooling scheme.

"Stocks are still considerable, but we are more nearly approaching normal, and now that we are no longer supplying munition orders, the demand can be depended upon to be more uniform than in the past.

"We are still suffering severe competition from Mexican lead, and have to meet such prices as are made by those selling this lead. The so-called Montreal lead price is merely the St. Louis price plus freight and duty. There is practically no lead saleable at this price in Canada under present conditions. In addition to the Mexican competition for Canadian domestic business, considerable quantities have had to be exported at the open market price to reduce stocks and take care of current production. This was due to the light Canadian demand. In spite of these adverse features we have been able to

average in each month's sales considerably more than the New York price for lead. We are therefore changing our method of lead settlement commencing with shipments received here on October 1, and are amending Schedule " C " as follows:

" All of the provisions on page 2 respecting payment for lead are cancelled, and the following substituted:

" LEAD:—The lead contents will be determined by the wet method of analysis deducting one and one-half units to arrive at the dry assay. Lead will be accounted for on the dry lead assay to the extent shown by the above schedule; provided, however, that in no case will the deduction from the said dry lead assay be less than one unit of twenty pounds per dry ton of ore.

" The price for lead to be used in settlement will be our average sales price delivered at destination in Canada, for the second calendar month succeeding the date of sampling, or the A. S. & R. Co's. New York average quotation for the said second calendar month, whichever is the greater, less a deduction in either case of one and one-half cents per pound for refining and marketing.

" There will be deducted also from the settlement price $2.30 per ton on sales at Toronto and common points, and $4.50 per ton on sales at Montreal and common points, and similar differentials to other points. The freight adjustment is to cover actual increases in freights; e.g., should sales in any month be 2,000 tons, and say 1,200 tons for delivery at Toronto and 800 tons at Montreal, the freight adjustment would be 3-5ths at $2.30 and 2-5ths at $4.50, or $3.10 per ton of lead.

" Paragraphs (*a*), (*b*) and (*c*) on page 4 under the heading ' Settlement ' are cancelled, and the following substituted:—

" SETTLEMENT:—(*a*) Shortly after sampling, an advance payment of 90% of the apparent value will be made. The prices used for estimating the apparent value will be the New York price for silver of the date of sampling, and the previous month's sales price for lead.

" (*b*) Shortly after the close of the second calendar month after sampling, when the data is available, the final value will be computed and any adjustment necessary will be made between the smelter and the mine.

" You will note that the least you can get is the price the United States smelters settle upon, and we will use every effort to make it as much more as we can. This is of course in our interest as much as yours, as we are producing the bulk of the lead.

" Settlements for monthly receipts prior to October will proceed under the pooling scheme until fully liquidated."